Ecological site R010XY225OR
Aspen Riparian 12-18 PZ

Last updated: 12/13/2023
Accessed: 05/12/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 010X–Central Rocky and Blue Mountain Foothills

This MLRA is characterized by gently rolling to steep hills, plateaus, and low mountains at the foothills of the Blue Mountains in Oregon and the Central Rocky Mountains in Idaho. The geology of this area is highly varied and ranges from Holocene volcanics to Cretaceous sedimentary rocks. Mollisols are the dominant soil order and the soil climate is typified by mesic or frigid soil temperature regimes, and xeric or aridic soil moisture regimes. Elevation ranges from 1,300 to 6,600 feet (395 to 2,010 meters), increasing from west to east. The climate is characterized by dry summers and snow dominated winters with precipitation averaging 8 to 16 inches (205 to 405 millimeters) and increasing from west to east. These factors support plant communities with shrub-grass associations with considerable acreage of sagebrush grassland. Big sagebrush, bluebunch wheatgrass, and Idaho fescue are the dominant species. Stiff sagebrush, low sagebrush, and Sandberg bluegrass are often dominant on sites with shallow restrictive layers. Western juniper is one of the few common tree species and since European settlement has greatly expanded its extent in Oregon. Nearly half of the MLRA is federally owned and managed by the Bureau of Land Management. Most of the area is used for livestock grazing with areas accessible by irrigation often used for irrigated agriculture.

Classification relationships

Landfire Biophysical Setting:
Rocky Mountain Aspen Forest & Woodland

US National Vegetation Classification System
Group: G506. Rocky Mountain-Great Basin Montane Riparian & Swamp Forest
Alliance: A3760. *Populus tremuloides* Riparian Forest Alliance
Association: (Undetermined)

Ecological site concept

In reference condition, this site supports a mature aspen forest with a diverse understory. In comparison to upland aspen sites, this site has higher soil moisture and exists on riparian landforms such as terraces and meadows. Common plant species within the reference community include chokecherry (*Prunus virginiana*), willows (Salix spp.) and great basin wildrye (*Leymus cinereus*). Historically wildfire was an important disturbance on this site that reduced invasion of encroaching western Juniper. Alteration of this disturbance regime may be promoting expansion of this competitive conifer on this site.

Associated sites

R010XC032OR	**SR Mountain 12-16 PZ** SR Mountain 12-16 PZ (drier site, no available sub-surface flows, different composition – aspen absent)

R010XC047OR	**SR Mountain South 12-16 PZ** SR Mountain South 12-16 PZ (drier site, no available sub-surface flows, different composition – aspen absent)
R010XC066OR	**SR Mountain North 12-16 PZ** SR Mountain North 12-16 PZ (drier site, less available sub-surface flows, different composition – aspen absent)
R010XY003OR	**Wet Meadow** Wet Meadow and Cold Wet Meadow (wet site, sub-surface flows at or near the surface, different composition – sedge/tufted hairgrass association, aspen absent)
R010XY004OR	**Meadow** Meadow and Cold Meadow (wetter site, sub-surface flows seasonally at or near the surface, different composition - tufted hairgrass/sedge association, aspen absent)
R010XY012OR	**Booth-Yellow Willow Riparian** Willow Riparian: Booth-Yellow Willow and other Willow and Alder Riparian Sites (wetter site, higher available sub-surface and surface flows, different composition – aspen absent)
R010XY117OR	**Mountain Swale 12-16 PZ** SR Mountain Swale 12-16 PZ (drier site, less available sub-surface flows, different composition – basin wildrye dominant, aspen absent)
R010XY220OR	**Alder Riparian 12-18 PZ** Alder Riparian 12-18 (transportation reach, steeper grade, gravelly surface and subsurface, different composition – aspen minor)
R010XY230OR	**Aspen Upland 12-18 PZ** Aspen Upland 12-18 PZ (drier site, different composition- POTR5/SYOR2-RIBES/FEID-LECI4 association)

Similar sites

R023XY418OR	**ASPEN 16-35 PZ** D23 Aspen 16-35 PZ (higher elevation, coarser soil, different composition–POTR5/SYOR2/CAREX association with an increase in ACHNA)
R010XY230OR	**Aspen Upland 12-18 PZ** Aspen Upland 12-18 PZ (drier site, well drained soil, different composition- POTR5/SYOR2-RIBES/FEID-LECI4 association)

Table 1. Dominant plant species

Tree	(1) *Populus tremuloides*
Shrub	(1) *Salix*
Herbaceous	Not specified

Physiographic features

This aspen riparian site typically occurs near forestland on the southern edge of the Ochoco and Blue Mountains where juniper invasion is a concern. It occurs at mid to higher elevation on relatively narrow to wide depositional areas of perennial and near perennial streams. Often it is adjacent to meadows and upland spring areas. As a depositional area it is subject to run on, frequent seasonal flooding and sediment deposition. In reference condition the site is well connected to the primary channel with a depth to the channel bottom of two feet or less on small streams and slightly greater on larger streams. Subsurface water is available within the root zone for the majority of the growing season and a seasonal high water table from 90 to 150 cm below the surface may occur sometime from November through July. Historically, the hydrology, soil formation and biotic processes were often influenced by the presence of beaver. Slopes are typically 0 to 5 percent but may range from 0 to 15 percent. Elevations range from 4,300 to 6,000 feet (1,300 to 1,850 meters).

Table 2. Representative physiographic features

Landforms	(1) Mountains > Stream (2) Mountains > Stream terrace (3) Mountains > Mountain valley
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Occasional to frequent
Ponding duration	Very brief (4 to 48 hours)
Ponding frequency	None to rare
Elevation	1,311–1,829 m
Slope	0–5%
Ponding depth	0 cm
Water table depth	91–203 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Flooding duration	Not specified
Flooding frequency	Not specified
Ponding duration	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	0–15%
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

The annual precipitation ranges from 12 to 18 inches (300 to 450 mm), but may be as high as 25 inches (630 mm), most of which occurs in the form of snow and rain during the months of November through May. Frequent surface flows and long duration seasonal subsurface flows from adjacent perennial and seasonal streams and associated uplands augment the precipitation. Localized convection storms occasionally occur during the summer. The soil temperature regime is frigid to mesic near frigid with a mean air temperature of 43° F (6 degrees C) and a range of 39 to 46° F (4 to 8° C). Temperature extremes range from 90 to -20° F (-28 to 32° C). The soil moisture regime is xeric. The frost free period is 20 to 90 days. The optimum growth period for plant growth is late May through July. Climate graphs are based on the nearest available climate stations to representative site locations and are provided to indicate general climate patterns.

Table 4. Representative climatic features

Frost-free period (characteristic range)	20-90 days
Freeze-free period (characteristic range)	70-120 days
Precipitation total (characteristic range)	305-457 mm
Frost-free period (actual range)	
Freeze-free period (actual range)	
Precipitation total (actual range)	305-635 mm
Frost-free period (average)	55 days
Freeze-free period (average)	95 days
Precipitation total (average)	406 mm

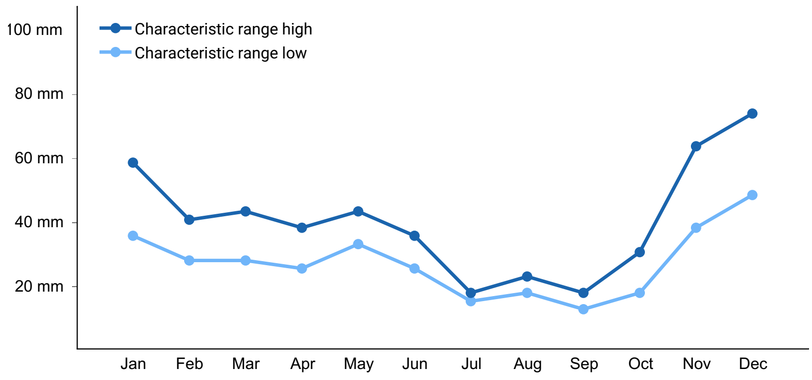


Figure 1. Monthly precipitation range

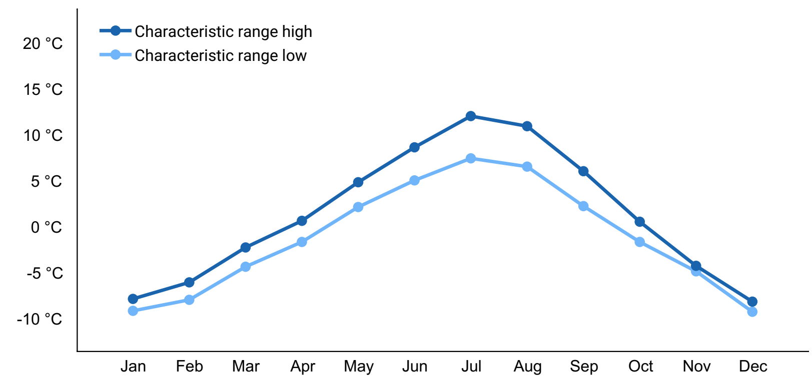


Figure 2. Monthly minimum temperature range

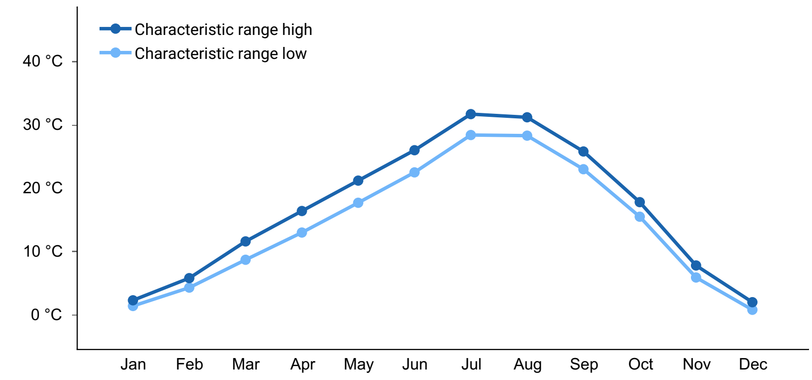


Figure 3. Monthly maximum temperature range

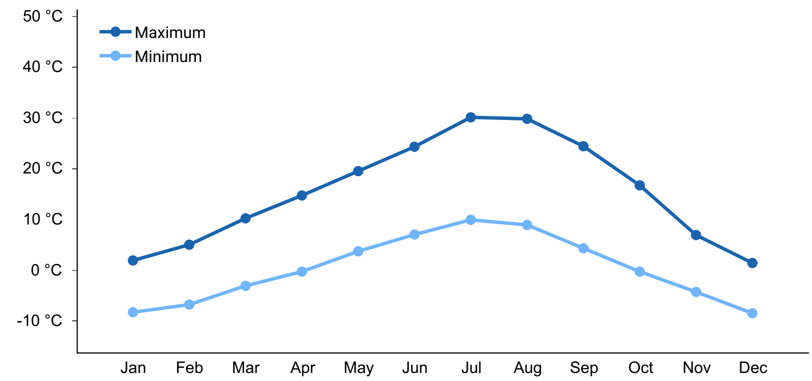


Figure 4. Monthly average minimum and maximum temperature

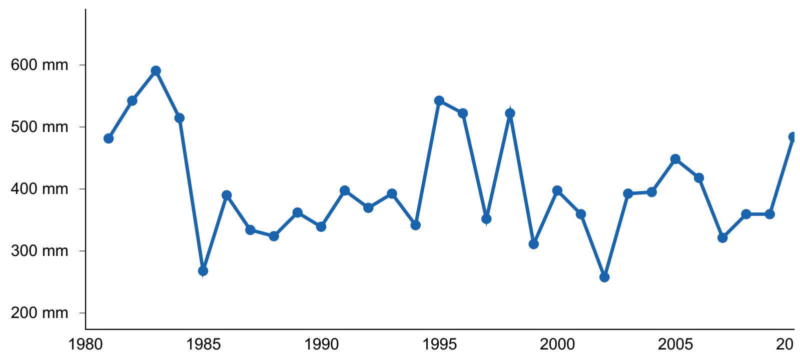


Figure 5. Annual precipitation pattern

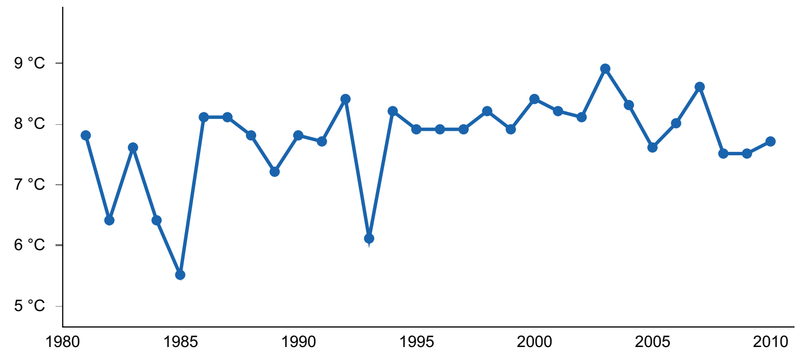


Figure 6. Annual average temperature pattern

Climate stations used

- (1) AUSTIN 3 S [USC00350356], Prairie City, OR
- (2) WESTFALL [USC00359176], Harper, OR

Influencing water features

The water table of this site is influenced by the adjacent stream course which in a natural functioning system is controlled by drought, beavers, large woody debris inputs, climate cycles that influence watershed snowpack and rainfall, and natural disturbances that modify local and upland plant communities such as fire, insects and disease. Currently in much of the range of this site, stream levels and water tables are often modified by irrigation withdrawals, channel modifications, upland vegetation change, beaver removal, large woody debris removal, road construction and stream impoundment.

Wetland description

Not defined.

Soil features

The soils of this site are typically deep to very deep and moderately well to somewhat poorly drained. Soil organic matter is typically high. The surface layer and subsoils are typically silt loams. Gravels when present are fine, occurring as scattered lenses. Depth to alluvial sediments is typically greater than 60 inches. Permeability is moderate. The available water holding capacity (AWC) is about 10 to 12 inches for the profile. Perennial to near perennial subsurface flows supplements the AWC. The erosion potential is moderate to severe. See Widowspring for a typical soil series associated with this site concept.

Table 5. Representative soil features

Parent material	(1) Alluvium–rhyolite (2) Overbank deposits–basalt (3) Volcanic ash–tuff

Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to somewhat poorly drained
Permeability class	Moderate to moderately slow
Depth to restrictive layer	152–203 cm
Soil depth	203 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	25.4–30.48 cm
Soil reaction (1:1 water) (0-101.6cm)	6.8–7.6
Subsurface fragment volume <=3" (10.2-152.4cm)	10–20%
Subsurface fragment volume >3" (10.2-152.4cm)	0–15%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	102–203 cm
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	Not specified
Subsurface fragment volume <=3" (10.2-152.4cm)	Not specified
Subsurface fragment volume >3" (10.2-152.4cm)	Not specified

Ecological dynamics

The potential native plant community is dominated by a multi age stand of quaking aspen (*Populus tremuloides*). Willows (Salix spp.), chokecherry (*Prunus virginiana*) and golden currant (*Ribes aureum*) are typically common. Basin wildrye (*Leymus cinereus*), blue wildrye (*Elymus glaucus*), mountain brome (*Bromus carinatus*), Idaho fescue (*Festuca idahoensis*) and a variety of forbs are present. Sedges (Carex spp.) are common along perennial stream margins. Wood's rose (*Rosa woodsii*), wax currant (*Ribes cereum*), snowberry (Symphoricarpos spp.) and mountain big sagebrush (*Artemisia tridentata* spp. vaseyana) are present. Ponderosa pine (*Pinus ponderosa*) and/or Douglas-fir (*Pseudotsuga menziesii*) are minor. Vegetative composition of the community is approximately 25 percent grasses, 5 percent forbs and 70 percent shrubs and trees. Approximate ground cover is 80 to 120 percent (basal and crown).

Range in Characteristics:
Healthy quaking aspen stands are uniform with varying age classes. The understory composition is influenced by the stand age, canopy closure and the connectivity, slope and extent of the active floodplain. Understory shrub diversity and density increases significantly in open shrub-sapling and open sapling-pole stands. Basin wildrye

increases along outer site edges and open areas. Under a closed older canopy understory shrub diversity and production decreases dramatically. Willows and sedges increase along well connected perennial stream with high water tables. In areas adjacent to forestland snowberry, willows, rose, elk sedge (*Carex geyeri*) and pinegrass (*Calamagrostis rubescens*) increase. On flatter deposition areas the site typically grades into a sedge/tufted hairgrass wet meadow or meadow site. Adjacent fans and drier slopes are often dominated by an aspen upland site having an increase in mountain snowberry and wax currant. Basin wildrye dominates adjacent dry swale, fan and bottomland sites.

Quaking Aspen Dynamics:
Quaking aspen occurs on this site as the dominant plant species in a stable plant community. The aspen community is multi aged with trees in varies stages of development well represented. Reference phases are shrub/grass stand initiation, sapling-pole, mature aspen and decadent aspen.

Individual aspen are short-lived and rarely survive for more than 150 years. Aspen, however, are noted for their ability to regenerate vegetatively by suckers arising along their long lateral roots. Root sprouting results in many genetically identical trees (ramets), in aggregate called a “clone”. All the trees in a clone have identical characteristics and share a common root structure, however, a stand can be made up of several clones.

When aspen trees die or light becomes available in aspen openings, chemical signals from the tree to the root stimulate new sprouts to start growing. Through this cycle of regrowth, an aspen clone can lives much longer than an individual tree. Aspen clone survival can be hundreds of years old (5,000 to 10,000 year old clone ages have been estimated in some areas).

Aspen trees are dioecious, with male and female flowers normally borne on separate trees. Sexual reproduction may occur, yet in comparison to vegetative reproduction, reproduction by seed is less commonly observed in the Western US except following fire on adequately moist seedbeds. Few aspen seedlings survive in nature due to the short time seed is viable, lack of moisture during seed dispersal, poor seedbed conditions, fungi and adverse day/night temperatures.

Historically, periodic disturbance events have been important to the maintenance of healthy aspen stands. These include drought, windthrow, wildfire, insect outbreaks, and disease (e.g. stem cankers and root pathogens), that would remove portions of the stand, with advanced ramet age increasing the likelihood of damage from some disturbance agents.

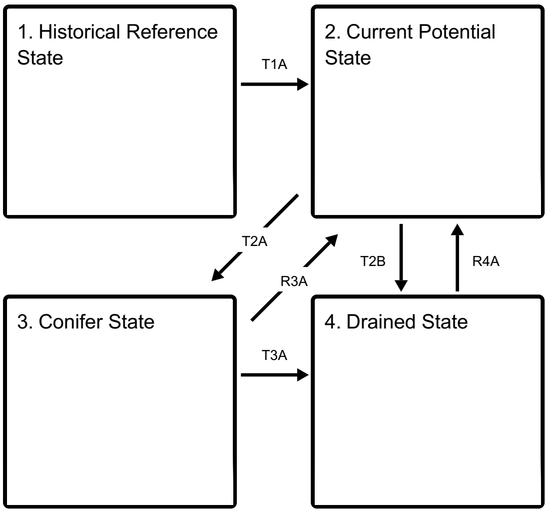
Wildfire has been an important disturbance in these aspen stands historically, stimulating vegetative reproduction, promoting stand heterogeneity and controlling the invasion of coniferous species. While the high fuel moisture content of aspen stands may render them somewhat resistant to fires for much of the year, fire frequency and intensity is influenced by the surrounding vegetation matrix within which the stand is found. For this site, surrounding vegetation types often include mountain big sagebrush, dry ponderosa pine woodlands and dry mixed conifer forests, all of which would have historically been subject to frequent low to replacement severity fires (Landfire fire regime groups 1 and 2, Landfire 2007). Without fire, coniferous species, readily invade and can dominate this site over time, outcompeting the less shade tolerant aspen for light and depleting soil moisture. Research has demonstrated that Western juniper (*Juniperus occidentalis*) expansion into similar sites in southeast Oregon has been widespread, coinciding with the suppression of fire in these areas beginning around the turn of the 20th century, in addition to associated grazing and climate factors (Wall et al. 2001).

Aspen provides quality browse for many ungulates including deer, elk and cattle. Excessive grazing can have profoundly detrimental effects on aspen regeneration and stand viability by suppressing regenerating saplings (among other impacts). Aspen stands may severely impacted by high utilization rates by native ungulate (in particular elk in some regions) as well as by livestock. If the condition of the site deteriorates as a result of over grazing by livestock and/or deer/elk use a decline in aspen reproduction occurs. Tall shrubs, willow and chokecherry become hedged with severe utilization to browse height and limited reproduction. Shorter shrubs and the herbaceous understory is severely affected with the replacement of currants, snowberry, basin wildrye, Idaho fescue, blue wildrye, sedge and palatable forbs by Kentucky bluegrass (*Poa pratensis*), low palatability forbs (such as *Veratrum viride*) and annuals. With continued heavy use bare ground increases, erosion accelerates and site productivity decreases. Canada thistle (*Cirsium arvense*), houndstongue (*Cynoglossum officinale*) and white top (*Cardaria draba*) invade. With continued heavy use bare ground increases, channels incise, becoming deeper and wider in the process and erosion accelerates. Water tables are lowered as the adjoining channels incise. The site becomes moisture limited shifting composition toward drought adapted species and further decreasing productivity. Under prolonged heavy ungulate use aspen clone reproduction is eliminated and stands slowly become decadent, potentially transitioning the site to a shrub or juniper dominated community. Alterations to water withdraws, creation of impoundments, removal of beaver and modifications to stream channels may have similar effects on stream morphology and changes to water tables.

Severe drought events have been linked to episodes of widespread aspen mortality in North America and these types of events are expected to increase under a changing climate (Worrall et al. 2012). While the potential impacts of climate change and severe drought on this site are unknown, aspen stands in other marginal habitats in Oregon have demonstrated physiological sensitivity to drought related climate parameters (Neary et al. 2021) and it is possibly that interactions of changing climate with other stressors will render stands in the region more vulnerable to decline (Dwire et al. 2018).

State and transition model

Ecosystem states



T1A - Invasion of the site by non-native plant species.

T2A - Time and lack of wildfire

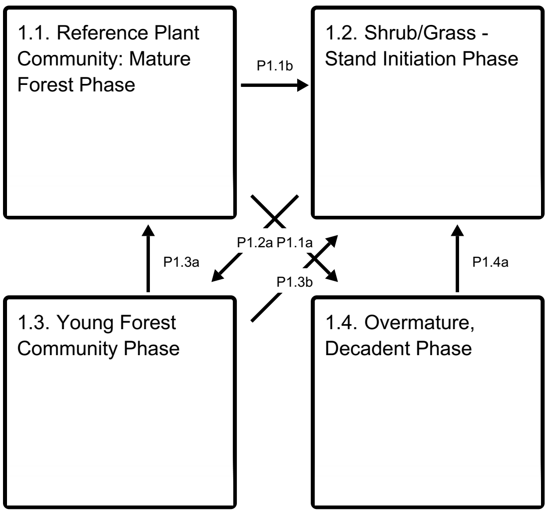
T2B - Hydrologic alteration

R3A - Mechanical removal of conifers, prescribed fire, ungulate exclosure fencing

T3A - Hydrologic alteration

R4A - Restoration of hydrologic function

State 1 submodel, plant communities



P1.1b - Large-scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drough

P1.1a - Extended time elapses in the absence of disturbance

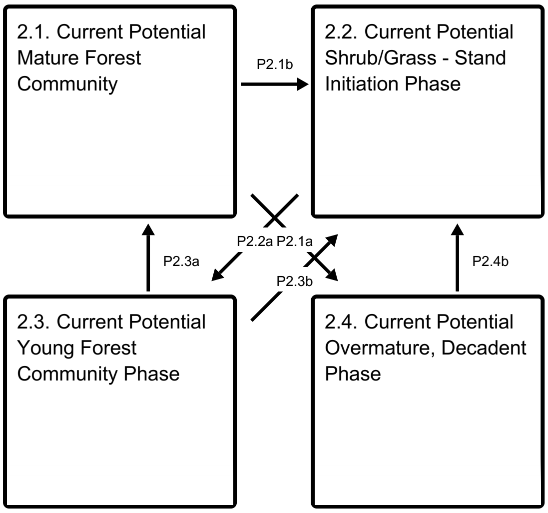
P1.2a - Extended time elapses in the absence of disturbance

P1.3a - Extended time elapses in the absence of disturbance

P1.3b - Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought

P1.4a - Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought

State 2 submodel, plant communities



P2.1b - Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought

P2.1a - Extended time elapses in the absence of widespread disturbance

P2.2a - Extended time elapses in the absence of widespread disturbance

P2.3a - Extended time elapses in the absence of widespread disturbance

P2.3b - Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought

P2.4b - Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought

State 1
Historical Reference State

This state represents the pristine historical reference conditions with no exotic species present. Healthy aspen stands are on this site type are heterogeneous with vigorous trees in all natural life stages from young saplings to mature. Stands will cycle through several development phases from shrub/grass communities through mature stands, with many phases often occurring on a single site. These dynamics are driven by an intact historical disturbance regime with periodic events acting to maintain a dynamic equilibrium with adjacent stream morphology and vegetative composition; helping to reduce conifer invasion; remove diseased and decadent mature trees and stimulate sucker reproduction. The resilience and resistance of the site is bolstered by positive feedbacks between aspen production and the formation of deep, mollic epipedons with high organic matter, nutrient content and water holding capacity; and negative feedbacks between stand maturity and disturbance frequency/magnitude.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- willow (*Salix*), shrub
- chokecherry (*Prunus virginiana*), shrub
- golden currant (*Ribes aureum*), shrub
- common snowberry (*Symphoricarpos albus*), shrub

Community 1.1
Reference Plant Community: Mature Forest Phase

The reference native plant community is dominated by a multi age stand of quaking aspen. Willows, chokecherry and golden currant are typically common. Basin wildrye, blue wildrye, mountain brome, Idaho fescue and a variety of forbs are present. Sedges are common along perennial stream margins. Wood’s rose, wax currant, snowberry and mountain big sagebrush are present. Understory composition will decline as canopy closure progresses.

Ponderosa pine and/or Douglas-fir are minor. Vegetative composition of the community is approximately 25 percent grasses, 5 percent forbs and 70 percent shrubs and trees. Approximate ground cover is 80 to 120 percent (basal and crown).

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	1121	1681	2242
Grass/Grasslike	560	841	1121
Shrub/Vine	448	673	897
Forb	112	168	224
Total	**2241**	**3363**	**4484**

Community 1.2
Shrub/Grass - Stand Initiation Phase

In this phase, the stand is dominated by herbaceous species and sprouting shrubs. Young sapling aspen may be regenerating, conifers are absent. High populations of native ungulates such as deer and elk and subsequent heavy browsing of regenerating aspen, may maintain the site in this phase. Additionally, frequent fire intervals driven by abnormal climate conditions may maintain the site in this phase.

Community 1.3
Young Forest Community Phase

In this phase the stand is dominated by regenerating and recruiting aspen from sapling to pole size. Initial closed conditions and very high, uniform stem densities will give way to open stand conditions, lower stem densities and multi-layered stand structure as self-thinning, overstory recruitment and further regeneration takes place. Shrub and grass composition will decrease relative to community 1.2. Some conifers may be present at low levels.

Community 1.4
Overmature, Decadent Phase

In this phase the stand is dominated by large, mature aspen with a relatively even stand structure (~100 years). Closed canopy conditions decrease understory diversity and favor shade tolerant grasses, forbs and shrubs. Understory aspen regeneration is uncommon due to lack of light at lower heights but may occur in localized patches as decadent overstory trees succumb to various disturbance agents. Conifers may be increasing in this state and the site risks a transition to a conifer dominated state with a prolonged lack of large scale disturbance.

Pathway P1.1b
Community 1.1 to 1.2

Large-scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought event leads to mortality of aspen trees

Pathway P1.1a
Community 1.1 to 1.4

Extended time elapses in the absence of disturbance allowing the forest to become over mature and conifer expansion to occur.

Pathway P1.2a
Community 1.2 to 1.3

Extended time without widespread disturbance.

Pathway P1.3a
Community 1.3 to 1.1

Extended time without widespread disturbance.

Pathway P1.3b
Community 1.3 to 1.2

Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought event leads to mortality of aspen trees.

Pathway P1.4a
Community 1.4 to 1.2

Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought event leads to mortality of aspen trees.

State 2
Current Potential State

This state is similar to the historical reference state yet with the introduction of non-native plant species and an increased presence of western juniper. Kentucky bluegrass is one of the most common and persistent invading herbaceous plants with others including cheatgrass (*Bromus tectorum*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), houndstongue (*Cynoglossum officinale*), Whitetop and St. Johnswort (*Hypericum perforatum*) also common. Ecological process and function have not been altered fundamentally by this low level of invasion, yet resistance and resilience to disturbance are decreased. Vegetated communities include all historical functional and structural groups, yet composition and richness may be reduced. This state is common due to widespread invasion of Kentucky bluegrass and expansion of western juniper in the Western US.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- willow (*Salix*), shrub
- golden currant (*Ribes aureum*), shrub
- chokecherry (*Prunus virginiana*), shrub
- common snowberry (*Symphoricarpos albus*), shrub

Community 2.1
Current Potential Mature Forest Community

The reference native plant community is dominated by a multi age stand of quaking aspen. Understory regeneration of aspen will slow as canopy closure progresses, yet periodic disturbance will remove mature aspen, create gaps and allow for localized pulses of regeneration to occur. Kentucky bluegrass (and potentially other exotic species) is a common associate with herbaceous plants listed in the reference plant communities.

Community 2.2
Current Potential Shrub/Grass - Stand Initiation Phase

In this phase, the stand is dominated by herbaceous species and sprouting shrubs, Kentucky bluegrass (and potentially other exotic species) is common. Young sapling aspen may be regenerating from root suckers or seed given favorable conditions, seedling conifers may be present in low numbers. High populations of native ungulates such as deer and elk and subsequent heavy browsing of regenerating aspen, may maintain the site in this phase. Additionally, frequent fire intervals driven by abnormal climate conditions or adjacency with rangelands dominated by invasive annual grasses may maintain the site in this phase.

Community 2.3
Current Potential Young Forest Community Phase

In this phase the stand is dominated by regenerating and recruiting aspen from sapling to pole size. Initial closed conditions and very high, uniform stem densities will give way to open stand conditions, lower stem densities and multi-layered stand structure as self-thinning, overstory recruitment and further regeneration takes place. Shrub and grass composition will decrease relative to community 1.2, exotic species are likely present. Conifers may be present at moderate density.

Community 2.4
Current Potential Overmature, Decadent Phase

In this phase the stand is dominated by large, mature aspen with a relatively even stand structure. Closed canopy conditions decrease understory diversity and favor shade tolerant grasses, forbs and shrubs, with exotic species present. Understory aspen regeneration is uncommon due to lack of light at lower heights but may occur in localized patches as decadent overstory trees succumb to various disturbance agents. Conifers may be increasing in this state toward codominance with mature aspen and the site risks a transition to a conifer dominated state with a prolonged lack of large scale disturbance.

Pathway P2.1b
Community 2.1 to 2.2

Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought event leads to mortality of aspen trees.

Pathway P2.1a
Community 2.1 to 2.4

Extended time elapses in the absence of disturbance allowing the forest to become over mature and conifer expansion to occur.

Pathway P2.2a
Community 2.2 to 2.3

Extended time without widespread disturbance.

Pathway P2.3a
Community 2.3 to 2.1

Extended time without widespread disturbance.

Pathway P2.3b
Community 2.3 to 2.2

Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought event leads to mortality of aspen trees.

Pathway P2.4b
Community 2.4 to 2.2

Large scale disturbance such as fungal disease, insect outbreak, high severity wildfire or extreme drought event leads to mortality of aspen trees.

State 3
Conifer State

In this state, conifer succession has advanced to overtop aspen and outcompete the species for light and soil moisture. On this site, western juniper is the most likely conifer invader, yet ponderosa pine (*Pinus ponderosa*), or Douglas fir (*Pseudotsuga menziesii*) may also encroach on favorable sites. Over mature, decadent aspen may still be present and aspen reproduction may occur in patches with adequate light and moisture. However, feedbacks have been altered and aspen will likely not successfully compete with conifers to regenerate successfully, recruit into the overstory, and regain forest structure without management interventions or altered disturbance regimes. Impacts and emerging feedbacks may include alterations to soil chemistry, changes in hydrologic cycling (including increased sublimation and translocation of snowfall by conifers), and persistent increases in understory shading favoring more shade tolerant conifer reproduction (Wall et al. 2001, LaMalfa and Ryle 2008). Heavy herbivory of sapling aspen, and/or low intensity fire that leaves more fire resistant conifers intact may further accelerate the loss of aspen to conifers. Several community phases may occur within this state with the common thread of conifer dominance.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree
- ponderosa pine (*Pinus ponderosa*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree

State 4
Drained State

Streambanks have become unstable from loss of vegetation and the channel degrades becoming deeper and wider in the process. Subsurface flows are affected. The water table drops and storage of water for the late season flows is reduced. Plants well adapted to a drier climatic regime increase or invade and production drops. Channel widening and incision are common in this state as unstable banks and vegetation loss create a positive feedback loop that decreases resilience to runoff events. Abandoned floodplains transition into primary terraces and primary terraces transition toward secondary terraces which become dominated by drought adapted species that do not require a connection to the water table. Many community phases may exist within this state depending on the disturbance history and stand dynamics prior to incision.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree
- quaking aspen (*Populus tremuloides*), tree
- common snowberry (*Symphoricarpos albus*), shrub
- Woods' rose (*Rosa woodsii*), shrub
- wax currant (*Ribes cereum*), shrub

Transition T1A
State 1 to 2

Invasion of the site by non-native plant species.

Transition T2A
State 2 to 3

Time and lack of wildfire allows juniper to overtop and outcompete aspen for light and moisture. Shade intolerant aspen die off and regeneration is dramatically decreased due to closed canopy conditions. On some sites ponderosa pine and/or Douglas fir may encroach and facilitate a similar dynamic in the absence of fire.

Transition T2B
State 2 to 4

This transition may be the result of several disturbances that lower water tables beyond depths that support riparian woody vegetation, alter sediment supply and transport leading to scouring and channel incision, or directly increase flow velocities or flashiness. These may include: alteration of streamflow by irrigation or impoundment leading to a lowering of the water table during times of year when riparian woody vegetation is dependent; removal of beaver; direct manipulation of channel morphology (namely straightening for agricultural or development purposes); removal of large woody debris or large woody debris sources, from channels or adjacent forests and significant alterations of upland watershed vegetation altering peak discharge or sediment loads.

Restoration pathway R3A
State 3 to 2

Mechanical removal of conifers may release understory aspen from canopy shading. Prescribed fire may also be used to remove conifers and stimulate aspen regeneration. However, under circumstances where advanced decline has led to an absence of aspen regeneration, the use of prescribed fire may actually lead to further damage to the clone and may accelerate complete clone mortality. Depending on the degree of encroachment and aspen loss, these interventions may transition the site to any one of the current potential community phases. Under conditions of high native ungulate or livestock use of the stand, management actions such as fencing or jackstrawing may need to follow conifer removal to allow aspen regeneration to occur unimpeded.

Context dependence. Restoration options will be highly site specific and may not be possible in many circumstances.

Transition T3A
State 3 to 4

This transition may be the result of several disturbances that lower water tables beyond depths that support riparian woody vegetation, alter sediment supply and transport leading to scouring and channel incision, or directly increase flow velocities or flashiness. These may include: alteration of streamflow by irrigation or impoundment leading to a lowering of the water table during times of year when riparian woody vegetation is dependent; removal of beaver; direct manipulation of channel morphology (namely straightening for agricultural or development purposes); removal of large woody debris or large woody debris sources, from channels or adjacent forests and significant alterations of upland watershed vegetation altering peak discharge or sediment loads.

Restoration pathway R4A
State 4 to 2

Restoration of hydrologic and biotic process and function through rehabilitation of channel and vegetation structure may be possible but will require considerable inputs, time and cost. This may require the placement of large woody debris, creation or removal of impoundments, alteration of water withdrawals, management changes to adjacent agricultural or grazing practices, or mechanical manipulation of stream channel courses among other intensive interventions.

Context dependence. Restoration options will be highly site specific and may not be possible in many circumstances.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant deep rooted bunchgrass**			67–269	
	basin wildrye	LECI4	*Leymus cinereus*	67–269	–
2	**Sub-dominant moderate rooted bunchgrasses**			168–729	
	blue wildrye	ELGL	*Elymus glaucus*	56–280	–
	Idaho fescue	FEID	*Festuca idahoensis*	56–280	–
	mountain brome	BRMA4	*Bromus marginatus*	56–168	–
3	**Other rhizomatous grass & grass-like**			0–224	
	Geyer's sedge	CAGE2	*Carex geyeri*	0–168	–
	pinegrass	CARU	*Calamagrostis rubescens*	0–168	–
4	**Common grass-like & grasses by stream margins**			67–336	
	tufted hairgrass	DECE	*Deschampsia cespitosa*	34–168	–

	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	45–112	–
	Nebraska sedge	CANE2	*Carex nebrascensis*	34–67	–
	water sedge	CAAQ	*Carex aquatilis*	22–67	–
	Northwest Territory sedge	CAUT	*Carex utriculata*	0–67	–
	awlfruit sedge	CAST5	*Carex stipata*	11–34	–
	lakeshore sedge	CALE8	*Carex lenticularis*	0–11	–
5	**Other perennial grasses**			45–112	
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	11–45	–
	needlegrass	ACHNA	*Achnatherum*	0–34	–
	squirreltail	ELEL5	*Elymus elymoides*	6–17	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	6–17	–
	Sandberg bluegrass	POSE	*Poa secunda*	6–11	–
Forb					
7	**Common perennial forbs**			56–112	
	tall ragwort	SESE2	*Senecio serra*	11–45	–
	lupine	LUPIN	*Lupinus*	11–22	–
	starry false lily of the valley	MAST4	*Maianthemum stellatum*	6–22	–
	palapalai	MIST4	*Microlepia strigosa*	6–22	–
	milkvetch	ASTRA	*Astragalus*	11–22	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	6–11	–
	common yarrow	ACMI2	*Achillea millefolium*	6–11	–
	slender cinquefoil	POGR9	*Potentilla gracilis*	6–11	–
9	**Other perennial forbs**			34–112	
	cowparsnip	HERAC	*Heracleum*	0–11	–
	California false hellebore	VECA2	*Veratrum californicum*	0–11	–
	desertparsley	LOMAT	*Lomatium*	6–9	–
	buckwheat	ERIOG	*Eriogonum*	2–9	–
	largeleaf avens	GEMA4	*Geum macrophyllum*	2–6	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	2–6	–
	small camas	CAQU2	*Camassia quamash*	0–6	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	2–6	–
	fleabane	ERIGE2	*Erigeron*	2–6	–
	western stoneseed	LIRU4	*Lithospermum ruderale*	2–6	–
	beardtongue	PENST	*Penstemon*	0–6	–
	sticky cinquefoil	POGL9	*Potentilla glandulosa*	0–6	–
	buttercup	RANUN	*Ranunculus*	2–4	–
	ballhead waterleaf	HYCA4	*Hydrophyllum capitatum*	2–4	–
	Indian paintbrush	CASTI2	*Castilleja*	0–4	–
	Jessica sticktight	HAMI	*Hackelia micrantha*	0–4	–
	tall bluebells	MEPA	*Mertensia paniculata*	2–4	–
	aster	ASTER	*Aster*	2–4	–
	western meadow-rue	THOC	*Thalictrum occidentale*	0–3	–

	western meadow-rue	THOC	*Thalictrum occidentale*	0–3	–
	strawberry	FRAGA	*Fragaria*	0–3	–
	bedstraw	GALIU	*Galium*	0–3	–
	western coneflower	RUOC2	*Rudbeckia occidentalis*	0–3	–
	columbine	AQUIL	*Aquilegia*	0–3	–
	monkshood	ACONI	*Aconitum*	0–2	–
	Oregon checkerbloom	SIOR	*Sidalcea oregana*	1–2	–
	woodland-star	LITHO2	*Lithophragma*	1–2	–
Shrub/Vine					
10	**Common deciduous sprouting shrubs**			224–673	
	chokecherry	PRVI	*Prunus virginiana*	67–336	–
	Scouler's willow	SASC	*Salix scouleriana*	67–336	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	67–280	–
	water birch	BEOC2	*Betula occidentalis*	0–280	–
	thinleaf alder	ALINT	*Alnus incana ssp. tenuifolia*	0–269	–
	golden currant	RIAU	*Ribes aureum*	67–224	–
	yellow willow	SALU2	*Salix lutea*	67–224	–
	wax currant	RICE	*Ribes cereum*	34–168	–
	Woods' rose	ROWO	*Rosa woodsii*	56–168	–
	narrowleaf willow	SAEX	*Salix exigua*	0–168	–
	common snowberry	SYAL	*Symphoricarpos albus*	0–168	–
	redosier dogwood	COSES	*Cornus sericea ssp. sericea*	34–168	–
14	**Other shrubs**			56–280	
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–34	–
	bitter cherry	PREM	*Prunus emarginata*	0–34	–
	black hawthorn	CRDO2	*Crataegus douglasii*	0–34	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0–22	–
	prickly currant	RILA	*Ribes lacustre*	0–22	–
	red elderberry	SARA2	*Sambucus racemosa*	0–22	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–22	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–22	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	0–17	–
	creeping barberry	MARE11	*Mahonia repens*	0–6	–
Tree					
18	**Dominant, deciduous, sprouting tree**			1345–2018	
	quaking aspen	POTR5	*Populus tremuloides*	1345–2018	–
20	**Other evergreen and deciduous trees**			0–336	
	ponderosa pine	PIPO	*Pinus ponderosa*	0–224	–
	cottonwood	POPUL	*Populus*	0–224	–
	Douglas-fir	PSME	*Pseudotsuga menziesii*	0–224	–

Animal community

Livestock Grazing:
This site is suitable for livestock grazing use in the summer, and early fall under a prescribed grazing system. Use

should be postponed until the soils are firm enough to prevent trampling damage and soil compaction. Grazing management should be keyed to aspen regeneration, bunchgrasses and sedges. Use levels on aspen regeneration should be no more than one-third of the current year’s annual growth. Use levels on basin wildrye, Idaho fescue, blue wildrye and sedges should be no more than 50 percent of the current year’s growth. These species can be severely damaged if heavily grazed when soils are wet and during periods of flowering and seed formation before root reserves have accumulated. Fall season residual growth of sedge in wet areas and on banks should be adequate to prevent erosion and retain sediments during spring flow events (6 to 10 inches). The erosive forces of high spring flows are reduced with good vegetation roughness and by shallow water depths when flows rise and spread across bank protecting aspen-tall shrub stands. Deferred grazing or rest is recommended at least once every three years.

Wildlife:
Wildlife habitat diversity in a healthy aspen stand with willow and other shrubs is very high. The natural heterogeneity of the aspen stand with various stages of development provides excellent habitat. The extent and health of each aspen age class determines the available habitat for both wildlife and livestock use.

Mule deer and elk respond most favorably to early aspen reproductive stages because of the quantity, quality, and diversity of plants present. Excellent summer and fall forage as well as rearing areas is provided by various stages. Mature stages provide excellent hiding and thermal cover. Grouse, migratory birds, woodpeckers and other birds make good use of edges and the intermediate and older stages for food, nesting and rearing.

Excess ungulate use can severely impact the quality of the habitat and life of the stand. In addition to excessive browsing of reproducing aspen, bark chewing of mature trees by elk may damage and even girdle trees. Other uses such as road construction and intense recreation use directly impacts habitat quality.

Aspen woodland is one of the strategy habitats in the “Oregon Conservation Strategy”. The limiting factors in aspen woodland are altered habitat and juniper encroachment, lack of reproduction, degraded understories, fragmentation and mapping limitations (small patches- connectivity). Oregon Conservation Strategy is an action plan for the long term conservation of Oregon’s native fish and wildlife and their habitats.

Excellent habitat is provided for fisheries in perennial streams from shade, insect population build-ups, stable well vegetated overhanging banks, emergent vegetation cover and cold ground water return flows from well connected floodplains. Beaver historically used the site extensively, distributing flows on the floodplain and retaining sediment.

Hydrological functions

The soils of this site are in a riparian topographic position. They have moderate runoff potential and medium infiltration rates when the hydrologic cover is good. With a reduction of ground cover, erosion, channel incision and lowering of water tables can occur. This can accelerate with a continued decrease in ground cover. Hydrologic cover is good when deep rooted perennial herbaceous and shrub cover is greater than 70 percent of potential.

When incised channels are present, rehabilitation will markedly improve production, reduce downstream sedimentation, and restore good hydrologic characteristics. On altered sites, the reintroduction of deep rooted perennials may be needed to fully restore the site potential.

Recreational uses

This site has high aesthetic values. It provides opportunities for recreational hunting and limited camping activities. As a critical wildlife area, camping, roads and other uses should be limited.

Wood products

As a key wildlife area, the site should be carefully managed with little potential for wood fiber production.

Other information

Threatened And Endangered Plants And Animals:
This site contains unique rare plant communities and animal habitat. On site investigation is required for the

determination of sensitive and T&E species.

Juniper Invasion and Control:
Juniper if present will readily invade aspen stands in the absence of fire. It can replace aspen to become the dominant over story species. Increases in western juniper and the subsequent competition for moisture and shading will lead to reduced ground cover and available forage. Overgrazing can accelerate this trend, reducing available forage and accelerating soil loss.

Juniper control measures include cutting and/or prescribed burning followed by prescribed grazing. A prescribed grazing system including periodic rest will improve the vigor, density and reproduction of aspen along with understory sedges and palatable perennial bunchgrasses. Re-seeding preferred perennial grasses may be a necessary component of this program if original palatable bunchgrasses and sedges are absent.

Fire Response & Prescribed Burns:
Fire is an important natural component of the site. Benefits include the control of invading juniper, promotion of natural aspen succession, improved habitat diversity, maintenance of vigorous palatable grass and forb understories and the creation of openings for aspen sapling regeneration. In the absence of natural fire, mechanical treatments and/or prescribed burns may help promote healthy and diverse aspen stands.

Understanding aspen response to fire is essential in determining the effects of wildfire and in developing a prescribed burn plan. Unlike conifers, aspen stands do not readily burn due to moist green leaves and thick twigs. Conifers are subject to a longer open window seasonal burn period due to higher terpene contents and a longer dry needle and twig period. Although aspen do not burn readily, when burned they are extremely sensitive to fire. Following a burn, sucker development is stimulated. A fire intense enough to kill aspen overstories will stimulate abundant suckering. However, evidence suggests that burning in severely weakened clones (where root systems have little available carbohydrate reserves) may accelerate decline or succession to conifers (Swanson et al. 2010). This may be especially true in stands experiencing advanced conifer encroachment where pre-fire aspen density and regeneration is very low and large conifers are resistant to all but high severity fire.

Fall burns are recommended if the management objective is to stimulate greater aspen suckering and eliminate western juniper with minimal cutting. A spring burn is recommended if the objective is to maintain shrub and herbaceous cover and moderately stimulate aspen suckering. With a spring burn follow-up management may be needed to remove juniper that are missed in initial treatments. Prescribed grazing to insure healthy stands is an important component with all treatment alternatives.

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2020 Update: Andrew Neary

Approval

Kirt Walstad, 12/13/2023

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)	
Contact for lead author	
Date	05/12/2024
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**