

Ecological site R034BY019UT Semiwet Streambank (Narrowleaf cottonwood)

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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

This site occurs on flood plains. Characteristic soils are very deep and somewhat poorly to moderately well drained. They formed in alluvium derived mainly from sedimentary and quartzite parent materials. Slopes are mostly 0 to 4 percent. Soils are occasionally flooded during high runoff and are affected by a fluctuating watertable during parts of the plant growing season. pH are neutral to moderately alkaline. Available water holding capacity ranges from 1 to 5 inches in the top 60 inches of soil. The soil moisture regime is mostly ustic and the soil temperature regime is mesic. Precipitation ranges from 6-12 inches annually.

Table 1. Dominant plant species

Tree	(1) <i>Populus angustifolia</i>
Shrub	(1) <i>Rhus trilobata</i> var. <i>trilobata</i>
Herbaceous	Not specified

Physiographic features

This site occurs on flood plains. Slopes are mostly 0 to 4 percent.

Table 2. Representative physiographic features

Landforms	(1) Flood plain
Runoff class	Low
Flooding duration	Long (7 to 30 days) to very long (more than 30 days)
Flooding frequency	Occasional
Elevation	4,700–6,400 ft
Slope	0–4%
Ponding depth	Not specified
Water table depth	18–42 in
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The climate is cold and snowy in the winter and warm and rainy in the summer. On the average the wettest months are march through July and the driest months are August through February. Average annual precipitation is 5 to 12 inches. The mean annual air temperature is 7 to 8 degrees Celsius and the soil temperatures are in the mesic regime

Table 3. Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	100-140 days
Precipitation total (characteristic range)	5-12 in

Influencing water features

This site is occasionally flooded during high runoff and are affected by a fluctuating water table (18 to 42 inches in depth) during parts of the plant growing season.

Soil features

Characteristic soils are very deep and somewhat poorly to moderately well drained. They formed in alluvium derived

mainly from sedimentary and quartzite parent materials. Soils are occasionally flooded during high runoff and are affected by a fluctuating watertable during parts of the plant growing season. pH are neutral to moderately alkaline. Available water holding capacity ranges from 1 to 5 inches in the top 60 inches of soil. The soil moisture regime is mostly ustic and the soil temperature regime is mesic. Precipitation ranges from 6-12 inches annually.

Modal Soil: Robido FSL, 1-4% – coarse-loamy, siliceous, mesic Cumulic Haplustolls

Table 4. Representative soil features

Parent material	(1) Alluvium–sedimentary rock (2) Alluvium–quartzite
Surface texture	(1) Fine sandy loam (2) Loam
Family particle size	(1) Coarse-loamy
Drainage class	Moderately well drained
Permeability class	Moderate to moderately rapid
Depth to restrictive layer	60 in
Soil depth	60–80 in
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0–3%
Available water capacity (Depth not specified)	1–5 in
Calcium carbonate equivalent (Depth not specified)	0–5%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–5
Soil reaction (1:1 water) (Depth not specified)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	23–32%
Subsurface fragment volume >3" (Depth not specified)	33–53%

Ecological dynamics

Community Phase 1.1: Reference State

The Reference State is a description of this ecological site just prior to Euro-American settlement but long after the arrival of Native Americans. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information and familiarity with rangeland relict areas where they exist. The Reference State would have been in any of three phases depending on stream gradient and how recently fire had occurred or when beavers had last been present. Along steeper stream gradients, succession would have rapidly proceeded from low-statured graminoids (1.1), to shrubs (1.2), and lastly to trees that reproduce in their own shade (1.3). A complete list of species by lifeform for the Reference State is available in accompanying tables in the “Plant Community Composition by Weight and Percentage” section of this document. Along gentle gradients beavers would have consumed all the largely deciduous woody stems and constructed dams. Once the nearby food and building materials were exhausted, the colony of beavers would have moved to another reach of the stream, making the abandoned dams and depleted stretch vulnerable to blow out from the next large convective storm. This phase is short since most of the woody species re-sprout and are dominant again within a decade or so.

The resulting drop in the water table would have stressed the moisture-demanding woody species and favored the graminoids, allowing the graminoids to eventually reclaim the drier streamside banks. Thus, rather than one plant

community becoming stable, these stretches of stream would have been in a continual state of change. Fur trapping in the 1820s-1830s resulted in the reduction of beaver by about 95% (Parson 1996). Without these animals to maintain their stair-step configuration of dams, the whole hydrologic regime of these drainages changed. What were once small perennial streams became ephemeral, and succession was truncated. Beaver have not returned in number until recent decades (when the fur trade diminished and furbearers began to be raised on farms). Thus, by the time of the European settlement period, huge changes in these systems had already taken place.

Community Phase 1.1: graminoid dominance (rushes & sedges)

This early seral phase would have been dominated by rushes (*Juncus* spp.), sedges (*Carex* spp.), and native perennial water-demanding species such as mat muhly (*Muhlenbergia richardsonis*), and mountain brome (*Bromus marginatus*). Heavy local utilization by moose or beaver would have kept back the woody species, allowing this graminoid phase to persist.

Community Pathway 1.1a:

Along gentler stream gradients, ponding caused by construction of beaver dams would have brought the water table up in areas that would have otherwise been dry. Heavy grazing by bison and/or elk would have reduced the graminoids, giving way first to some taller forbs such as Missouri goldenrod (*Solidago missouriensis*) and feathery false lily of the valley (*Maianthemum racemosum*). Quickly following were a set of water-loving shrubs and small trees. The same successional process would have taken place along steeper gradients, but at a more rapid rate.

Community Phase 1.2: mesic shrub dominance

A set of mesic shrubs including coyote willow, sumac would have quickly over-topped the graminoids, unless shrubs were cropped by moose or beaver.

Community Pathway 1.2a:

The presence of narrowleaf cottonwood (*Populus angustifolia*) seeds being carried by water would have provided for the rapid succession from shrubs to a gallery forest.

Community Pathway 1.2b:

As the supply of palatable deciduous shrubs and trees increased, beaver numbers would also have increased. With time, a heavy concentration of beaver and moose would have reduced the woody component, with the exception of the less palatable shrubs (e.g. Woods' rose (*Rosa woodsii*), causing the canopy to open up.

Community Phase 1.3: gallery forest (narrowleaf cottonwood)

Without beaver, tree cutting, and/or fire, a thick streamside (gallery) forest dominated by shade-tolerant narrowleaf cottonwood would have developed.

Community Pathway 1.3a:

A strong convectional storm associated with flash flooding would have blown out existing beaver dams. Unless the beavers were still occupying the area and rebuilt their dams, the water table would have eventually returned to previously lower levels. This would have allowed the graminoids to reclaim the site. Wildfire would have had a similar effect by removing most of the woody vegetation and debris, thereby re-opening the site to graminoids.

Community Pathway 1.3b:

This community pathway would be similar to 1.2b, except less intense. Flash flooding may blow out existing beaver dams following convectional storm events, but some smaller-statured trees and shrubs would persist, leaving enough woody material such that beavers could subsist and rebuild their dams.

Transition T1a: from State 1 to State 2 (Reference State to Xerified Shrub and Tree Dominated Drained State)

The simultaneous introduction of European livestock and exotic plant species, the near extirpation of beaver along with its influence on the hydrologic regime, and a warmer drier climate were all factors involved in the transition to State 2. A return to State 1 would not be impractical because of these issues.

Community Phase 2.2: Xerified Shrub and Tree Dominated Drained State

State 2 is similar to State 1 in form and function, with the exception of the presence of non-native plants and animals, possible extinctions, and a different climate. State 2 is a description of the ecological site shortly following Euro-American settlement. This state can be regarded as the current potential. Depending on the size of the

watershed above, the stream could well have changed from a perennial to ephemeral drainage. Many of the same species of plants found in the Reference State continue to exist in the latter situation because of hyporheic (i.e. below ground) movement of water, although the period of greenery and its productivity are lessened. The introduction of cattle put pressure on the graminoids (2.1a) and hastened the conversion to shrubs (2.2). The lack of beaver dams meant that sediment moved more rapidly downstream with flashy (short duration, high intensity) precipitation events. Stream channelization occurred with increased rates of flow, leading to xerification of the streamside. With beaver temporarily absent, livestock numbers relatively reduced due to lack of forage, and lack of natural disturbances (2.2a), the shrubs and trees grow larger and shade out many of the forage species favored by livestock (2.3). The most disturbed phase of this State would be the graminoid-dominant phase (2.1), which occurs if moose effectively browse out the shrubby vegetation (2.2b). Kentucky bluegrass (*Poa pratensis*) was introduced at some sites for livestock forage; however it is not capable of holding the stream banks together during convectional storms.

Community Phase 2.1: graminoid dominance

This graminoid-dominated phase is frequently dominated by Kentucky bluegrass. The Forest Service regards this as an introduced species, but it is preferred by livestock over other native graminoids. It is, however, less able to protect stream banks than its native counterparts because of its shallower, weaker roots.

Community Pathway 2.1a:

Heavy season-long use by cattle will diminish the grass component and allow an increase in tall forbs. Sheep will consume most of the forbs and shrubs, but will leave the thistles (*Cirsium* spp.), horsetail (*Equisetum* spp.), Woods' rose, skunkbush sumac (*Rhus trilobata*), and silver buffaloberry (*Shepherdia argentea*).

Community Phase 2.2: mesic shrub dominance

This plant community will be dominated by unpalatable mesic shrubs such as Woods' rose, sumac, and silver buffaloberry, with an understory of unpalatable herbs including thistles and horsetail. Species composition will depend upon the type of livestock utilizing the area.

Community Pathway 2.2a:

Without moose and/or beaver consumption of shrubs and sapling trees, the shrub phase quickly transforms to a gallery forest.

Community Pathway 2.2b:

Moose have become more abundant of late and focus their attention on yellow willow and water birch, especially during the winter. This will cause a retardation of the shift to shrub and tree dominance.

Community Phase 2.3: gallery forest (narrowleaf cottonwood)

This plant community is dominated by narrowleaf cottonwood, a shade-tolerant species, which will persist in the absence of wildfire, wood cutting, and/or large storm events.

Community Pathway 2.3a:

A gallery forest can persist in the absence of fire or wood cutting, creating a jack-strawing of downed trees that will make access to the site difficult for large animals.

Transition T2a: from State 2 to State 3 (Xerified Shrub and Tree Dominated Drained State to Improved Pasture State)

Since there is diminished forage production in the woody plant-dominated phases of State 2, some private landholders have, through prescribed fire and mechanical treatments, cleared out the streamside vegetation and planted exotic species such as smooth brome (*Bromus inermis*) or orchardgrass (*Dactylis glomerata*) to replace the native species.

State 3: Improved Pasture State

Community Phase 3.3: Improved Pasture State

Some private land owners have bulldozed the streamside vegetation to remove trees needed by beavers to pond up the stream and/or to remove shade to increase forage production for livestock. Introduced species such as orchardgrass and smooth brome have been planted as the site became xerified, but more conducive to cattle grazing. The early seral vegetation created constitutes Phase 3.1. With time and heavy cattle grazing (3.1a), the

tendency is for the original shrubs and trees to return (3.2). If introduced grass dominance is desired, mechanical or chemical re-treatment to reduce the woody plants will be required (3.2a).

Community Phase 3.1: planted pasture

This plant community will be dominated by introduced species such as orchardgrass and smooth brome.

Community Pathway 3.1a:

In order to maintain an herbaceous-dominant phase, the native woody species may require re-treatment using mechanical or chemical means.

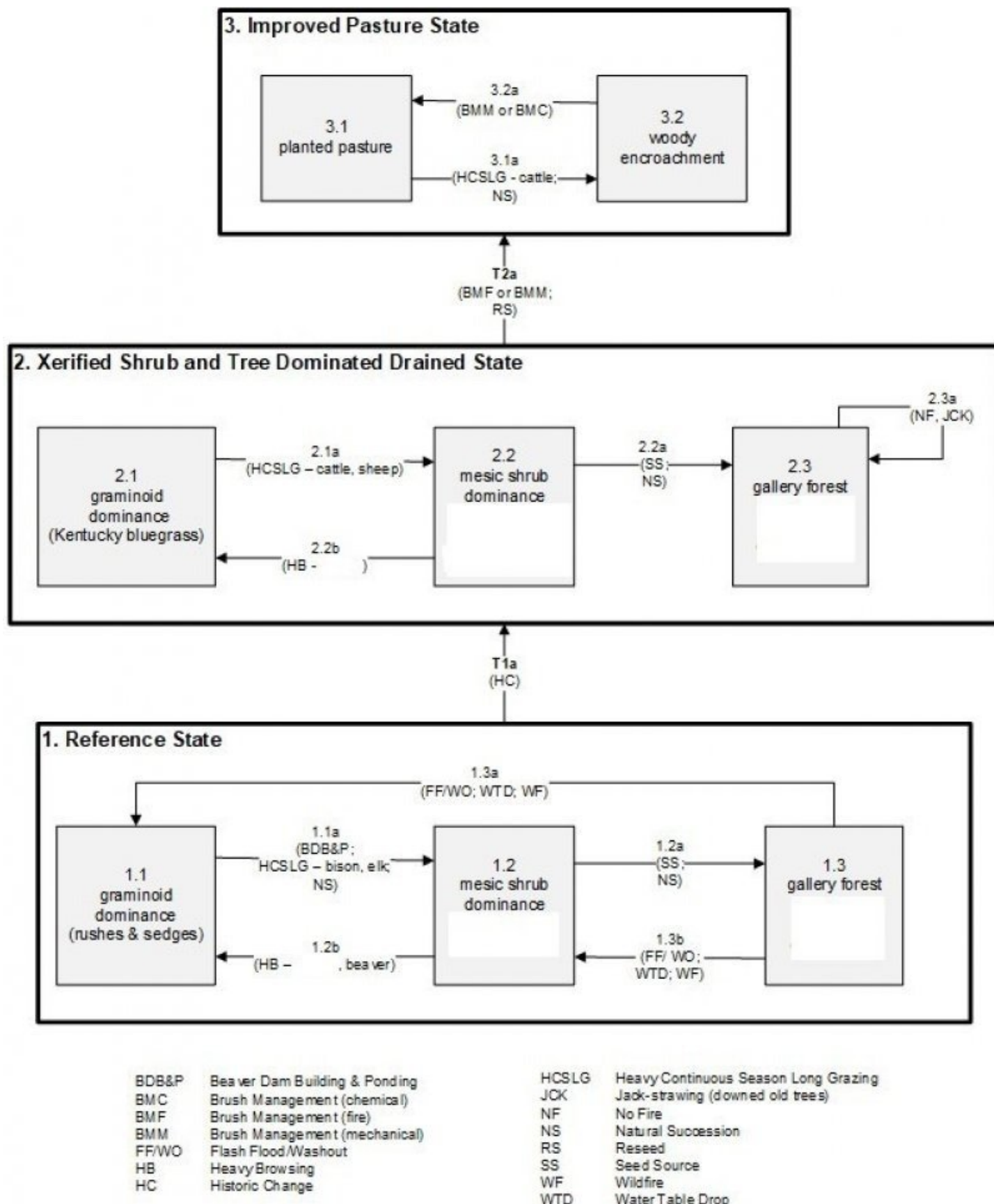
Community Phase 3.2: woody encroachment

This plant community will be a mix of introduced grasses and native shrubs that have re-established following a period of heavy continuous season-long grazing.

Community Pathway 3.2a:

Some re-establishment of native shrubs will occur if the site is heavily grazed during the growing season of the grasses.

State and transition model



State 1 Reference State

Community 1.1 Reference State

The general view of this area is basin big sagebrush and skunkbush shrubs with alkali sacaton, Mountain rush

(baltic rush) on outer edges of braided stream channels. Also narrowleaf cottonwood trees with an understory of narrowleaf cottonwood reproduction skunkbush sumac, woods rose, an occasional silver buffaloberry, dogbane, goldenrod, baltic rush, western wheatgrass, and many annual grasses and forbs. The composition by air-dry weight is approximately 25 percent perennial grasses and grass-like plants, 20 percent forbs, 45 percent shrubs and 5% trees.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	180	315	450
Grass/Grasslike	100	175	250
Forb	80	140	200
Tree	40	70	100
Total	400	700	1000

Table 6. Ground cover

Tree foliar cover	19-21%
Shrub/vine/liana foliar cover	29-31%
Grass/grasslike foliar cover	9-11%
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	—	—	9-11%	4-6%
>1 <= 2	—	—	—	—
>2 <= 4.5	—	—	—	—
>4.5 <= 13	—	29-31%	—	—
>13 <= 40	19-21%	—	—	—
>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			50–150	
	narrowleaf cottonwood	POAN3	<i>Populus angustifolia</i>	80–120	–
Shrub/Vine					
0	Dominant Shrubs			200–320	
	skunkbush sumac	RHTRT	<i>Rhus trilobata</i> var. <i>trilobata</i>	80–120	–
	basin big sagebrush	ARTRT	<i>Artemisia tridentata</i> ssp. <i>tridentata</i>	40–80	–
3	Sub-Dominant Shrubs			112–200	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	40–80	–
	Woods' rose	ROWO	<i>Rosa woodsii</i>	24–40	–
	narrowleaf willow	SAEX	<i>Salix exigua</i>	24–40	–
	silver buffaloberry	SHAR	<i>Shepherdia argentea</i>	24–40	–
Grass/Grasslike					
0	Dominant Grasses			96–160	
	creeping bentgrass	AGST2	<i>Agrostis stolonifera</i>	24–40	–
	mountain rush	JUARL	<i>Juncus arcticus</i> ssp. <i>littoralis</i>	24–40	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	24–40	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	24–40	–
1	Sub-Dominant Grasses			96–224	
	Grass, annual	2GA	<i>Grass, annual</i>	24–40	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	24–40	–
	clustered field sedge	CAPR5	<i>Carex praegracilis</i>	8–24	–
	saltgrass	DISP	<i>Distichlis spicata</i>	8–24	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	8–24	–
	basin wildrye	LECI4	<i>Leymus cinereus</i>	8–24	–
	mat muhly	MURI	<i>Muhlenbergia richardsonis</i>	8–24	–
Forb					
0	Dominant Forb			72–120	
	spreading dogbane	APAN2	<i>Apocynum androsaemifolium</i>	24–40	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	24–40	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	24–40	–
2	Sub-Dominant Forbs			80–176	
	Forb, annual	2FA	<i>Forb, annual</i>	24–40	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	24–40	–
	littleleaf pussytoes	ANMI3	<i>Antennaria microphylla</i>	8–24	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	8–24	–
	hairy false goldenaster	HEVI4	<i>Heterotheca villosa</i>	8–24	–
	feathery false lily of the valley	MARAR	<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	8–24	–

Animal community

This site provides forage for cattle in the late spring.

This site provides food and cover for wildlife. Wildlife using this site include jackrabbit, coyote, mule deer, small mammals, raptors, and birds. During the winter, moose also use the area.

Hydrological functions

The soil series are in hydrologic groups a and b. Hydrologic curve numbers are 39 and 51 when the vegetation is in good condition.

Recreational uses

This site provides color and aesthetic appeal in spring, summer, and fall. Recreation activities may include hiking and hunting.

Wood products

Stunted cottonwoods, Firewood

Contributors

Jim Brown

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.

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Date	05/29/2012
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rill occurrence is highly variable. This site is subject to frequent disturbance caused by seasonal flooding with its' associated soil scouring and deposition activities. Where rills are present they should be less than 1 inch deep, somewhat widely spaced (10 to 15 feet), and may be connected. They will often run the length of the streambank to a point of depositional interruption. An increase in rill development may be observed following large storm events or spring runoff periods. Rill development may also increase where the site is adjacent to other sites that produce large amounts of runoff (i.e. steeper sites, slickrock, etc.)

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2. **Presence of water flow patterns:** Water flow patterns are common. They may be stright and/or sinuous and wind

around perennial plant bases. They may be long (15 to 25 feet), 1 to 3 feet wide, and spaced from 5 to 20 feet apart. They should become somewhat stable between flooding events. This site will often act as a soil filter and trap large amounts of sediment. These become ideal locations for the establishment of new riparian vegetation.

3. **Number and height of erosional pedestals or terracettes:** Plants are expected to show some pedestalling where they are adjacent to water flow patterns. Exposed roots may be present where scouring has occurred. Terracettes are also typically present following flooding events. They often develop behind debris such as twigs and tree branches that act as dams within water flow patterns.
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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is variable on this site, but should range from 25 to 40%. Bare ground openings should be approximately 1 to 3 feet in size and may be connected as flow channels. Adapted rhizomatous riparian vegetation will often re-populate these opening between flood events.
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5. **Number of gullies and erosion associated with gullies:** None at site level. Widely scattered landscape level gully channels, however, are a normal component of desert environments. Where landscape gullies are present, they should be stable, partially vegetated on their sides and bottoms, with little evidence of head-cutting. Some slight increase in disturbance may be evident following significant weather events or when gullies convey considerable runoff from higher elevation rocky or naturally eroding areas.
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6. **Extent of wind scoured, blowouts and/or depositional areas:** No evidence of wind generated soil movement. Wind caused blowouts and depositional areas are not present.
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7. **Amount of litter movement (describe size and distance expected to travel):** Litter accumulates in place at the base of plant canopies between flood events. Following significant flood events, litter is expected to be transported downstream by water. Considerable accumulation is observed behind obstructions such as rocks and woody debris.
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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 sites soil stability rating is highly variable. A rating of 3 to 5 should occur on areas with stable soils, with a rating of 1 to 4 on depositional materials. The average should be in the 2 to 4 range. Surface textures will typically vary from sands and gravels in depositional areas to sandy loams, loams and clay loams on stable soils.
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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Ashley) Soil surface is typically 0 to 7 inches deep. Surface texture is a loam and structure is weak fine granular. The A-horizon color is pinkish gray (7.5YR 6/2). Soils have an Ochric epipedon that extends 30 inches into the soil profile. The A horizon is normally deeper and better developed on the more stable portions of the streambank. 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:** Perennial vegetation helps anchor streambanks, reducing soil scouring and increasing deposition. Good spatial distribution of plants also slows runoff by obstructing surface flows, allowing time for

increased infiltration. With the physiographic location of this site being in low lying areas, it often acts as a terminal accumulation site for runoff.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. This site will normally have textural variation within its' soil profile. These should not be mistaken for 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 (Narrowleaf cottonwood) > Sprouting Shrubs (Coyote willow, skunkbush sumac) >> Perennial Grasses (slender wheatgrass, redtop) > Perennial grasslikes (arctic rush, scouring rush) > Perennial Forbs (goldenrod, spreading dogbane).

Sub-dominant: Non-sprouting Shrubs (basin big sagebrush) > Rhizomatous Grasses (saltgrass, western wheatgrass) >> Perennial Forbs (hairy false goldenaster).

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. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

Additional: Disturbance regimes include seasonal flooding, insects, and infrequent fire. Temporal variability can be caused by fires, droughts, insects, etc. Spatial variability can be caused by periodic flooding, soil pH, and topography. Narrowleaf cottonwood appears to be more resistant to fire than Fremont cottonwood, and with repeated fire, may replace that species in the community where both occur. Following a recent disturbance such as drought, or flooding damage that removes woody vegetation, forbs and perennial grasses and grasslikes may dominate the community. If a disturbance has not occurred for an extended period of time, woody species may continue to increase on the site, reducing herbaceous species. Yearly variations in flow and large floods that scour vegetation and deposit sediment on floodplains are ideal microsites for willow and cottonwood seedlings. These conditions may reflect community phases within the reference state.

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** There should be no mortality or decadence in either trees, shrubs or grasses during years with average to above average precipitation. During severe (multi-year) droughts that affect groundwater levels, up to 15% of the trees and shrubs may die. Minor mortality of perennial grasses and grasslikes may also occur during these drought periods. There may be partial mortality of individual grasses, grasslikes and shrubs during less severe droughts.
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14. **Average percent litter cover (%) and depth (in):** Litter cover is highly variable on this site and ranges from 15 to 25%. Depth should be 1/2 inch thickness in the interspaces and up to 2.5 inches under perennial plant canopies.
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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 600 to 800 pounds per acre on an average year. Production could vary from 300 to 1100 pounds per acre during drought or above-average years.
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16. **Potential invasive (including noxious) species (native and non-native).** List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site: Tamarisk, knapweed species, Russian thistle, mustard species, filarie, other non-native annual forbs and grasses.
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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually in most years, except in drought years. Rhizomatous plants including rushes and sedges are often the first to re-establish following flooding, coyote willow and Fremont cottonwood seedlings and saplings should also be present.
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