Ecological site R034BY330UT
Upland Stony Loam (Pinyon-Utah Juniper)

Last updated: 3/05/2022
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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.

MLRA notes

Major Land Resource Area (MLRA): 034B–Warm Central Desertic Basins and Plateaus

MLRA 34B occurs in is in Utah (70 percent) and Colorado (30 percent). It makes up about 12,850 square miles (33,290 square kilometers). A small part of the area is in the High Plateaus of Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. The northern part of the MLRA occurs in the Uinta Basin Section, which is bounded by the Uinta Mountains to the north, the Wasatch Range to the west, the Roan Plateau to the south, and the Rabbit Hills to the east. The southern part of the MLRA occurs in the northern third of the Canyon Lands Section. This section is bounded by the Roan Plateau to the north, the Wasatch Plateau to the west, the southern end of the San Rafael Swell to the south, and the western slope of the Rocky Mountains to the east. Elevation ranges from 4,100 feet (1,250 meters) near Green River, Utah, to 7,500 feet (2,285 meters) at the base of the Wasatch Range and the Roan Plateau.

Most of this area is covered by residual basin-floor materials and materials washed in from the surrounding mountains and plateaus. Shale and sandstone are the dominant rock types. The Tertiary-age Green River, Uinta, and Duchesne Formations dominate the northern part of the MLRA. The southern part is dominated by Cretaceous-age materials with lesser amounts of Jurassic and Triassic materials. The dominant Cretaceous formations are Mancos Shale, Dakota Sandstone, and the members of the Mesa Verde Group. The dominant Jurassic formations are the Morrison, Entrada, and Navajo. The dominant Triassic formations are the Chinle and Moenkopi. Quaternary alluvial, eolian, and glacial deposits occur in both parts of the MLRA.

The average annual precipitation in most of this area ranges from 6 to 10 inches (150 to 255 millimeters). A small part of this area receives as much as 24 inches of annual precipitation.
Much of the precipitation occurs as high-intensity, convective thunderstorms during the period July through September. May and June are usually the drier months. Precipitation is more evenly distributed throughout the year in the northern part of the MLRA than in the southern part, where there is a significant peak in late summer. The northern part of the MLRA receives more precipitation as snow during winter than the southern part. The average annual temperature ranges from 41 to 54 degrees F (5 to 12 degrees C). The freeze-free period averages 170 days and ranges from 110 to 235 days.

The dominant soil orders in this MLRA are Aridisols and Entisols. Mollisols occur at the higher elevations, particularly in the northern part of the MLRA. The dominant soil temperature regime is mesic, and the dominant soil moisture regime is aridic. The soils receiving less than 8 inches (205 millimeters) of precipitation annually have an aridic soil moisture regime. The soils receiving 8 to 12 inches (205 to 305 millimeters) have an aridic soil moisture regime that borders on ustic. The soils receiving 12 to 16 inches (305 to 405 millimeters) generally have an ustic soil moisture regime that borders on aridic. The dominant soil mineralogy is mixed and soils are formed in slope alluvium or residuum derived from shale or sandstone. Many of the soils are shallow or moderately deep to shale or sandstone bedrock. The soils at the lower elevations generally have significant amounts of calcium carbonate, salts, and gypsum

Ecological site concept

The soils of this site formed mostly in colluvium, outwash and/or slope alluvium derived from sandstone and shale. Surface soils are very bouldery fine sandy loam, to very stony loam in texture. Rock fragments may be present on the soil surface and throughout the profile and make up at least 50 percent of the soil volume. These soils are deep to very deep, well-drained, and have moderate to moderately rapid permeability. pH is slightly to strongly alkaline.. Available water-holding capacity ranges from 1.3 to 4.6 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly aridic ustic and the soil temperature regime is mesic. Precipitation ranges from 12-16 inches annually.

Associated sites

R034BY306UT	**Upland Loam (Wyoming Big Sagebrush)**
R034BY322UT	**Upland Shallow Loam (Two-Needle Pinyon / Utah Juniper)**

Table 1. Dominant plant species

Tree	(1) *Pinus edulis*
Shrub	(1) *Artemisia nova*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Achnatherum hymenoides*

Physiographic features

This site occurs on benches, mountain slopes and outwash plains. Slopes range from 3-50%.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Bench (3) Outwash plain
Runoff class	High
Flooding frequency	None
Ponding frequency	None
Elevation	5,800–8,500 ft
Slope	3–50%
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

Average annual precipitation is 12 to 16 inches. Approximately 60% occurs as rain from March through October. Much of this summer precipitation occurs as convection thunderstorms. On the average, November through February are the driest months and July through October are the wettest months. The soil temperatures are in the mesic and frigid regime. In average years, plants begin growth around March and April and end growth in October. Plants usually remain green until frost in October except in drier than average years. There is usually an active greenup period in the fall. The most rapid growth occurs during April, May and June.

Table 3. Representative climatic features

Frost-free period (average)	
Freeze-free period (average)	125 days
Precipitation total (average)	14 in

Influencing water features

None.

Soil features

The soils of this site formed mostly in colluvium, outwash and/or slope alluvium derived from sandstone and shale. Surface soils are very bouldery fine sandy loam, to very stony loam in texture. Rock fragments may be present on the soil surface and throughout the profile and make up at least 50 percent of the soil volume. These soils are deep to very deep, well-drained, and have moderate to moderately rapid permeability. pH is slightly to strongly alkaline.. Available water-holding capacity ranges from 1.3 to 4.6 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly aridic ustic and the soil temperature regime is mesic. Precipitation ranges from 12-16 inches annually.

Modal Soil: Whetrock CNX 8-25% ST-FSL 25-50% Eroded — loamy-skeletal, mixed Aridic Calciborolls

Soil Survey Area: 047:
Whetrock CNX-L 8-25% Chilton CBV-L Moist 25-40%
Clapper STX-L 25-50% Eroded Whetrock ST-FSL 25-50% Eroded
Strych STV-L 3-15% Grobutte Family GRV-L 25-40% Eroded

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale (2) Outwash–sandstone and shale (3) Slope alluvium–sandstone and shale
Surface texture	(1) Very bouldery fine sandy loam (2) Very stony loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Depth to restrictive layer	60 in
Soil depth	60 in
Surface fragment cover <=3"	14–20%
Surface fragment cover >3"	25–44%
Available water capacity (Depth not specified)	1.3–4.6 in
Calcium carbonate equivalent (Depth not specified)	1–20%
Electrical conductivity (Depth not specified)	0–8 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–4
Soil reaction (1:1 water) (Depth not specified)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	16–23%
Subsurface fragment volume >3" (Depth not specified)	21–42%

Ecological dynamics

Ecological Dynamics of the Site

As ecological condition deteriorates due to anthropogenic disturbances and/or the alteration of the natural disturbance regime, native perennial bunch grasses decrease while pinyon and juniper increase. When the potential natural plant community is burned and/or drought conditions persist, pinyon and juniper decrease while native perennial bunch grasses increase.

State 1: Reference State
This state represents the natural variability and dynamics of this site that occurred naturally. This state includes the dominant biotic communities that would have occurred on this ecological site prior to European Settlement. The dominant aspect of this site is Pinyon and Utah Juniper with an understory of shrubs and associated grasses. Fluctuations in species compositions and relative production may change from year to year dependent upon abnormal precipitation or other climatic factors. The primary disturbance mechanisms for this site in reference condition include drought, insects, and infrequent fire. Because catastrophic disturbances like a crown fire or drought happen with long intervals, these communities have long periods of succession, (i.e. long periods of dense Pinyon and Juniper)—300-600 years in upland/foothills ecological site zone and 300 to 1,000 in semi-desert ecological site zone. Typically, fires occurred in late spring through mid-summer following several wet years that allowed the fine fuels to become more contiguous. The higher in elevation and higher precipitation area would burn more frequently as they would have more fine fuels in the understory. The timing of drought, and fire, coupled with surface disturbance can dictate whether the community can stay within the reference state or if the community transitions into another state.

When this site is at or near it's potential, pinyon pine and Utah juniper dominate the site and make up over 80 percent of the plant community. Understory production is very limited and provides marginal amounts of forage for livestock and or wildlife. It does provide good escape cover and thermal cover for deer. When the tree canopy cover exceeds 30 percent, diversity, both plant and animal drops to its lowest level.

Community Phase 1.1: Pinyon-Juniper Woodland
A well-developed understory with a canopy of younger pinyon and Utah juniper. At this stage Utah juniper may be dominant over pinyon. Pinyon trees are more susceptible to drought, insects, and disease than Utah juniper trees. In fact, it is difficult to identify methods beside fire that naturally reduce Utah juniper. After long periods of drought weaken the pinyon trees, beetle kills can become quite extensive, especially after the droughts. Drought periods can also weaken and reduce the understory. Plant establishment is mainly limited by the available moisture. Biological crusts can be highly developed and diversified in the large interspaces between trees.

When the tree canopy ranges from 15 to 30 percent, a wide variety of grasses, forbs, and shrubs will also be present in addition to the pinyon pine and Utah juniper. During this tree canopy stage, diversity of plant and animal species will reach its peak.

Community Phase Pathway 1.1A
This pathway occurs when events create a wetter climate cycle, favor pinyon and perennial bunch grass establishment. Following several favorable precipitation years and lack of surface disturbances, native perennial plants will reestablish.

Community Phase Pathway 1.1B
This pathway is very unlikely but can occur when a fire is able to move through the community. Two situations can make this occur: 1) a fire can carry in the understory after several wet years allow fine fuels to accumulate, or 2) as the woodland approaches the later stages of development where canopies become dense and crown sizes have increased, and thus community phase becomes susceptible to crown fires.

Community Phase 1.2: Mature Pinyon-Juniper Woodland
Mature pinyon and Utah juniper woodland characterized this community phase. When weather patterns favor an increase of pinyon and Utah juniper canopy with the associated understory of shrubs, grasses and forbs. Depending on the timing of precipitation, cool season grasses, like Indian ricegrass or warm season grasses could be dominant. Interspaces supporting highly developed biological crusts are common.

Community Phase Pathway 1.2A
This pathway occurs during and after events such as drought or insect/pathogen outbreaks. Droughts and insects can kill the trees, increasing nutrient availability in the system. Due to the natural conditions of drought, grasses typically do not take up the extra nutrients in the long term. In the short term, grasses and forbs may increase for a few years until juniper and pinyon recover.

Community Phase Pathway 1.2B
This pathway is very unlikely but can occur when a fire is able to move through the community phase. Two situations can make this occur: 1) a fire can carry in the understory after several wet years allow fine fuels to accumulate, or 2) as the woodland approaches the later stages of development where canopies become dense and crown sizes have increased, and thus community phase becomes susceptible to crown fires.

Community Phase 1.3: Perennial Grassland/Shrubland with scattered PJ
The overall aspect of this community phase is grasses and shrubs with scattered pinyon and Utah juniper. The herbaceous understory has a mix of grasses and forbs. This community phase is a result of a crown fire or sufficiently large and hot ground fire that will kill many of the trees, combined with sufficient seed-banks and moisture for reestablishment of grasses and forbs. It is common that after a crown fire many patches of trees will remain unburned, because of fire's unpredictability and broken topography. This leaves a seed bank for the burned areas. This community phase is very short lived in comparison to the other community phases in this state.

When the tree canopy ranges from 0 - 15 percent; grasses, forbs, and shrubs will produce approximately 80 to 90 percent of the total production. When the tree canopy level is reduced by fire, chaining and/or application of herbicides, forage production will be at its highest level for big game animals as well as domestic livestock.

Community Phase Pathway 1.3A
This pathway occurs when the climate favors the establishment and growth of trees. More energy is taken-up and stored in the trees as the length between fires and droughts increase. In addition, when shrubs establish on the site they can provide safe-sites for tree establishment furthering the presence of trees.

Transition T1A
This transition from the native perennial bunchgrass and shrub understory in the reference state to a state that has been invaded by naturalized species such as crested wheatgrass (blown in or seeded), cheatgrass, annual wheatgrass and other introduced or exotic plants. This transition occurs as natural and/or management actions favor an increase in non-native grasses and forbs, especially annuals. Possible events include the presence of invasive species, improper livestock grazing, extended droughts, and fire combined with an available seed source of non-native species.

State 2: Current Potential State
This state is very similar to the reference state, except that non-native grasses and/or forbs are now present in all community phases. The current potential state may include introduced (seeded) or invasive nonnative species. The invasive plants are present in sparse amounts in this state. Natural disturbance are still drought, insects, and infrequent fires still influence the community shifts. The human caused disturbance drivers (i.e. domestic livestock grazing, vegetation manipulation, and recreational activities (i.e. OHV use)) are now present. This shift in species composition could affect nutrient cycling, hydrology and soil stability. At this time there is no known way to effectively remove the non-native plants from the site once they have become established. State 2 is in jeopardy of moving to State 3 (Pinyon-Juniper Invasive State) when remaining native understory plants are stressed and invasive species have increased till they are dominant.

Community Phase 2.1: Pinyon-Juniper Woodland
A well-developed understory with a canopy of younger Pinyon and Utah juniper. At this stage Utah juniper may be dominant over Pinyon. Pinyon trees are more susceptible to drought, insects, and disease than Utah Juniper trees. In fact, it is difficult to identify methods beside fire that naturally reduce Utah juniper. After long periods of drought weaken the Pinyon trees, beetle kills can become quite extensive, especially after the droughts. Drought periods can also weaken and reduce the understory. Plant establishment is mainly limited by the available moisture. Biological crusts can be highly developed and diversified in the large interspaces between trees. Sparse invasive introduced plants species would be present in this phase.

Community Phase Pathway 2.1A
This pathway occurs when events create a wetter climate cycle, favor Pinyon and perennial bunch grass establishment. Following several favorable precipitation years and lack of surface disturbances, native perennial bunch grasses and forbs will reestablish.

Community Phase Pathway 2.1B
This pathway is very unlikely but can occur when a fire or vegetation manipulation happens to the trees. Two situations can make this occur: 1) a fire can carry in the understory after several wet years allow fine fuels to accumulate, or 2) as the woodland approaches the later stages of development where canopies become dense and crown sizes have increased, and thus community phase becomes susceptible to crown fires. Seeding after the tree removal may be necessary to help facilitate the return of understory species. Seeding depending on the species may take this community phase into state 4 (Seeded State).

Community Phase 2.2: Mature Pinyon-Juniper Woodland
Mature pinyon and Utah juniper woodland with a well-developed understory would characterized this community phase. This phase supports a diverse understory of grasses, forbs and shrubs. Depending on the timing of precipitation, cool season grasses, like Indian ricegrass or warm season grasses could be dominant. Interspaces supporting highly developed biological crusts are common. Sparse invasive introduced plants species would be present in this phase.

Community Phase Pathway 2.2A
This pathway occurs during and after events such as drought or beetle infestations. Droughts and insects can kill pinyon trees, increasing nutrient availability in the system. Due to the natural conditions of drought, grasses typically do not take up the extra nutrients in the long term. In the short term, grasses and forbs may increase for a few years until Juniper recover. Utah Juniper are more able to compete for these nutrients and became the dominant overstory tree over time.

Community Phase Pathway 2.2B
This pathway is very unlikely to occur naturally with fire. But, vegetation manipulation can be used to remove trees. Two situations occur naturally: 1) a fire can carry in the understory after several wet years allow fine fuels to accumulate, or 2) as the woodland approaches the later stages of development where canopies become dense and crown sizes have increased, and thus community phase becomes susceptible to crown fires. Seeding after the tree removal may be necessary to help facilitate the return of understory species. Seeding depending on the species may take this community phase into state 4 (Seeded State).

Community Phase 2.3: Perennial Grassland/Shrubland with scattered PJ
The overall aspect of this community phase is grassland with scattered pinyon and Utah juniper. The herbaceous understory has a mix of grasses and forbs. This community phase is a result of a crown fire or sufficiently large and hot ground fire that will kill many of the trees, combined with sufficient seed-banks and moisture for reestablishment of grasses and forbs. It is common that after a crown fire many patches of trees will remain unburned, because of fire's unpredictability and broken topography. This leaves a seed bank for the burned areas. This community phase is very short lived in comparison to the other community phases in this state. Sparse invasive introduced plants species would be present in this phase.

Community Phase Pathway 2.3A
This pathway occurs when the climate favors the establishment and growth of trees. More energy is taken-up and stored in the trees as the length between fires and droughts increase. In addition, when shrubs establish on the site they can provide safe-sites for tree establishment furthering the presence of trees.

Transition T2A
When this transition to state 3 occurs the site has lost much of its expected resistance and resilience. At this point natural and/or management actions have decreased the understory to a point where erosion increases. Reduced influence from fire, insects, and drought could cause the tree canopy to close, effectively reducing the herbaceous understory thus facilitating the transition. Improper grazing and or increase surface disturbance combined with periods of drought can facilitate this transition because soil stability is lost and susceptibility to soil loss increases.

Transition T2B
This transition is from tree canopy reduction and re-establishment of grasses and forbs. If the community is

approaching state 3 (pinyon juniper invasive state), due to a loss of understory and increase invasive plants this pathway of seeding could be preferable to doing nothing. This pathway may facilitate the recovery of the soils. The infrequent naturally occurring fires could also cause this transition. Reseeding after a fire may be the only way to successfully restore the ecological dynamics to a site. Either way this pathway involves large energy and monetary inputs by man.

State 3: Pinyon-Juniper Invasive State
This state occurs when there is an absence of natural disturbance (i.e. Insects and drought and/or fire) over long time frames. Also, management actions could have allowed trees to become very mature and have effectively closed out the understory. Invasive plants have increased in abundance. This state has the lowest resiliency and resistance of any state in this model. There may be no practicable way back to the Current Potential State (State 2), due to the large amounts of energy and monetary inputs that are needed. Seeding, with either natural disturbance and/or vegetation management to transition it to State 3 (Seeded State) may be the best long term option for this site.

Community Phase 3.1: PJ Woodland with Invasive Plants
A lack of understory with a canopy of older Pinyon and Juniper, where plant interspaces very large and connected. This community phase occurs when natural or management actions allow for the increase in Pinyon and Utah juniper and a decrease in the grass and forb understory. Invasive introduced plants species would be present in this phase and are increasing.

Community Phase Pathway 3.1A
This pathway occurs when events such as frequent fire or drought remove the trees and shrubs, and facilitate the continued establishment of cheatgrass or other invasive annuals. Cheatgrass will typically invade/increase in tree/shrub interspaces when PJ communities are degraded. Once the cheatgrass establishes the amount and continuity of fine fuels increases. This can reduce the fire return interval and shorten the time between fires. When fire eliminates the tree/shrub/native grass component, it completes the conversion to annual dominant community phase. Cheatgrass and other invasive annuals can persist for long periods of time. Once a fire or a drought removes the trees/shrubs, it is difficult to reestablish because, not only has the fire return interval been shortened to a time that will not allow seedling establish, the soil and other abiotic factors have been altered.

Community Phase 3.2: Invasive Annuals
This state is characterized by annual grasses like cheatgrass, annual wheatgrass dominating the understory. Also, invasive forbs like storkbill, halogeton and others may be present. This community phase has active erosion under the pinyon and Utah juniper canopy. Utah Juniper has allelopathic effects on some plant (i.e. Sandberg bluegrass, blue grama).

Community Phase Pathway 3.2A
This pathway is when there is a lack of fire and/or disturbance. The fire return interval lengthens. This could be done by having firebreaks and/or fire suppression which will allow the perennial species a chance to establish with natural processes or with vegetation manipulation.

Transition T3A
Vegetation treatment can transition it to a seeded state. Because of the soils (shallow and/or rocky) and the unpredictable precipitation, this pathway should be used cautiously. This pathway involves large energy and monetary inputs by man.

State 4: Seeded State
This state is a result seeding plants species. Vegetation manipulation may or may not have been done depending on disturbance history of the location. The trees were removed and adapted grasses, forbs and shrubs are established. Plants can be native or introduced depending on the desired management goals. If grazing tolerant species were established these communities can better withstand grazing and other disturbances. Due to the shallow or rocky soils and unpredictable precipitations patterns, it is difficult to establish grasses from seed, so this state may be hard to achieve and require large energy inputs.

Community Phase 4.1: Seeded Grassland/Shrubland
This community phase appears as a grassland with scattered shrubs and trees. The vegetative production is typically higher than in the current potential state, depending on grass species seeded; however the grass is still

sparse due to the low water holding capacity of soils associated with pinyon and juniper.

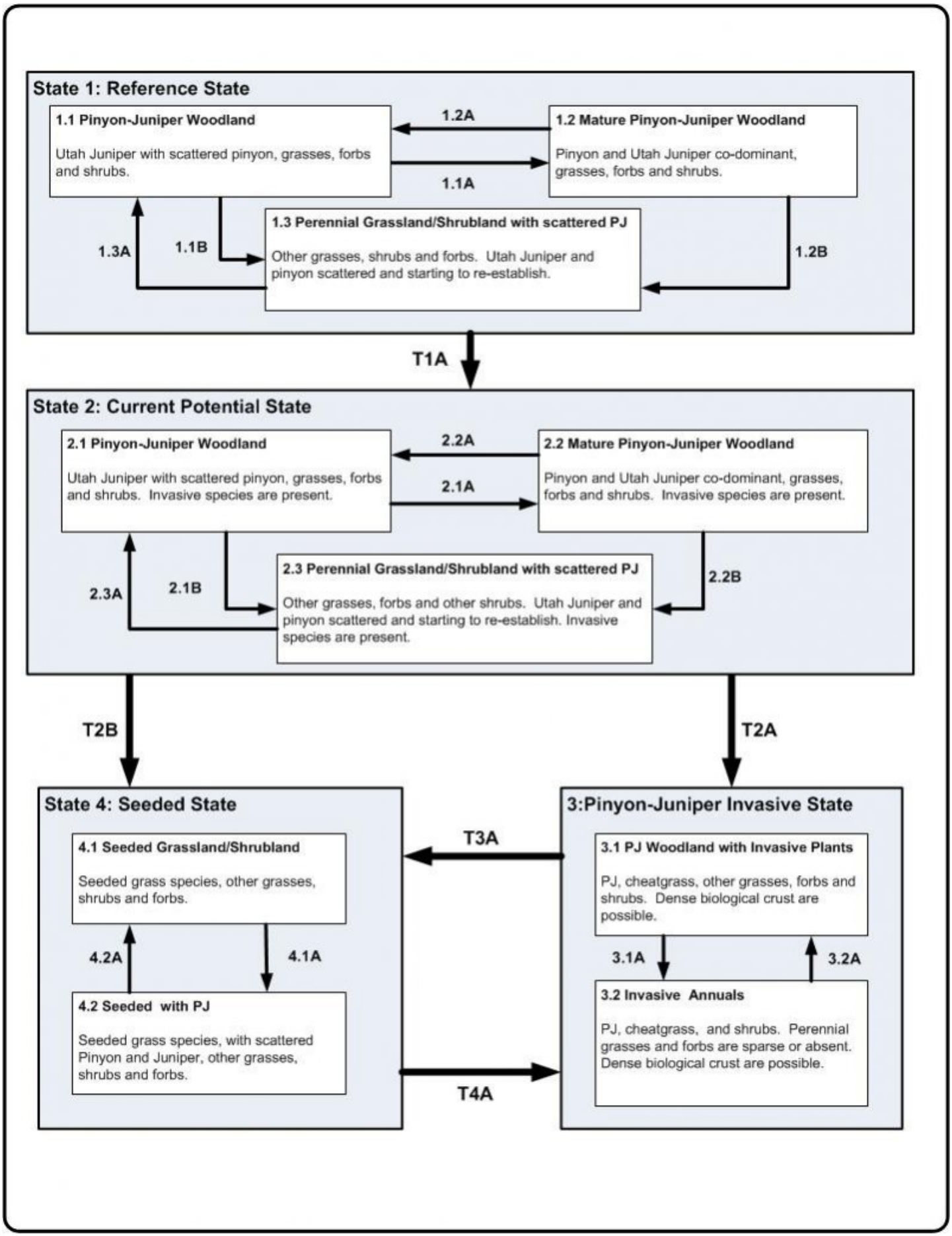
Community Phase Pathway 4.1A
This pathway occurs when events favor the establishment of shrubs and trees, including long periods without disturbances.

Community Phase 4.2: Seeded with PJ
This community phase has a dense under story of introduced grasses and forbs, but a canopy of pinyon and Utah juniper are establishing. Native perennial grasses, forbs, and shrubs may also be starting to establish. Interspaces are filled with biological crusts and herbaceous plants.

Community Phase Pathway 4.2A
This pathway occurs as trees and shrubs are removed from the community, either naturally through insect herbivory or through vegetation manipulation by man.

Transition T4A
This transition occurs when events favor the establishment and dominance of invasive annuals. Events may include an extended drought, surface disturbance such as off road vehicle use, and/or a shortened fire return interval, all of which can stress the native perennial bunchgrasses.

State and transition model


State 1: Reference State
1.1 Pinyon-Juniper Woodland
Utah Juniper with scattered pinyon, grasses, forbs and shrubs.
1.2A
1.1A
1.2 Mature Pinyon-Juniper Woodland
Pinyon and Utah Juniper co-dominant, grasses, forbs and shrubs.
1.3A
1.1B
1.3 Perennial Grassland/Shrubland with scattered PJ
Other grasses, shrubs and forbs. Utah Juniper and pinyon scattered and starting to re-establish.
1.2B
T1A
State 2: Current Potential State
2.1 Pinyon-Juniper Woodland
Utah Juniper with scattered pinyon, grasses, forbs and shrubs. Invasive species are present.
2.2A
2.1A
2.2 Mature Pinyon-Juniper Woodland
Pinyon and Utah Juniper co-dominant, grasses, forbs and shrubs. Invasive species are present.
2.3A
2.1B
2.3 Perennial Grassland/Shrubland with scattered PJ
Other grasses, forbs and other shrubs. Utah Juniper and pinyon scattered and starting to re-establish. Invasive species are present.
2.2B
T2B
T2A
State 4: Seeded State
4.1 Seeded Grassland/Shrubland
Seeded grass species, other grasses, shrubs and forbs.
4.2A
4.1A
4.2 Seeded with PJ
Seeded grass species, with scattered Pinyon and Juniper, other grasses, shrubs and forbs.
T3A
T4A
3:Pinyon-Juniper Invasive State
3.1 PJ Woodland with Invasive Plants
PJ, cheatgrass, other grasses, forbs and shrubs. Dense biological crust are possible.
3.1A
3.2A
3.2 Invasive Annuals
PJ, cheatgrass, and shrubs. Perennial grasses and forbs are sparse or absent. Dense biological crust are possible.

Legend

1.1A, 2.1A,1.3A, 2.3A – wetter climate period, time without disturbance
1.1B, 2.1B, 1.2B, 2.2B – Fire
1.2A, 2.2A – Insect and pathogen outbreaks, drought, small scale fires
T1A – Establishment of non-native invasive plants
T2A, T4A – reduced fire return interval, increase in invasive plants in understory, extended drought
T2B, T3A – Vegetation manipulation
3.1A – drought, reduced fire return interval
3.2A, 4.1A – time without disturbance
4.2A – vegetation manipulation, insect or pathogen outbreaks, drought

State 1
Reference State

Community 1.1
Reference State

The dominant aspect of the plant community is pinyon and Utah juniper. The understory composition by air-dry weight is approximately 30 percent perennial grasses, 10 percent forbs and 60 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	270	450	570
Grass/Grasslike	135	225	285
Forb	45	75	95
Total	**450**	**750**	**950**

Table 6. Ground cover

Tree foliar cover	34-36%
Shrub/vine/liana foliar cover	29-31%
Grass/grasslike foliar cover	24-26%
Forb foliar cover	4-6%
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 (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	4-6%
>1 <= 2	–	–	24-26%	–
>2 <= 4.5	–	29-31%	–	–
>4.5 <= 13	34-36%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Dominant Trees**			120–265	
	twoneedle pinyon	PIED	*Pinus edulis*	96–225	–
	Utah juniper	JUOS	*Juniperus osteosperma*	24–40	–
Shrub/Vine					
0	**Dominant Shrubs**			256–440	
	black sagebrush	ARNO4	*Artemisia nova*	160–240	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	80–120	–
	mormon tea	EPVI	*Ephedra viridis*	8–40	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	8–40	–
3	**Sub-Domiant Shrubs**			80–200	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	40–80	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	8–24	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	8–24	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	8–24	–
	Gambel oak	QUGA	*Quercus gambelii*	8–24	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	8–24	–
Grass/Grasslike					
0	**Dominant Grasses**			144–280	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	120–160	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	8–40	–
	needle and thread	HECO26	*Hesperostipa comata*	8–40	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	8–40	–
1	**Sub-Dominant Grasses**			80–176	
	Grass, annual	2GA	*Grass, annual*	24–40	–
	Grass, perennial	2GP	*Grass, perennial*	24–40	–
	Geyer's sedge	CAGE2	*Carex geyeri*	8–24	–

	squirreltail	ELEL5	*Elymus elymoides*	8–24	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	8–24	–
	muttongrass	POFE	*Poa fendleriana*	8–24	–
Forb					
2	**Sub-Dominant Forbs**			120–352	
	Forb, annual	2FA	*Forb, annual*	40–80	–
	Forb, perennial	2FP	*Forb, perennial*	40–80	–
	yellow milkvetch	ASFL	*Astragalus flavus*	8–24	–
	western tansymustard	DEPI	*Descurainia pinnata*	8–24	–
	cushion buckwheat	EROV	*Eriogonum ovalifolium*	8–24	–
	shaggy fleabane	ERPU2	*Erigeron pumilus*	8–24	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	8–24	–
	thickleaf beardtongue	PEPA6	*Penstemon pachyphyllus*	24	–
	rock goldenrod	PEPU7	*Petradoria pumila*	8–24	–
	longleaf phlox	PHLO2	*Phlox longifolia*	8–24	–

Animal community

This site provides proper grazing for cattle and sheep during spring, summer, and fall.
This site produces food and cover for wildlife. Wildlife using this site include jackrabbit, woodrat, pinyon jay, coyote, mule deer, and elk.

Hydrological functions

The soil is in hydrologic groups b and c. The runoff curve numbers are 61 through 86 depending on the condition of the watershed.

Recreational uses

This site has aesthetic appeal but limited recreational potential.

Wood products

There are approximately 12-15 cords of firewood per acre in the potential plant community when the average tree diameter is 5 inches at one foot. About 12 to 15 posts and 10 to 12 Christmas trees are produced per acre. The site index is 60.

Contributors

J. Lee Broadbent
Garth Leishman

Approval

Kirt Walstad, 3/05/2022

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)	V. Keith Wadman (NRCS Retired).
Contact for lead author	shane.green@ut.usda.gov
Date	03/10/2012
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to few rills present. Some minor rill development may occur on steeper slopes or on areas located below exposed bedrock, or other water shedding areas, where increased runoff may occur. Any rills present should be <1 inch deep, fairly short (<8 feet) and somewhat widely spaced (6-8 feet). Minor rill development may be observed following major thunderstorm or spring runoff events but should heal during the next growing season.

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2. **Presence of water flow patterns:** A very few sinuous flow patterns wind around perennial plants and surface rock. Evidence of flow patterns is expected to increase somewhat with slopes greater than 15%. Water flow patterns are long (15-20 feet), narrow (<1 foot wide), and spaced widely (10-20 yards) on gentle slopes (<15%) and more closely (<10 yards) on steeper slopes (>15%).

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3. **Number and height of erosional pedestals or terracettes:** Small pedestals may form at the base of plants that occur on the edge of water flow patterns, but should not show any exposed roots. Terracettes are fairly common, forming behind debris dams of small to medium sized litter (up to 2 inches in diameter) in water flow patterns. These debris dams may accumulate smaller litter (leaves, grass and forb stems) and sediment.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 15–20%. (Soil surface is typically covered 35-75% surface fragments). Most bare ground is associated with water flow patterns, rills, and gullies. Poorly developed biological soil crusts that are interpreted as functioning as bare ground should be recorded as bare ground.

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5. **Number of gullies and erosion associated with gullies:** None to rare on slopes < 15%. On steeper slopes and on areas below exposed bedrock, a few gullies may occur. There they do occur, their length often extends from the exposed bedrock to where the gully reaches a stream or other area where water and sediment accumulate. Gullies may show slightly more indication of erosion as slope increases, or as the site occurs adjacent to steep sites/watershed with concentrated flow patterns.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None to very few. Trees break the wind and reduce the potential for wind erosion. The channers on the soil surface help armor it and reduce the potential for wind erosion.

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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. Minor litter removal may occur in flow channels with deposition occurring

within 1 to 2 feet at points of obstruction. The majority of litter accumulates at the base of plants. Some grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move. However, some litter movement is expected (up to 6 feet) with increases in slopes >15% and/or increased runoff resulting from heavy thunderstorms.

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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 an erosion rating of 4 or 5 under the plant canopies, and a rating of 3 to 4 in the interspaces. The average should be a 4. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Whetrock) Soil surface horizon is typically 0 to 2 inches deep. Texture is an extremely channery loam, structure is typically very thin platy parting to moderate very fine subangular blocky. Color is a grayish brownish (10YR5/2). A mollic epipedon ranges to a depth of 8 inches. Use the 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:** Spatial distribution of well developed biological soil crusts (where present) intercept raindrops reducing splash erosion and provide areas of surface detention to store water allowing additional 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 (beyond the reference state) reduces understory vegetation causing an associated increase in 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, There may be dense layers of rock fragments or other naturally occurring hard layers found in the soil subsurface. These should not be considered to be 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 (two-needle pinyon/Utah juniper) > = Sprouting shrubs (black sage, alderleaf mountain mahogany)>> Perennial bunchgrasses (bluebunch wheatgrass, Indian ricegrass).

    Sub-dominant: Non-sprouting shrubs (Wyoming big sagebrush) > Perennial bunchgrasses (needle-and-thread, prairie junegrass)>> Forbs (yellow milkvetch, cushion wild buckwheat) > Biological soil crusts.

    Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state. 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: Factors contributing to temporal variability include insects and other pathogens (mistletoe), drought, extreme precipitation events, etc. Factors contributing to spatial variability include slope, amount of rock fragments, aspect, etc. Following recent natural disturbances such as fire, drought or insects that may remove the woody vegetation, forbs and perennial grasses (herbaceous species) may become more dominate in the community. These conditions may reflect a functional community phase within the reference state.

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 trees, shrubs, or grasses. During severe (multi-year) drought up to 20% of the pinyons and junipers may die, either from drought, insect damage or pathogens such as mistletoe. There may be partial mortality on individual bunchgrasses and shrubs during drought periods, and complete mortality of individual plants during severe drought periods, particularly on the shallower and coarser soils associated with this site. Because woody stems may persist for many years, both pinyons and junipers (especially older trees) will normally have dead stems within the plant canopy.

14. **Average percent litter cover (%) and depth (in):** Litter cover (including under plants) nearly all of which should be fine litter. Depth should be 1 leaf thickness in the interspaces, up to 1/2” under shrub canopies, and up to 1” under tree canopies. Litter cover may increase to 30% on some years due to increased production of plants.

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 700 - 800#/acre on an average year, but could range from 400 to 1000#/acre during periods of prolonged drought or above average precipitation.

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Few invasive species are capable of dominating this site. When invasion does occur, cheatgrass, and various mustard species are the most likely to invade.

17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce in all years, except in extreme drought years. There are no restrictions on either seed or vegetative reproduction. Some seedling recruitment of major species is present during average and above average growing years.