USDA Natural Resources Conservation Service

Ecological site R009XY503OR
Moderately Sloping Narrow Alluvial Valley Riparian Complex

Accessed: 05/13/2025

General information

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

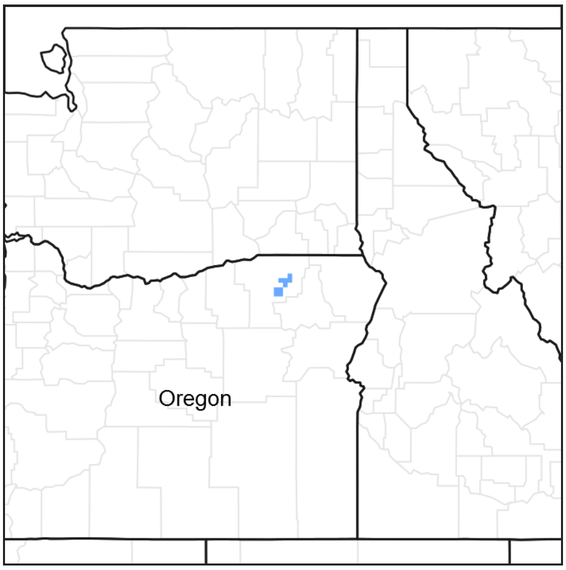


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 009X–Palouse and Nez Perce Prairies

Palouse and Nez Perce Prairies.
The majority of this MLRA lies within the Walla Walla Plateau Section of the Columbia Plateaus Province of the Intermountain Plateaus. A portion of this MLRA in the southeastern area is in the Blue Mountain Section of the Colombia Plateau Province. This MLRA is characterized by an undulating, highly-dissected basalt plateau. Streams are deeply cut into the plateau, with elevations for major stream bottoms of approximately 650 feet (198 meters) while plain elevation ranges from 2,000 to 4,000 feet (610 to 1220 meters). The average annual precipitation typically ranges from 13 to 28 inches (300 to 710 mm), but may be as high as 43 inches (1,090 mm) in the south. Precipitation is evenly distributed between fall, winter, and spring, with winter precipitation typically occurring as snow. Summers are typically dry. The average annual temperature ranges from 47 to 57 degrees F (8 to 12 degrees C), but can be as low as 40 degrees F (5 degrees C) at higher elevations in the south. The freeze-free period averages 165 days, and ranges from 100 to 230 days.

Ecological site concept

This riparian complex occurs on Strahler 3rd and 4th order or streams in moderately sloping (2 to 10 percent), narrow, alluvial fill valleys in mountains and dissected lava plateaus. Drainage area is typically between 8,000 and 25,000 acres. Stream potential is a Rosgen C or Bc type channel (Rosgen 1994). Channel gradients range from 1.5 to 4 percent. Plant communities are dominated by white alder (*Alnus rhombifolia*), water birch (*Betula occidentalis*) black cottonwood (*Populus balsamifera* ssp. trichocarpa), and black hawthorn (*Crataegus douglasii*). Soils have developed in recent alluvium from basalt.

Associated sites

R009XY031OR	**Shallow South 14+ PZ** This site occurs on mountain and plateau side slopes. Soils formed in loess and colluvial parent material. Soil temperature regime is frigid. Slopes typically range from 40 to 70 percent. Hawthorn is dominant.
R009XY046OR	**Shrubby Moist North 15+ PZ** This ecological site occurs on the adjacent south- facing hillslopes on the Gwin soils. Native vegetation is dominated by bluebunch wheatgrass (Pseudoroengneria spicata) and Idaho fescue (Festuca idahoensis).

Similar sites

R009XY504OR	**Moderately Sloping Plateau Riparian Complex** This ecological site occurs on gentle terraces on the edge of the Colombia Plateau. Channel gradients are between 2 and 5 percent, and flow may be intermittent.
R009XY505OR	**Moderately Sloping Confined Intermittent Riparian Complex** This ecological site occurs on first and second order streams in dissected lava plateaus. Flow is intermittent. Slopes range from 5 to 15 percent.
R009XY501OR	**Low Slope Alluvial Valley Riparian Complex** This ecological site occurs on 5th order or greater stream, at lower elevations, on the edge of the Colombia Plateau. Ponderosa pine is absent and basin wildrye (Leymus cinereus) may be present on the terraces.
R009XY502OR	**Low Slope Alluvial Mountain Valley Riparian Complex** This ecological site occurs on 5th order or greater streams, at similar elevations, with channel gradients between 0 and 2 percent.

Table 1. Dominant plant species

Tree	(1) *Alnus rhombifolia* (2) *Populus balsamifera subsp. trichocarpa*
Shrub	(1) *Crataegus douglasii* (2) *Symphoricarpos albus*
Herbaceous	Not specified

Physiographic features

This ecological site occurs on floodplains and stream terraces. Valley slope ranges from 1 to 5 percent, and elevations range from 1,600 to 2,500 feet (488 to 792 m).

There are 5 community components associated with this ecological site.

CC1, Gravel Bar,
The water table varies from 0 to 35 inches, with frequent, brief flooding.

CC2, Floodplain, frequently flooded
The water table varies from 0 to 35 inches, with frequent, brief flooding.

CC3, Floodplain, occasionally flooded
The water table varies from 47 to 59 inches, with occasional, brief flooding.

CC4, Terrace, rarely flooded
The water table is below to 65 inches, with rare flooding.

CC5, Terrace, seeped rarely flooded
The water table varies from 10 to 40 inches, with rare flooding.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Flood-plain step (3) Terrace
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	488–762 m
Slope	1–5%
Aspect	Aspect is not a significant factor

Climatic features

This ecological site has a xeric temperature regime, with moist winters and dry summers. Precipitation occurs as rain in the fall and spring, and snow in winter. There is very little rain in the summer months. Mean annual precipitation (MAP) ranges from 23 to 33 inches (584 to 838 millimeters). Mean annual air temperature (MAAT) ranges from 45 to 50 degrees F (7.2 to 10 degrees C). The frost-free period ranges from 110 to 190 days, and the freeze-free period ranges from 148 to 205 days.

The mean annual temperature and precipitation ranges in the narrative above are from PRISM data, and are most representative for the site. Data for the Frost Free table and the MAAT Temperature Distribution table are a combination of Meacham and Pendleton Climate stations. Mean annual precipitation in the table below is from the Meacham Climate station.

The Pendleton Climate station has a MAAT is 50.7 degrees F. and MAP of 16.6 inches, and the Meacham Climate station has a MAAT of 43.5 degrees F and MAP of 32.4 inches.

Table 3. Representative climatic features

Frost-free period (average)	122 days
Freeze-free period (average)	154 days
Precipitation total (average)	711 mm

Climate stations used

- (1) PENDLETON BR EXP STN [USC00356540], Pendleton, OR

Influencing water features

This site occurs on floodplains and terraces, with frequent to very rare flooding.

The blue line in the cross section diagram represents bank full flow, the red line represents the level of flow at 1.5 times the bank full depth, and the dotted red line represents low bank height.

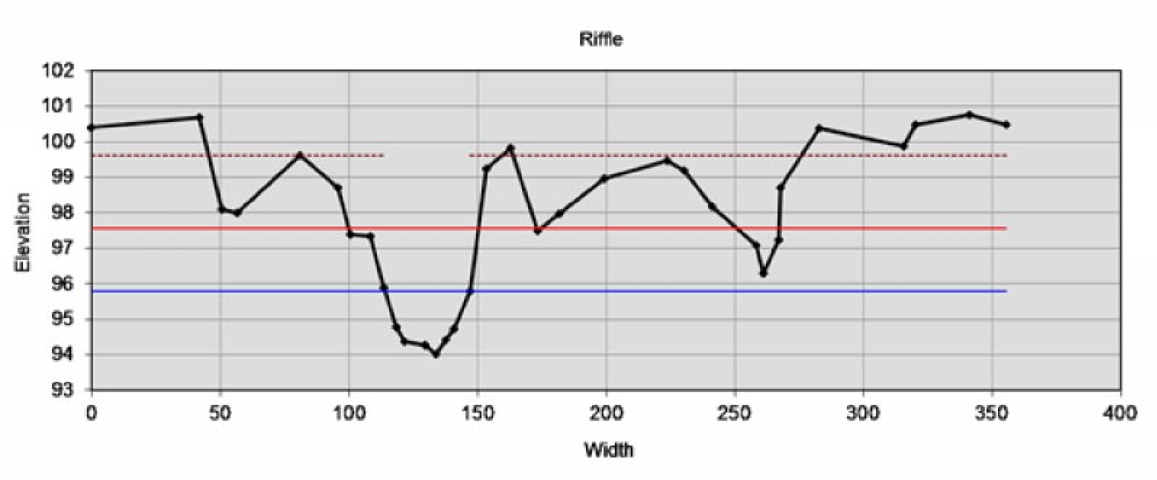


Figure 6. Isquulkpte Creek Cross Section 1

Soil features

There are several soils associated with this ecological site. They are associated with different fluvial surfaces and vary in wetness, development, and texture. These soils are all very deep, and formed in alluvium predominantly derived from basalt parent material. The soil moisture regime is xeric and the soil temperature regime is mesic.

CC1, Gravel bar, active floodplain
The Joseph soils associated with this landform are in active channels and on gravel bars, which are subject to frequent flooding. These soils are typically somewhat poorly drained, but depending upon the topography of the hummocky gravel bars, they may be moderately well or poorly drained.

The surface texture is extremely gravelly loamy sand and subsurface textures are extremely cobbly sand, extremely cobbly coarse sand, and extremely gravelly loamy sand. There is very little soil development and a high percentage of gravels and cobbles. These soils are classified as Sandy-skeletal, mixed, mesic, Oxyaquic Xerofluvents. Surface rock cover < 3 inches (gravels) typically would be 55 percent, and rock fragments > 3 inches (cobbles and stones) typically would be 26 percent. Subsurface rock fragments < 3 inches range from 50 to 65 percent, and > 3 inch fragments range from 15 to 30 percent.

Floodplain, frequently flooded
The Psuni, moist phase soils are somewhat poorly drained and occur on frequently flooded floodplains.

The Psuni soils are classified as Sandy-skeletal, mixed, mesic Oxyaquic Haploxerolls. Surface rock fragments cover < 3 inches range from 20 to 30 percent and > 3 inches range from 0 to 30 percent. Subsurface rock fragments < 3 inches range from 30 to 70 percent, and > 3 inch fragments range from 10 to 15 percent by volume.

CC3, Floodplain, occasionally flooded
The Psuni soils are moderately well drained and occur on occasionally flooded floodplains.

The Psuni soils are classified as Sandy-skeletal mixed mesic Oxyaquic Haploxerolls. Surface rock fragments < 3 inches ranges from 20 to 30 percent cover and > 3 inches ranges from 0 to 30 percent cover. Subsurface rock fragments < 3 inches range from 30 to 70 percent, and > 3 inch fragments range from 10 to 15 percent by volume.

CC4, Floodplain step, rarely flooded
The Patit Creek soils are associated with this fluvial surface. They are well drained and developed on rarely flooded floodplain steps.

The Patit Creek soils are classified as Coarse-loamy, mixed, superactive, mesic Cumulic Haploxerolls. Surface rock cover < 3 inches range from 0 to 10 percent, and rock fragments > 3 inches range from 0 to 2 percent. Subsurface rock fragments < 3 inches range from 0 to 65 percent, and > 3 inch fragments range from 0 to 15 percent by volume.

CC5, Terrace, seeped
The Olallie soils occur on stream terraces, are somewhat poorly drained and rarely flooded (1 to 5% chance of flooding in any given year) (Natural Resources Conservation Service 1993). There is moderate soil development with thick A horizon.

The Olallie soils are classified as Loamy-skeletal, mixed, superactive, mesic Cumulic Endoaquolls. Surface rock cover < 3 inches ranges from 0 to 3 percent, and rock fragments > 3 inches are typically absent. Subsurface rock fragments < 3 inches range from 5 to 55 percent, and > 3 inch fragments range from 0 to 5 percent by volume.

Table 4. Representative soil features

Parent material	(1) Alluvium–basalt
Surface texture	(1) Extremely cobbly sandy loam (2) Gravelly loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained to well drained
Soil depth	152 cm
Surface fragment cover <=3"	0–55%
Surface fragment cover >3"	0–30%
Soil reaction (1:1 water) (0-101.6cm)	6.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–70%
Subsurface fragment volume >3" (Depth not specified)	0–30%

Ecological dynamics

Scale and stream classification system:
Lotic ecological sites describe portions of valley sections with similar reaches, defined by slope, valley width, Strahler stream order, and similar associated fluvial landforms and associated vegetation. Lotic ecological sites are tied to the scale of the NRCS soil survey. The Umatilla County Soil Survey for this area was mapped at Order 3, with map unit size ranging from 1.6 to 16 hectares (Soil Survey Division Staff 1993). The closest equivalent scale for stream classification is the valley segment, which ranges from 0.1 to 10,000 hectares (Montgomery and Buffington 1993). Soil surveys may have different map units for a valley section based on slope classes and changes in composition of soil components, which often correspond to changes in stream classification. Lotic ecological sites incorporate Rosgen stream classification (Rosgen 1994) to identify the channel morphology and stream succession scenarios. Stream succession scenarios are used to develop state-and-transition models based on morphological changes of stream channels over time.

Site concept:
This riparian complex occurs on Strahler third and fourth order or streams in moderately sloping (1 to 4 percent), narrow, alluvial fill valleys in mountains and on dissected lava plateaus. Drainage area is typically between 8,000 and 25,000 acres. Stream potential is a Rosgen C or Bc channel type. Streams typically have perennial flow, but may have intermittent sections during late summer and fall. Valley bottom width ranges from 75 to 300 feet. Bank full channel widths range from 20 to 75 feet, with mean depths between 0.5 and 2 feet. Channel morphology is dominated by moderately-entrenched, single-thread Rosgen Bc type channels (Rosgen 2006). Valley slopes are typically less than 4 percent, but may range up to 10 percent. Channel gradients are less than 3 percent. Steeper bedrock sections can occur within this ecological site. There are five community components laterally associated with this ecological site. Starting from the stream they are: Gravel bar, Floodplain-frequently flooded, Floodplain-occasionally flooded, Terrace, and Terrace with moist meadow. The gravel bar component occurs in the active channel and is associated with poorly developed soils, which are subject to frequent flooding and reworking. The gravel bar component (CC1) is vegetated by pioneer forbs, of which the majority are invasive, non-native species. The frequently flooded, floodplain component (CC2) occurs within the active flood zone, with greater than 50%

chance of flooding in any given year. Depending upon duration of stability, the soils may be poorly developed or have a thick A horizon from accumulation of organic matter and fine sediments. The plant community is dominated by white alder (*Alnus rhombifolia*), water birch (*Betula occidentalis*), black cottonwood (*Populus balsamifera* ssp. trichocarpa), and willows (Salix sp.). The occasionally flooded, floodplain component (CC3) occurs between the historic 2 and 50-year floodplain. Black cottonwood, black hawthorn (*Crataegus douglasii*), and other shrubs are present. These floodplain soils (CC2 and CC3) have developed in recent alluvium from basalt. The original floodplain components may become abandoned in the altered entrenched states. The floodplain becomes abandoned when the channel is cut deeper and becomes larger, which lowers the water table and reduces flooding frequency onto the floodplain. Species dependent on a shallow water table or flooding, such as white alder and black cottonwood, may become decadent and decline over time. The fourth community component exists on stream terraces typically above the 50-year flood prone area. The water table is only above 60 inches for a short period in spring. Black hawthorn, ponderosa pine (*Pinus ponderosa*), and common snowberry (*Symphoricarpos albus*) are common. Community component 5 (CC5) is a moist meadow community situated on the terrace. It is supported by subsurface water from seeps. Vegetation is variable, but is dominated by graminoids and forbs.

Disturbance Factors:
This ecological site is developed based on the main channel of Isquulkpte Creek and sections within Buckaroo Creek. These streams are tributaries of the Umatilla River in northeast Oregon, and are within the boundaries of the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). The treaty between the US government and the CTUIR was signed in 1855; this designated the reservation and began the settlement of tribal people in this area. The valleys were farmed and horses grazed the hillslopes. Additional incentives for land allotments drew more Indian and non-Indian settlers. Land use intensified, and cattle and sheep grazing increased (CTUIR 2014). Highest stocking rates occurred during the 1880s to the 1920s. The tribes possessed 20,000 horses and 3,000 cattle by 1890, and non-Indian settlers and travelers brought several thousand additional head of cattle (BIA and CTUIR 2007). Today, cattle and feral horses graze in the uplands and in riparian corridors. Intensive grazing caused a decline in vegetative cover on the steep hillslopes from foraging and hoof trampling (BIA and CTUIR 2007). The exposed and disturbed soils are highly susceptible to water and wind erosion. Sheet, rill and gully erosion transported sediments to the streams, especially during extreme rain events. Grazing along the stream channels can impact and alter riparian vegetation by selective herbivory and physical trampling of the stream banks, resulting in a decline in bank stability from the loss of root structure and increase in bare soil. Exposed, overgrazed hillslopes and riparian areas are then poorly structured for large flood events. Large floods events occurred in 1881-1882, 1947-1948, and 1964-1965, with smaller floods in 1997 and 2011(U.S. Geological Survey 2015). Large flood events erode the hillslopes and unstable banks, which can leave deep sediment deposits in channels and on floodplains. Although this is a natural process, the scale of sedimentation may be increased by anthropogenic disturbances. These large flood events are the primary drivers of dramatic changes in stream morphology. These streams are showing signs of past down-cutting to reach grade equilibrium, and the stream sections are dominated by transport reaches.

Beavers were abundant in these watersheds prior to 1840. The fur trade was a major industry in Oregon in the early 1800s, when beavers were avidly exploited for their thick, smooth pelts. From 1820 to 1830, the Hudson Bay Company initiated a practice of exterminating beavers from areas south and east of the Columbia River to eliminate competition. This purposeful, detrimental practice, along with other trapping, caused a severe decline in beaver populations by 1825 and a near extinction of this species by 1900 (Harrison 2009). Since the 1900s there has been a gradual increase in beaver populations, however, beavers are still uncommon in these streams today. Beaver dams create ponds, which slow water flow and raise surface flow. Beaver ponds also raise water tables and cause more frequent flooding onto floodplains. A higher water table and increased flooding can change plant species composition to wetland obligate species, and will also increase growth rates and abundance of existing riparian vegetation. Below the beaver dam, stream flow may be reduced for short to long durations. Beaver can be detrimental to vegetation if the vegetation does not produce forage fast enough for beaver consumption. Although beavers are a natural part of the ecology for these streams, beaver dams may have detrimental impacts on developed landscapes by eroding or flooding railroads, roads, and other structures built adjacent to streams. Some agencies are attempting to reintroduce or enhance existing beaver dams to improve habitat for steelhead. Initial results have shown an increase in density and survival rates of young steelhead (Pollock, Jordan et al. , Pollock, Beechie et al. 2007).

In addition to land use disturbance, physical barriers and alterations from railroad and road development in flood plains or at stream crossings have confined or redirected stream channel flow, causing changes in channel gradient, sinuosity, and morphology.

Invasive weeds are a concern for this ecological site. Himalayan blackberry (*Rubus armeniacus*) is common, and can create dense impenetrable thickets that crowd out native species. Invasive forbs such as bull thistle (*Cirsium vulgare*), gypsyflower (*Cynoglossum officinale*), Queen Anne's lace (*Daucus carota*), Fuller's teasel (*Dipsacus fullonum*), common viper's bugloss (*Echium vulgare*), common St. Johnswort (*Hypericum perforatum*), catnip (*Nepeta cataria*), yellow salsify (*Tragopogon dubius*), moth mullein (Vebascum blatteria), and common mullein (*Verbascum thapsus*) were recorded on this ecological site. Non-native grasses recorded in plots are tall oatgrass (Arrhenatherrum elatius), orchardgrass (*Dactylis glomerata*) and medusahead (*Taeniatherum caput-medusae*).

Fire was historically an important natural disturbance in these riparian areas and adjacent ponderosa pine forests. Ponderosa pine forests typically have fire regimes dominated by frequent, low intensity understory burns. Ponderosa pine forests and shrublands are typical on north facing slopes and grasslands are typical on the south facing slopes above the valley floor. Fires initiated on the hillslopes may burn down into the riparian areas due to wind or fuel conditions. A study in the Blue Mountains, south of this ecological site, indicate that historic fire regimes in riparian areas are closely associated with the fire regime of the surrounding upslope vegetation. The mean fire return interval (MFRI) for the riparian plots near Dugout, OR was between 13-14 years, one year longer than the upslope forest. The riparian plots near Baker, OR had a MRFI of 13-36 years, while paired upland plots have 10 to 20 year MFRI (Olson 2000). With fire suppression since the 1900’s the structure, density, and extent of the riparian forest and upland ponderosa pine forest has changed. Documentation is limited on historic riparian forest structure, but with frequent understory burns, a more open herbaceous and grass dominated understory would be favored. The shrubs associated with this ecological site are adapted to fire. They have the ability to re-sprout from the root crown or from rhizomes after being top-killed by fire. Shrubs which re-sprout after fire include: black hawthorn, western chokecherry (*Prunus virginiana*), Woods’ rose (*Rosa woodsii*), and common snowberry, oceanspray (*Holodiscus discolor*), mallow ninebark (*Physocarpus malvaceus*), Lewis’ mock orange (*Philadelphus lewisii*), and the non-native Himalayan blackberry. Repeated fire may reduce shrub cover. Black cottonwood is injured by fire, but can also re-sprout from the root crown, and may regenerate well from seed in the freshly exposed soil if there is sufficient moisture (Steinberg 2001). White alder is often killed by severe fire, and reestablishes poorly from seed or by sprouting from the root crown. It may take decades for white alder to reestablish (Fryer 2014). In the absence of fire, dense development of mid-canopy layers may occur. The present structure of 95% of the riparian forest in the Dugout area is prone to severe crown fires under 90th percentile fire conditions, so fuel reduction is necessary prior to implementing prescribed burns (Olson 2000). The combination of altered hydrologic conditions (lower water tables, and less flood activity on floodplains) and fire suppression has allowed succession to continue with ponderosa pine forests becoming dominant on abandoned floodplains and terraces. When the floodplain and terraces become dry and disconnected from flooding events, these areas are more influenced by upland disturbance processes such as fire, lack of fire, and forest pathogens. Upland cycles are not included in the state and transition model for this riparian complex, due to the complexity of the model that would be needed to incorporate these concepts.

Hydrologic factors:

This ecological site incorporates the longitudinal, lateral, and to some extent the vertical connectivity of the stream. Longitudinally, the stream includes reaches of differing channel morphology. The channel may include reaches that are more confined by bedrock hillslopes, impacted by human alterations, or are less confined within a broad accessible floodplain. The valley bottom is typically wide (300 to 800 feet) throughout. Laterally, there may be braided side channels, active floodplains, and terraces. The variation in the hyporheic zone, and the relationship between surface water and ground water is at too fine of a scale to be described in this ecological site. The hyporheic zone associated with these streams has a complex pattern of upwelling and downwelling, which impacts the aquatic community and is important for fish spawning. Areas of downwelling may occur in sediment laden sections or above steps created by woody debris or bedrock. Upwelling is likely to occur where subsurface flow reenters the stream channel. Upwelling ground water is often cooler and more nutrient rich, which is preferable for fish spawning and creates a unique habitat for aquatic organisms.

Although historic information is lacking, the valley type and valley slope combined with current conditions indicate the potential for a slightly-entrenched C and B type channel complex. A C type channel is a slightly entrenched, single thread meandering channel with a well-defined floodplain. The channel has moderate to high sinuosity with less than two percent channel gradient. These channel types generally have a width to depth ratio greater than 12, which means they are moderately wide and shallow. They are often found in broad valleys with well-developed alluvial floodplains and terraces. These channels typically flood over bank two years out of three. C type channels are constantly in the process of transporting and storing sediments from upstream sources or bank erosion. As the particle size of the channel bottom material decreases, the sediment supply generally increases, as does erosion potential. The channels on this site support gravel and cobble (C4 and C3) reaches, which have very high erosion potentials and are very sensitive to disturbance. Vegetation such as white alder and willows exert a very high controlling influence on C type channel dynamics (Rosgen 1994).

C type channels can become unstable due to disturbances that impact stream bank vegetation, change the flow regime, sediment loads, or alter channel morphology. These channels respond quickly to such disturbances, exhibiting channel incision, bank erosion, or aggradation. This can shift a C type channel to a Bc, G, or F type channel. Overgrazing and excessive trampling by livestock can reduce streambank stability by reducing the vegetative cover or by physically trampling the banks.

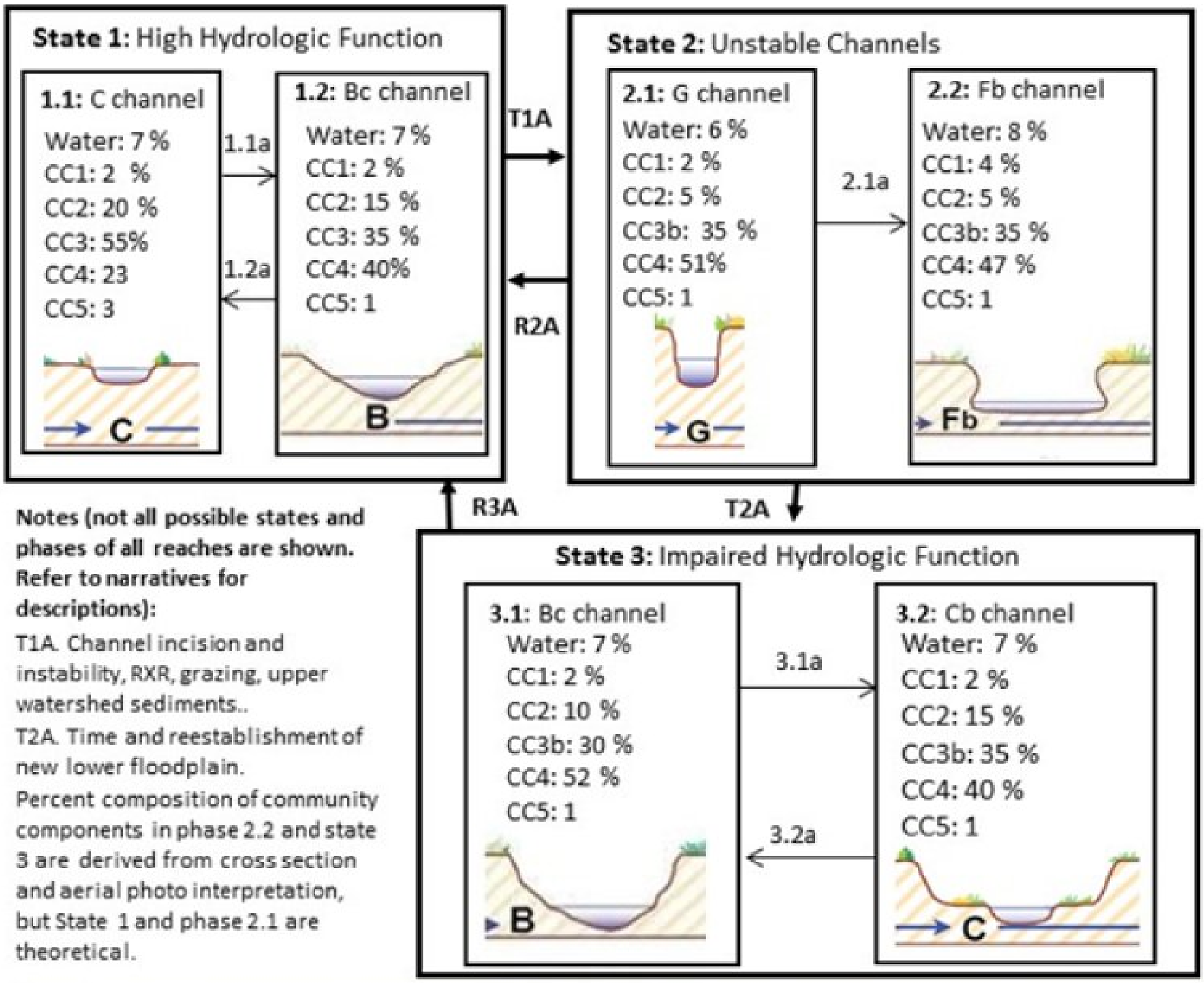
Bc type channels have the channel morphology of a B type channel, but have less than 2 percent channel gradients characteristic of C type channels. B type channels have 2 to 4 percent channel gradients and are naturally moderately entrenched, with entrenchment ratios between 1.4 and 2.2. B type channels are often in colluvial valleys or narrow moderately sloping alluvial valleys (Rosgen 1994). The Bc type channel can be a prolonged entrenched phase of a C type channel, caused by channel straightening and incision. Bc type channels may develop naturally where slopes range between 1.5 to 3 percent.

G and F type channels are often temporary or occur in short sections along the stream. G type channels occur as a stream headcuts or downcuts into sediments, creating a deep narrow channel. F type channels typically develop as bank erosion widens the narrow G type channel. In this site, the F type channel will develop into a C or Bc type channel.

Climate change
Climate records for the Pacific Northwest United States show that average annual temperature has increased 1.5 degree F in the last 100 years, and it is predicted to increase by 3 to 10 degrees F in the next century (EPA 2013). Precipitation predictions are less clear, but warmer temperatures are expected to cause more winter precipitation to come as rain instead of snow, and cause the reduced snowpack to melt 20 to 40 days earlier in spring (EPA 2013). The snowpack is currently the primary water source for late spring and summer flows in these streams. A greater proportion of rain and earlier snow melt could increase flood severity and frequency in winter and spring, and reduce flow in summer and fall. The change in timing of flooding could impact the migration and spawning of the anadromous fish that utilize these creeks; for example, increased flooding in the winter months could flush eggs and young fish from the streams (EPA 2013). The Meacham Creek USGS station has already shown a significant increase in flow during March (Chang and Jones 2010) likely due to earlier snow melt from warmer temperatures.

State and transition model

Moderately Sloping, Narrow Alluvial Valley Riparian Complex
(*Alnus rhombifolia*)-(*Betula occidentalis*) / (*Crataegus douglasii*) - (*Symphoricarpos albus*)
White alder-water birch/ Black hawthorn-common snowberry/



I.D.	Plant Association	Fluvial Surface/Landform
1	Forbs	Gravel bar
2	White alder, water birch	Floodplain, frequently flooded
3	Black cottonwood, black hawthorn	Floodplain, occasionally flooded
3b	Black hawthorn, oceanspray, ponderosa pine	Floodplain, abandoned
4	Ponderosa pine, common snowberry	Terrace, rare to no flooding
5	Moist Meadow, grass and grasslikes, forbs	Terrace, rare to no flooding

Figure 7. R009XY503OR STM

State 1
High Hydrologic Function

The historic or unaltered condition for this ecological site is based on current conditions and expected stream development in the associated narrow alluvial valley type and valley slope (1.5 to 3 percent). C type channels are expected in pristine conditions, but Bc type channels are a natural phase for this ecological site. Historically, a larger proportion of the reaches associated with this ecological site may have exhibited C type channel morphologies rather than the Bc type channel that is more common today. Although reaches with a C or Bc type channels may transition from one to the other, they may also perpetually exist due to valley constraints or bedrock features that create a semi-stable conditions. It is presumed that historic channels were less incised, and had broader and more frequent overbank flow onto floodplains. Beaver dams may have been important structural features historically. Most of this ecological site has been disturbed by grazing, stream crossings, non-native species, and other disturbances, so it is difficult to find data to describe the reference state or its phases.

Community 1.1
C Channel

This community phase is at equilibrium with the sediment supply and transport capability. It is a gently sloped, meandering, slightly-entrenched C type channel, which can access the floodplain every 2 to 3 years during moderate flood events. Flood energy is dissipated across the broad floodplain, leaving fresh nutrients and sediments, and instigating seed establishment of flood dependent species. The channel is rich with structural features, such as side channels, pools, and woody debris. The canopy cover across the stream is high, due to the well-developed riparian vegetation, and relatively narrow channel. This phase is similar to phase 3.1, which is an incised C channel. Phase 3.1 has a lower water table, and less connectivity to the floodplain. Historically the coverage of the white alder and cottonwood community (CC2) was greater due to higher water tables, stable stream banks, and floodplain connectivity. The upper terrace community may have been subjected to large flood events, which would have favored more cottonwood development. Plant Community Components I.D., Plant Association Fluvial Surface-Landform, Composition (%) W, Water, Water, Channel, 7 % CC1, Pioneer forbs, Gravel bar, 2 % CC2, White alder-water birch-willow, Floodplain- frequently flooded, 20 % CC3, Black cottonwood-black hawthorn, Floodplain- occasionally flooded, 55 % CC4, Ponderosa pine- common snowberry, Terrace- rare to no flooding, 23 % CC5, Moist meadow, Terrace- rare to no flooding, 3 %

Community 1.2
Bc Channel

The Bc channel phase is defined by moderate entrenchment, with a deeper, steeper-sided channel. The floodplain community (CC2) dependent upon shallow groundwater is limited to a narrow strip along the channel. The floodplain receives less frequent flooding, and community component 3 increases. Plant Community Components I.D., Plant Association, Fluvial Surface- Landform, Composition (%) W, Water, Water, Active channel, 7 % CC1, Pioneer forbs, Gravel bar, 2 % CC2, White alder- water birch-willow, Floodplain- frequently flooded, 15 % CC3, Black cottonwood-black hawthorn, Floodplain- occasionally flooded, 35 % CC4, Ponderosa pine- common snowberry, Terrace- rare to no flooding, 40 % CC5, Moist meadow, Terrace- rare to no flooding, 1 %

Pathway 1a
Community 1.1 to 1.2

This pathway occurs with channel incision to maintain grade equilibrium, which may have been altered by past sedimentation from large flood and erosion events or changes in local base level of the stream.

Pathway 2a
Community 1.2 to 1.1

This pathway occurs with time, establishment of grade equilibrium, reconnection with the flood plain, the development of point bars, and increase in channel sinuosity (C type channel).

State 2
Unstable Channels

This state is defined by unstable, incised, transitional G and F type channels. As channel incision occurs the water table is lowered across the floodplain and flow is contained within the channel which reduces over bank flooding onto the floodplain. G type channels are narrow and deep, with reduced sinuosity. The unstable banks of the G type channel erode rapidly into a wider and shallower entrenched F type channel. Stream velocity and confined flow often flush structural elements from the stream, causing a decline in habitat diversity. Riffle-pool sequences may develop into more continuous riffles.

Community 2.1
G Channel

This channel is unstable, deep and narrow, with reduced sinuosity. Stream banks are unstable and erode rapidly. This community phase was not encountered during surveys, but it is transitional and this ecological site may have already passed this evolutionary phase. Also, bedrock control restricts channel incision in some areas, causing the channel to widen into F or D type channels instead of incising. The community components are similar to those described in State 1, but the disconnected floodplain community (CC2) begins to decline, and species composition transitions to more upland species typical in CC3b. Plant Community Components I.D., Plant Association Fluvial Surface-Landform, Composition (%) W, Water, Water, Channel, 6 % CC1, Pioneer forbs, Gravel bar, 2 % CC2, White alder-water birch-willow, Floodplain- frequently flooded, 5 % CC3, Black cottonwood-black hawthorn, Floodplain- occasionally flooded, 35 % CC4, Ponderosa pine- common snowberry, Terrace- rare to no flooding, 51 % CC5, Moist meadow, Terrace- rare to no flooding, 1 %

Community 2.2
Fb Channel

The F type channel is a wide, incised channel with nearly vertical eroding banks. Flow is contained within the large channel, and the original floodplain is hydrologically disconnected from 50-year flood events. The floodplain community (CC2) declines, as the gravel bar (CC1) and terrace communities (CC3b) increase. Plant Community Components I.D., Plant Association Fluvial Surface-Landform, Composition (%) W, Water, Water, Channel, 8 % CC1, Pioneer forbs, Gravel bar, 4 % CC2, White alder-water birch-willow, Floodplain- frequently flooded, 5 % CC3, Black cottonwood-black hawthorn, Floodplain- occasionally flooded, 35 % CC4, Ponderosa pine- common snowberry, Terrace- rare to no flooding, 47 % CC5, Moist meadow, Terrace- rare to no flooding, 1 %

Pathway 1a
Community 2.1 to 2.2

This pathway occurs with time and lateral bank erosion, which creates a wider and shallower channel (F type channel).

State 3
Impaired Hydrologic Function

This state develops as new, lower floodplains develop along the entrenched channel. The new floodplains are at a lower elevation than the original floodplain, and are more confined. The majority of this ecological site currently exists in this state. This state may have C or Bc type channel morphology. Bedrock control is present in some sections, which may cause localized scouring and create deeper pools.

Community 3.1
Bc Channel

The entrenched C type channel has re-established a new floodplain at a lower elevation than the historic floodplain, but remains contained by the abandoned floodplain or terraces. The C channel has greater sinuosity than the D channel phase, with the development of point bars and increased meander. Pools are common in bends and along bedrock scoured sections. The floodplain community (CC2) establishes on the low floodplain, where water tables remain within 100 cm throughout the year. The gravel bar community (CC1) is present, but restricted to point bars and the active channel when the gravels are exposed at low flow. The abandoned floodplain community (CC3b) becomes dominated by upland species, but some relict floodplain species such as black cottonwood may be present. Black cottonwood will decline over time in the absence of flooding, because it requires flooding for dispersal and regeneration of seeds. The terrace community (CC4, CC5) increases as the area becomes drier. The small area of moist meadow (CC5) remains relatively constant. Plant Community Components I.D., Plant

Association Fluvial Surface-Landform, Composition (%) W, Water, Water, Channel, 7 % CC1, Pioneer forbs, Gravel bar, 2 % CC2, White alder-water birch-willow, Floodplain- frequently flooded, 10 % CC3, Black cottonwood-black hawthorn, Floodplain- occasionally flooded, 30 % CC4, Ponderosa pine- common snowberry, Terrace- rare to no flooding, 52 % CC5, Moist meadow, Terrace- rare to no flooding, 1 %

Community 3.2
Cb Channel

Figure 8. CC1 and CC2

Figure 9. CC2

Figure 10. CC3

Figure 11. CC4

Figure 12. CC2 soil

Figure 13. CC3 soil

Figure 14. CC4 soil

The entrenched C type channel has re-established a new floodplain at a lower elevation than the historic floodplain, but remains contained by the abandoned floodplain or terraces. The C channel has greater sinuosity than the D channel phase, with the development of point bars and increased meander. Pools are common in bends and along bedrock scoured sections. The floodplain community (CC2) establishes on the low floodplain, where water tables remain within 100 cm throughout the year. The gravel bar community (CC1) is present, but restricted to point bars and the active channel when the gravels are exposed at low flow. The abandoned floodplain community (CC3b) becomes dominated by upland species, but some relict floodplain species such as black cottonwood may be present. Black cottonwood will decline over time in the absence of flooding, because it requires flooding for dispersal and regeneration of seeds. The terrace community (CC4, CC5) increases as the area becomes drier. The small area of moist meadow (CC5) remains relatively constant. Plant Community Components I.D., Plant Association Fluvial Surface-Landform, Composition (%) W, Water, Water, Channel, 7 % CC1, Pioneer forbs, Gravel bar, 2 % CC2, White alder-water birch-willow, Floodplain- frequently flooded, 15 % CC3, Black cottonwood-black hawthorn, Floodplain- occasionally flooded, 35 % CC4, Ponderosa pine- common snowberry, Terrace- rare to no flooding, 40 % CC5, Moist meadow, Terrace- rare to no flooding, 1 % Description of community components: CC1 Community component 1 occurs on gravel bars and areas recently affected by flooding, such as recent sediment deposits or side channels on floodplains. Non-native forbs and grasses currently dominate. Historically this community may have been less extensive due to floodplain stability and the establishment of white alder and willow species along the water edge. Native forbs, grasses, and sedges may have been more abundant. Presently there is low cover of native species including willowherb (Epilobium sp.), knotweed (Polygonum sp.), seep monkeyflower (*Mimulus guttatus*), common yarrow (*Achillea millefolium*), bedstraw (Galium sp.), desertparsley (Lomatium sp.), clover (Trifolium sp.), and speedwell (Veronica sp.). Willow (Salix spp.) cover was intermittent along the water edge. Willows in our plots were browsed to short, multi-stemmed shrubs. In the absence of grazing from cattle and wild horses, riparian shrubs may increase with time. Currently non-native forbs that dominate this community include common viper's bugloss (*Echium vulgare*), common mullein (*Verbascum thapsus*), moth mullein (Vebascum blatteria), common St Johnswort (*Hypericum perforatum*), sweetclover (*Melilotus officinalis*), alfalfa (*Medicago sativa*), Queen Anne’s lace (*Daucus carota*), catnip (*Nepeta cataria*), common plantain (*Plantago major*), and prickly Russian thistle (*Salsola tragus*). This community is within the active channel at high flows, becoming exposed gravels and cobbles during low flow. It is subject to frequent scouring and depositional events, making it difficult for longer-lived species to establish. It is dominated by annual and short-lived perennial species, whose seeds are deposited by floods, wind, or animals. Willows and white alder may establish in areas with relative stability and absence of grazing. CC2 This community occurs on frequently-flooded floodplains, typically adjacent to the gravel bar community. In some areas it occurs at the bank full position, which may also be the greenline community. The water table typically remains within the upper 100 cm throughout the year. The species associated with this community are predominantly wetland or facultative wetland species. These species are adapted to and dependent upon flooding for seed dispersal and germination. White alder is a facultative wetland species (FACW), meaning it typically occurs in wetlands, but may occur in uplands. White alder forms thin linear stands along the bank full line, or on side channels and depressions where its roots can access the shallow water table. White alder requires moist soil for seedling development and survival. Seedlings will not survive in soils that dry in summer. The timing of seed production and high water flows are crucial. The seeds may be dispersed by water, wind, or animals, and develop best in areas after flood waters recede (Fryer 2014). Mature white alder typically needs a seasonal water table within three meters in order to survive, and can withstand seasonal inundation. After flood events and stem breakage, white alder can re-sprout or reproduce by layering. White alder develops best on soils that are coarse-textured and have well-aerated subsurface water flow. It has nitrogen fixing-nodules, which help develop soil nutrients. White alder’s roots develop dense matrixes along stream banks that help armor the soil from erosion and capture fine sediments. With continued stability, soils growing white alder develop darker, nutrient-rich, finer-textured surface horizons. Water birch is also a facultative wetland (FACW) species. Water birch establishes in areas that are subject to frequent flooding and typically have hydric soil features within 20 inches of the surface (Gucker 2012). Similar to white alder, water birch relies on flooding for seed dispersal, germination, and seedling survival. Water birch produces abundant seed, which are primarily transported by stream flow, but may also be wind-dispersed several kilometers. Seeds are primarily deposited in low-velocity flow areas such as eddies or side channels. The seedlings establish best when there is sufficient light and exposed mineral soil (Gucker 2012). Black cottonwood may be more widely dispersed across the floodplain, because it is less dependent upon a shallow water table. It is a facultative species (FAC), meaning it may occur equally in wetland or upland habitats. Black cottonwood produces a high volume of seed every spring, but seeds are only viable for a few weeks. Once the seeds become wet they begin to germinate and need a good substrate in order to survive. Seedling survival is best on mineral soil that remains moist near the surface for at least a month. If the water table and soil moisture drop to deeper layers and the young roots cannot access the water, they will succumb to drought. Short seed viability and specific moisture requirements for germination mean that in order for regeneration to occur, seed production and flood events need to occur in the same time frame. Seedlings develop best in open sunlight, and seldom regenerate under existing black cottonwood forest or other vegetative cover. Regeneration from seed typically occurs in pulses with large flood events. After damage from flood events, black cottonwood can re-sprout from buried stems or develop root succors after stem damage. Twigs broken by flood events can re-sprout if buried in moist sediments with leaves still attached (Steinberg 2001). This is more common in areas with moist summers. Mature cottonwood need to have roots in a perennial water table, but since roots may penetrate to depths of seven meters they can persist on higher floodplains and terraces (CC3 and CC4). Willow species also produce seeds annually that are only viable for a short period of time and require moist substrates for germination and seedling survival. Willows can withstand long periods of inundation, and their flexible stems enable them to flex with water flows. If stems are damaged they can resprout from the roots or lower stem. Some species of willow, such as narrowleaf willow (*Salix exigua*), can form dense, clonal colonies from sprouting of root shoots. Broken branches and root pieces can re-sprout if lightly buried in fresh flood deposits (Uchytil 1989, Anderson 2006). Other shrubs that may be present with low cover include black hawthorn, common snowberry, Lewis' mock-orange (*Philadelphus lewisii*), oceanspray (*Holodiscus discolor*), mallow ninebark (*Physocarpus malvaceus*), Rocky mountain maple (*Acer glabrum*), thimbleberry (*Rubus parviflorus*), western chokecherry (*Prunus virginiana*) Woods' rose (*Rosa woodsii*), redosier dogwood (*Cornus sericea*), and arroyo willow (*Salix lasiolepis*) and the non-native Himalayan blackberry. This floodplain community has a successional trend when it recovers from erosive or depositional flood events. Large flood events can uproot or break the stems of mature white alder, water birch, and cottonwoods, and leave a path of exposed gravel and cobble deposits. During this early successional period, the vegetation of this component is similar to the gravel bar (CC1) component, and is dominated by pioneer and short-lived forbs. At this time willow, white alder, water birch, and black cottonwood seedlings also establish. With time, the white alder and cottonwood develop into tree form, and riparian woodlands develop. Willows are less shade-tolerant, and may be shaded out with the development of the overstory canopy. The soils also develop with accumulation of organic matter and fine sediments. Conifers such as grand fir (*Abies grandis*) and ponderosa pine can establish in this area if water tables drop and there is an absence of flood disturbance or fire to initiate regeneration. Non-native species (listed in CC1) are more prominent in the early seral stages, with open sunlight and poorly developed soils. With increased canopy shading, many invasive species decline. However, Himalayan blackberry can form impenetrable thickets in the understory, which then outcompete native species. CC3 This community component (CC3) was historically the active floodplain. Due to channel incision in most of these streams, a less active floodplain community has developed (CC3b). It is typically above the 50-year flood influence, and the water table may drop below 100 centimeters in the summer and fall. Current channels may be incised one to four feet below the former channel. Historically this community component may have resembled CC2, or had more area in which CC2 could establish, such as in low positions or side channels. Today, because these floodplains are subject to less frequent or no flooding, black cottonwood is often over-mature and decadent, and seedling regeneration is minimal due to lack of flooding to provide the suitable moist substrate for germination and survival. The water table is too deep in the summer to support white alder and willows (except in occasional low depressions). Ponderosa pine has established in some areas in the absence of flood or fire disturbance. Black hawthorn (Crateagus douglasii) is common in open areas or in the understory of black cottonwood and ponderosa pine forested areas. It can form dense, nearly impenetrable thickets, with a sparse herbaceous layer. Common snowberry and Woods' rose (*Rosa woodsii*) may be present in the thickets. Black hawthorn was more abundant on plots with a deeply-incised channel (CC3b). The seeds of black hawthorn require scarification prior to germination. Information is lacking for regeneration requirements of black hawthorn, but fruits are likely partially digested by birds, bear, deer, and other small mammals and dispersed in their feces. Other shrubs include Lewis' mock-orange, mallow ninebark, Rocky mountain maple, whitebark raspberry (*Rubus leucodermis*), bittercherry (*Prunus emarginata*), Woods' rose, common snowberry, oceanspray (*Holodiscus discolor*), dwarf rose (*Rosa gymnocarpa*), and the non-native Himalayan blackberry. Outside the dense shrub thickets, blue wildrye (*Elymus glaucus*) may be abundant. Other grass and grass-like plants include smooth brome (*Bromus inermis*), sedges (Carex sp.), Geyer's sedge (*Carex geyeri*), common rush (*Juncus effusus*), bentgrass (Agrostis sp.), bluegrass (Poa sp.), and the non-native tall oatgrass (*Arrhenatherum elatius*). Forb cover is presently dominated by non-native species, including bull thistle, gypsyflower, Queen Anne's lace, Fuller's teasel, common viper's bugloss, catnip, yellow salsify, and common mullein. Native forbs include willowherb (Epilobium sp.), bedstraw (Galium sp.), and common cowparsnip (*Heracleum maximum*). CC4 This community component occurs on terraces above the active floodplain. Flooding frequency is very rare to none, and the water table drops to below six feet in the dry season. The vegetation is dominated by an open stand of ponderosa pine with common snowberry in the understory. This component may border the active channel where stream bank erosion has cut back into the terrace. Vertical cut banks of four to six feet are common on outer meander bends. Changes in sediment deposits, log jams, or other features that obstruct flow can cause flow to divert across terraces, creating a new channel or temporary side channels. This is less likely to occur in States 2 and 3, where flow is typically contained within the incised channel, requiring a large (50 to 100-year) flood event and ideal topography to allow overflow onto the terrace level. Ponderosa pine typically occurs above an elevation of 1800 feet, and increases in abundance at the higher elevations of this ecological site. This species develops on these stream terraces due to the lower water tables and longer periods of stability between large flood events. In the event of a large flood, the terrace may be scoured or trees undercut and uprooted, leaving a fresh swath of sediment for early successional species, such as pioneer forbs. Fire may also initiate regeneration, and is a natural cycle of this system. Historically, the open ponderosa pine forest developed with low-intensity surface fires, with a mean fire return interval of 11 years (Gucker 2012). Fire suppression has increased the mean fire return intervals in many areas. Combined with past logging practices, the structure of these forests has been altered to younger, denser forests. With historic flooding and fire regimes, the development of ponderosa pine forests on these terraces may have been less dense or uniform. The fire return interval for riparian areas may be similar to the fire frequency of the surrounding uplands (Gucker 2012). Stream temperature may increase if fire causes mortality or severe dieback of riparian vegetation, reducing the canopy shading of the stream. Livestock grazing in ponderosa pine forests may favor shrub development over grasses (Habeck 1992). Black hawthorn and oceanspray are common shrubs. Blue wildrye is the dominant grass in the understory, but the non-native orchardgrass (*Dactylis glomerata*) and medusahead (*Taeniatherum caput-medusae*) may be locally abundant. Forbs are dominated by non-native species including bull thistle, Fuller's teasel, common viper's bugloss, common St. Johnswort (*Hypericum perforatum*), catnip, moth mullein (Vebascum blatteria), and common mullein. Native forbs documented in plots are woodland strawberry (*Fragaria vesca*) and old man's whiskers (*Geum triflorum*). CC5 This community component is of limited extent, and is sporadically present. It is dominated by grass and grass-like plants, and has subsurface water late into summer from seeps. The plant community varies due to disturbance history and the site’s wetness. Grass and grasslike plants include sedges (Carex spp.), panicled bulrush (*Scirpus microcarpus*), common rush (*Juncus effusus*), bentgrass (Agrostis sp.), bluegrass (Poa sp.), mannagrass (Glyceria sp.), and the non-native compact brome (*Bromus madritensis*). Non-native forbs include bull thistle, Fuller's teasel, common viper's bugloss, and sulphur cinquefoil. Native forbs include willowherb and bedstraw. Annual production was estimated at 2100 lbs/acre. A variety of additional species are expected to be present.

Pathway 1a
Community 3.1 to 3.2

This pathway occurs with time and the resorting of sediments, which develops a meandering channel (C type channel) with point bars and access to a new lower floodplain.

Pathway 2a
Community 3.2 to 3.1

This pathway occurs with channel incision to maintain grade equilibrium, which may have been altered by past sedimentation from large flood and erosion events or changes in local base level of the stream.

Transition 1A
State 1 to 2

This transition occurs with changes in stream flow or sedimentation rates. The imbalance causes channel adjustments. Down-cutting or head-cutting of the channel bed may occur when a stream becomes confined or straightened due to obstructions in the floodplain, or loss of structural elements in the channel, such as woody debris and beaver dams. Flood events can deposit thick sediments, and normal stream flows may rapidly incise these sediments. A transitional, confined, entrenched, and unstable state develops. Stream gradient and velocity increases, and G or F type channel phases develop.

Restoration pathway 2A
State 2 to 1

Restoration from State 2 to State 1 would involve intensive stream surveying in order to determine the best restoration approach. Restoration methods may include channel redesign to raise the channel bed, increase meander, or remove floodplain restrictions. These streams have very little large woody debris, and may benefit with the planned placement of large woody debris to improve the diversity of pool habitat. Riparian vegetation may be enhanced by cattle exclusion or herding to reduce duration in riparian corridors. Reintroduction of beavers might increase pool habitat and increase the overbank flows onto the floodplains (Pollock, Beechie et al. 2007). Riparian vegetation may be planted in reaches with suitable water tables for establishment (not on incised, eroded banks).

Channel restoration on the larger, nearby, Meacham Creek has proven to be beneficial (Confederated Tribes of the Umatilla Indian Reservation 2014, Lambert 2014). The Isquulktpe Watershed progress report (Elseroad 2014) states that feral horses are hindering restoration efforts on hillslope grassland communities as well as riparian areas. Weeds on the gravel bars and blackberry on the floodplains and terraces should be treated. Over 40 acres have been treated with physical removal of Himalayan blackberry. Several herbicide treatments have been used for noxious weeds.

Transition 2A
State 2 to 3

This transition occurs with increased channel widening, and greater access to a new, lower floodplain within an entrenched C or Bc channel type. Bc type channels are moderately entrenched and may still be in a period of transition. C type channels develop as sediments build up point bars, and increase meander and pool-riffle formation. Habitat conditions for this state improve with the development of structural elements in the channel, such as pool formations from root wads. The channels in this state do not access the entirety of their former floodplain.

Restoration pathway 3A
State 3 to 1

Restoration from State 3 to State 1 would be similar to restoration from State 2 to State 1.

Additional community tables

Table 5. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			0–6	
	willow	SALIX	*Salix*	0–6	0–1
2	**Shrubs**			504–1233	
	arroyo willow	SALA6	*Salix lasiolepis*	0–426	0–8
	Lewis' mock orange	PHLE4	*Philadelphus lewisii*	112–202	3–8
	willow	SALIX	*Salix*	0–202	0–3
	mallow ninebark	PHMA5	*Physocarpus malvaceus*	34–157	1–3
	oceanspray	HODI	*Holodiscus discolor*	1–101	1–3
	Himalayan blackberry	RUAR9	*Rubus armeniacus*	1–73	0–25
	thimbleberry	RUPA	*Rubus parviflorus*	0–17	0–5
	common snowberry	SYAL	*Symphoricarpos albus*	0–17	0–3
	redosier dogwood	COSE16	*Cornus sericea*	0–17	0–3
	black hawthorn	CRDO2	*Crataegus douglasii*	0–17	0–2
	Rocky Mountain maple	ACGL	*Acer glabrum*	0–11	0–2
	blackberry	RUBUS	*Rubus*	0–6	0–1
	chokecherry	PRVI	*Prunus virginiana*	0–6	0–1
	Woods' rose	ROWO	*Rosa woodsii*	0–6	0–1
3	**Shrubs**			757–1681	
	black hawthorn	CRDO2	*Crataegus douglasii*	168–1681	10–75
	common snowberry	SYAL	*Symphoricarpos albus*	22–202	5–15
	Himalayan blackberry	RUAR9	*Rubus armeniacus*	0–17	0–5
	oceanspray	HODI	*Holodiscus discolor*	0–13	0–1
	Woods' rose	ROWO	*Rosa woodsii*	0–11	0–2

	bitter cherry	PREM	*Prunus emarginata*	0–9	0–1
	Pacific ninebark	PHCA11	*Physocarpus capitatus*	0–9	0–1
	Lewis' mock orange	PHLE4	*Philadelphus lewisii*	0–6	0–1
	Rocky Mountain maple	ACGL	*Acer glabrum*	0–6	0–1
	dwarf rose	ROGY	*Rosa gymnocarpa*	0–1	0–1
	whitebark raspberry	RULE	*Rubus leucodermis*	0–1	0–1
4	**Shrubs**			202–392	
	black hawthorn	CRDO2	*Crataegus douglasii*	6–129	1–15
	common snowberry	SYAL	*Symphoricarpos albus*	17–108	4–8
	mallow ninebark	PHMA5	*Physocarpus malvaceus*	0–101	0–2
	Woods' rose	ROWO	*Rosa woodsii*	0–84	0–6
	oceanspray	HODI	*Holodiscus discolor*	0–73	0–5
	Himalayan blackberry	RUAR9	*Rubus armeniacus*	0–67	0–2
	sweetbriar rose	RORU82	*Rosa rubiginosa*	0–28	0–2
	honeysuckle	LONIC	*Lonicera*	0–17	0–3
	Rocky Mountain maple	ACGL	*Acer glabrum*	0–17	0–2
	whitebark raspberry	RULE	*Rubus leucodermis*	0–6	0–1
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–3	0–1
5	**Shrubs**			–	
	common snowberry	SYAL	*Symphoricarpos albus*	–	0
Grass/Grasslike					
1	**grass**			0–3	
	bentgrass	AGROS2	*Agrostis*	0–3	0–1
	bluegrass	POA	*Poa*	0–1	0–1
2	**Grass and grasslike**			84–202	
	bentgrass	AGROS2	*Agrostis*	34–202	1–3
	blue wildrye	ELGL	*Elymus glaucus*	0–28	0–5
	common rush	JUEF	*Juncus effusus*	0–11	0–3
	rush	JUNCU	*Juncus*	0–1	0–1
3	**Grass and grasslike**			3–196	
	bentgrass	AGROS2	*Agrostis*	1–73	1–11
	blue wildrye	ELGL	*Elymus glaucus*	3–62	5–50
	bluegrass	POA	*Poa*	1–39	1–8
	smooth brome	BRIN2	*Bromus inermis*	0–18	0–1
	Geyer's sedge	CAGE2	*Carex geyeri*	0–1	0–1
	sedge	CAREX	*Carex*	0–1	0–1
	common rush	JUEF	*Juncus effusus*	0–1	0–1
	tall oatgrass	AREL3	*Arrhenatherum elatius*	0–1	0–1
4	**Grass and grasslike**			196–482	
	Kentucky bluegrass	POPR	*Poa pratensis*	0–331	0–50
	orchardgrass	DAGL	*Dactylis glomerata*	0–135	0–15
	blue wildrye	ELGL	*Elymus glaucus*	2–25	2–30
	largespike sedge	CAMA51	*Carex macrostachys*	0–1	0–1
	medusahead	TACA8	*Taeniatherum caput-medusae*	0–1	0–1

	medusahead	TACA8	*Taeniatherum caput-medusae*	0–1	0–1
5	**Grass and grasslike**			–	
	bentgrass	AGROS2	*Agrostis*	–	0
	compact brome	BRMA3	*Bromus madritensis*	–	0
	sedge	CAREX	*Carex*	–	0
	orchardgrass	DAGL	*Dactylis glomerata*	–	0
	mannagrass	GLYCE	*Glyceria*	–	0
	common rush	JUEF	*Juncus effusus*	–	0
	bluegrass	POA	*Poa*	–	0
	panicled bulrush	SCMI2	*Scirpus microcarpus*	–	0
Forb					
1	**Forbs**			0–80	
	common mullein	VETH	*Verbascum thapsus*	0–28	0–15
	Fuller's teasel	DIFU2	*Dipsacus fullonum*	0–28	0–10
	alfalfa	MESA	*Medicago sativa*	0–6	0–5
	common St. Johnswort	HYPE	*Hypericum perforatum*	0–6	0–1
	willowherb	EPILO	*Epilobium*	0–2	0–2
	Queen Anne's lace	DACA6	*Daucus carota*	0–2	0–1
	sweetclover	MEOF	*Melilotus officinalis*	0–2	0–1
	desertparsley	LOMAT	*Lomatium*	0–1	0–1
	common yarrow	ACMI2	*Achillea millefolium*	0–1	0–1
	bedstraw	GALIU	*Galium*	0–1	0–1
	seep monkeyflower	MIGU	*Mimulus guttatus*	0–1	0–1
	catnip	NECA2	*Nepeta cataria*	0–1	0–1
	common plantain	PLMA2	*Plantago major*	0–1	0–1
	knotweed	POLYG4	*Polygonum*	0–1	0–1
	prickly Russian thistle	SATR12	*Salsola tragus*	0–1	0–1
	clover	TRIFO	*Trifolium*	0–1	0–1
	speedwell	VERON	*Veronica*	0–1	0–1
2	**Forbs**			6–36	
	Fuller's teasel	DIFU2	*Dipsacus fullonum*	0–11	0–4
	catnip	NECA2	*Nepeta cataria*	0–9	0–5
	common viper's bugloss	ECVU	*Echium vulgare*	0–6	0–2
	bedstraw	GALIU	*Galium*	0–3	0–4
	common selfheal	PRVU	*Prunella vulgaris*	0–1	0–1
	black nightshade	SONI	*Solanum nigrum*	0–1	0–1
	violet	VIOLA	*Viola*	0–1	0–1
	small enchanter's nightshade	CIAL	*Circaea alpina*	0–1	0–1
	thistle	CIRSI	*Cirsium*	0–1	0–1
	gypsyflower	CYOF	*Cynoglossum officinale*	0–1	0–1
3	**Forbs**			0–24	
	common cowparsnip	HEMA80	*Heracleum maximum*	0–7	0–1
	common mullein	VETH	*Verbascum thapsus*	0–6	0–2
	catnip	NECA2	*Nepeta cataria*	0–2	0–2

	catnip	NECA2	*Nepeta cataria*	0–2	0–2
	bedstraw	GALIU	*Galium*	0–1	0–2
	yellow salsify	TRDU	*Tragopogon dubius*	0–1	0–1
	bull thistle	CIVU	*Cirsium vulgare*	0–1	0–1
	gypsyflower	CYOF	*Cynoglossum officinale*	0–1	0–1
	Queen Anne's lace	DACA6	*Daucus carota*	0–1	0–1
	Fuller's teasel	DIFU2	*Dipsacus fullonum*	0–1	0–1
	common viper's bugloss	ECVU	*Echium vulgare*	0–1	0–1
	willowherb	EPILO	*Epilobium*	0–1	0–1
4	**Forbs**			28–129	
	common St. Johnswort	HYPE	*Hypericum perforatum*	6–50	1–5
	catnip	NECA2	*Nepeta cataria*	0–11	0–2
	common mullein	VETH	*Verbascum thapsus*	0–11	0–2
	American vetch	VIAM	*Vicia americana*	0–6	0–3
	field horsetail	EQAR	*Equisetum arvense*	0–6	0–3
	plantain	PLANT	*Plantago*	0–6	0–3
	common viper's bugloss	ECVU	*Echium vulgare*	0–6	0–2
	old man's whiskers	GETR	*Geum triflorum*	0–1	0–2
	woodland strawberry	FRVE	*Fragaria vesca*	0–1	0–1
	bedstraw	GALIU	*Galium*	0–1	0–1
	geranium	GERAN	*Geranium*	0–1	0–1
	sulphur cinquefoil	PORE5	*Potentilla recta*	0–1	0–1
	common selfheal	PRVU	*Prunella vulgaris*	0–1	0–1
	black nightshade	SONI	*Solanum nigrum*	0–1	0–1
	common dandelion	TAOF	*Taraxacum officinale*	0–1	0–1
	yellow salsify	TRDU	*Tragopogon dubius*	0–1	0–1
	clover	TRIFO	*Trifolium*	0–1	0–1
	moth mullein	VEBL	*Verbascum blattaria*	0–1	0–1
	bull thistle	CIVU	*Cirsium vulgare*	0–1	0–1
	larkspur	DELPH	*Delphinium*	0–1	0–1
	Fuller's teasel	DIFU2	*Dipsacus fullonum*	0–1	0–1
5	**Forbs**			–	
	bull thistle	CIVU	*Cirsium vulgare*	–	0
	Fuller's teasel	DIFU2	*Dipsacus fullonum*	–	0
	common viper's bugloss	ECVU	*Echium vulgare*	–	0
	willowherb	EPILO	*Epilobium*	–	0
	bedstraw	GALIU	*Galium*	–	0
	sulphur cinquefoil	PORE5	*Potentilla recta*	–	0
	speedwell	VERON	*Veronica*	–	0
Tree					
2	**Trees**			588–1177	
	white alder	ALRH2	*Alnus rhombifolia*	588–1177	5–80
	water birch	BEOC2	*Betula occidentalis*	0–1121	0–70
	black cottonwood	POBAT	*Populus balsamifera ssp. trichocarpa*	0–56	0–2

			trichocarpa		
	ponderosa pine	PIPO	*Pinus ponderosa*	0–6	0–2
	grand fir	ABGR	*Abies grandis*	0–6	0–1
3	**Trees**			168–448	
	white alder	ALRH2	*Alnus rhombifolia*	0–448	0–35
	ponderosa pine	PIPO	*Pinus ponderosa*	0–56	0–10
	black cottonwood	POBAT	*Populus balsamifera ssp. trichocarpa*	0–39	0–5
4	**Trees**			17–140	
	ponderosa pine	PIPO	*Pinus ponderosa*	17–135	15–25
	grand fir	ABGR	*Abies grandis*	0–67	0–12
	white alder	ALRH2	*Alnus rhombifolia*	0–17	0–3
	Douglas-fir	PSME	*Pseudotsuga menziesii*	0–1	0–1
Moss					
2	**Moss**			0–1	
3	**Moss**			0–1	
4	**Moss**			0–3	

Animal community

This ecological site provides valuable structurally diverse habitat for a variety of aquatic and upland animals. Bear, beaver, deer, birds, and small mammals find shelter within the riparian forests along these streams. The surrounding hillslopes are often dominated by grasslands, which offer limited cover. The leaves and young stems of white alder, cottonwood, water birch, Rocky Mountain maple, and willows provide browse for deer, elk, and livestock. The leaf litter of these tree species and willows which falls into the stream is eaten by caddisfly larvae (Going 2008) and other macroinvertebrates. The seeds of white alder are eaten by birds and small mammals.

Beaver cut and use water birch, cottonwood, white alder, and willows for building their dams and lodges. A majority of a beaver’s diet is the cambium (inner bark) of birch, maples, cottonwood, and alders.

Black hawthorn thickets provide shelter, thermal cover, and hiding places for small and large animals. The berries are eaten by birds, bear, deer, and small mammals. Livestock will graze the foliage, but it is considered poor-quality browse (Habeck 1991). Common snowberry is an important browse for wildlife, domestic sheep, and cattle. It also provides cover and food for a variety of bird species and small mammals (McWilliams 2000). Woods’ rose provides forage, and the fruit is consumed by a variety of large and small mammals and birds.

Anadromous species such as Coho salmon (Oncorhynchus kisutch), steelhead (Oncorhynchus mykiss), and Pacific lamprey (Entosphenus tridentatus) access portions of this ecological site (CTUIR 2014). The Coho salmon and steelhead are listed as federally threatened species in this region, and the Pacific lamprey is a species of concern. These species spawn and live in the stream during their juvenile stages, migrate to the ocean, return to spawn, and die after spawning. These species prefer cool streams with gravel substrate for spawning. They need good water quality with high levels of dissolved oxygen for spawning. Fine sand, silt, clay, and organic matter can clog pores in the gravel, reducing dissolved oxygen content. Water temperatures greater than 16 degrees C can cause high mortality. Steelhead prefer to spawn at the head or tail of riffles with stream velocities between 0.6 to 1.5 m/s (Fulton 2004).

Resident fish include the longnose dace (Rhinichthys cataractae), speckled dace (Rhinichthys osculus), and skulpin (Personal communication CTUIR 2015). Dace are freshwater minnows that feed on aquatic insects. They are bottom feeders, and prefer riffles with fast-moving water and overhead canopy cover.

Surveys of macroinvertebrate species are lacking for this ecological site. The macroinvertebrate community will vary depending upon location, flow duration, canopy shading, and stream bed morphology.

Wood products

Ponderosa pine produces valuable lumber that can be used for molding, mill work, cabinets, doors, and windows. Lower grade wood is used for dimensional lumber (Habeck 1992).

The wood of black cottonwood is used to make book and magazine paper, biomass production, and other wood products such as pallets and fiberboard. The wood decays easily and is not very strong, so is not used for lumber (Steinberg 2001).

Other products

Grass seeds provided a significant amount of food in some areas. The seeds can be harvested and utilized like wild rice. Some species that have been documented for this purpose include wildry (Leymus sp.), needlegrass (Achnatherum sp.), fescue (Festuca sp.), barley (Hordeum sp.), blue wildrye (*Elymus glaucus*), bromes (Bromus sp.), and wild oats (Avena sp.) (Anderson 2006).

Young green leaves were an important source of vitamins and minerals. Some plants documented as used for this purpose include, sweet cicely (Osmorhiza sp.), angelica (Angelica sp.), common cow parsnip (*Heracleum maximum*), wild onions (Allium sp.), clovers (Trifolium sp.), stinging nettle (Urtica Dioica), violets (Viola sp.), vetch (Vicia sp.), horsetail (Equisetum sp.), spring beauty (Claytonia sp.), and thistles (Cirsium sp.).

Many shrubs and forbs provide edible fruits, such as wild strawberry (Fragaria sp.), wild raspberry and blackberry (Rubus sp.), serviceberry (Almelanchier sp.), wild rose (Rosa sp.), western chokecherry (*Prunus virginiana*), blue elderberry (Sambucus nigra), gooseberries and currents (Ribes sp.) (Anderson 2006). Black hawthorn berries are also edible, and the flowering tops and berries are used to make a tincture used as a heart tonic (Moore 1993). Most of these fruits can be eaten raw, or they are used to make pies, jellies, and jams.

Historically, shrubs used for basketry were carefully managed to promote long unbranched stems. Common shrubs used for basketry include willows (Salix sp.), dogwoods (Cornus sp.), and maples (Acer sp.) (Anderson 2006).

Young shoots of cottonwood (Populus sp.) and maple were used to make cordage. Snowberry (Symphoricarpos sp.), gooseberries, willow, alder (Alnus sp.), and mock orange (*Philadelphus lewisii*), were pruned to collect material to make arrows (Anderson 2006).

There are many medicinal or ritual uses for plants that occur on this site. For example, cottonwood leave buds can be used to make tinctures or salves, and are also used as a topical anti-inflammatory and antimicrobial medicine (Moore 1993). Willow bark, shoots, and twigs can be used as a fever reducer, pain-killer, and anti-inflammatory. The chemical compound salacin was isolated from willow and eventually used to develop Aspirin (Chatfield 1997).

Inventory data references

Vegetation data includes ocular cover, production estimates, and double weight sampling methods. Herbaceous production was collected in 4.8 sq. ft. circular hoops. Shrubland production was estimated by counting weight units in four (21' X 21') plots. Soils were described at the center of selected vegetation plots, and channel cross-section measurements were made when possible to intersect soil and vegetation plots.

Community component 1:
IS_XS2_CC1_006 Type location
IS_XS3_CC1

Community component 2:
BK_XS1_CC2_310 Type location
IS_XS1_CC2_300
IS_XS2_CC2_007
IS_XS3_CC2
BK_XS2_note

Community component 3:

BK_XS1_CC3_311
IS_XS1_CC3_301 Type location

Community component 4:
IS_XS1_CC4_303 Type location
IS_XS2_CC4_008
IS_XS3_CC4_022

Community component 5:
IS_021_N

Type locality

Location 1: Umatilla County, OR	
UTM zone	N
UTM northing	5058455
UTM easting	390854
General legal description	The type location is on Isquulkpte Creek, approximately 3.3 miles upstream from the confluence of the Umatilla River.

Other references

Anderson, K. (2006). Tending the Wild. Berkeley, CA, University of California Press.

Anderson, M. (2006). "*Salix exigua* In: Fire Effects Information System." 2015, from http://www.fs.fed.us/database/feis/plants/shrub/salexi/all.html.

BIA and CTUIR (2007). Environmental Assessment Draft. A program to manage rangeland and pasture resouce on the Umatilla Indian Reservation, Umatilla County, Oregon. Pendleton, OR, US. Department of the Interior.

Chang, H. and J. Jones (2010). Climate change and freshwater resources in Oregon. Chapter 3, Oregon Climate Assessment Report. K. D. Dello and P. W. Mot. , Corvallis, OR, Oregon Climate Change Research Institute.

Chatfield, K. (1997). Medicine from the Mountains, Medicinal Plants of the Sierra Nevada
South Lake Tahoe, CA, Range of Light Publications.

Confederated Tribes of the Umatilla Indian Reservation (2014). Meacham Creek river mile 6.0 to 8.5 floodplain restoration and in-stream enhancement project and completion report. Bothell, Washington, Tetra Tech, Inc.

Elseroad, A. (2014). Isquulktpe Watershed Project Progress Report 2012-2013, Confederated Tribes of the Umatilla Indian Reservation: 45.

Fryer, J. L. (2014). "*Alnus rhombifolia*. In: Fire Effects Information System." from http://www.fs.fed.us/database/feis/plants/tree/alnrho/all.html.

Fulton, A. (2004). A review of the characteristics, habitat requirements, and ecology of the anadromous steelhead trout (Oncorhynchus mykiss) in the Skeena Basin. , UC Davis.

Going, B. M., Dudley, Tom L. (2008). "Invasive riparian plant litter alters aquatic insect growth." Biological Invasions 10(7): 10.

Gucker, C. (2012). "*Betula occidentalis*. In: Fire Effects Information System." 2015, from http://www.fs.fed.us/database/feis/plants/tree/betocc/all.html.

Habeck, R. J. (1991). "*Crataegus douglasii*. In: Fire Effects Information System." 2015, from http://www.fs.fed.us/database/feis/plants/shrub/cradou/all.html.

Habeck, R. J. (1992). "*Pinus ponderosa* var. ponderosa In: Fire Effects Information System." 2015, from http://www.fs.fed.us/database/feis/plants/tree/pinponp/all.html.

Harrison, J. (2009). "Beavers." Retrieved March 18th, 2015, from nwcouncil.org/history/Beavers.

Jeffrey P. Repp, et al. (2011). Lotic riparian complex ecological site descriptions guidelines for development. P. West National Technology Support Center, Oregon: 123.

Lambert, M. B. (2014). The Umatilla Anadromous Fish Habitat Project: 2012 Annual Report, Confederated Tribes of the Umatilla Indian Reservation.

McWilliams, J. (2000). "*Symphoricarpos albus*. In: Fire Effects Information System." 2015, from http://www.fs.fed.us/database/feis/plants/shrub/symalb/all.html.

Montgomery, D. R. and J. M. Buffington (1993). Channel classification, prediction of channel response, and assessment of channel condition. Seattle, WA 98195, University of Washington: 110.

Moore, M. (1993). Medicinal Plants of the Pacific West. Santa Fe, New Mexico Red Crane Books.

Natural Resources Conservation Service (1993). "National soil survey handbook." 430-VI. 2015, from http://www.soils.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242.

Olson, D. (2000). Fire in riparian zones: a comparison of historical fire occurrence in riparian and upslope forests in the Blue Mountains and southern Cascades of Oregon. Seattle, WA, College of Forest Resources, University of Washington. Master of Science: 274.

Pollock, M., et al. "Working with beaver to restore salmon habitat." Retrieved March 18th, 2015, from http://www.nwfsc.noaa.gov/research/divisions/fe/wpg/beaver-assist-stld.cfm.

Pollock, M. M., et al. (2007). "Geomorphic changes upstream of beaver dams in Bridge Creek, an incised stream channel in the interior Columbia River basin, eastern Oregon." Earth Surface Processes and Landforms, Wiley Interscience 32: 1174-1185.

Rosgen, D. L. (1994). "A classification of natural rivers." 22.

Rosgen, D. L. (2006). Watershed assessment of river stability and sediment supply (WARSSS). Fort Collins, Colo., Wildland Hydrology.

Soil Survey Division Staff (1993). Soil survey manual, Soil Conservation Service, USDA.

Steinberg, P. D. (2001). "*Populus balsamifera* subsp. trichocarpa. In: Fire Effects Information System." 2015, from http://www.fs.fed.us/database/feis/plants/tree/alnrho/all.html.

U.S. Environmental Protection Agency (2013). "Climate impacts in the Pacific Northwest." from http://www.epa.gov/climatechange/impacts-adaptation/northwest.html.

U.S. Geological Survey (2015). Water data for USA: USGS Surface-Water Annual Statistics . Meacham.

Uchytil, R. J. (1989). "*Salix lasiolepis*. In: Fire Effects Information System." 2015, from http://www.fs.fed.us/database/feis/plants/tree/sallas/all.html.

Contributors

Marchel Munnecke

Acknowledgments

This project was completed by a contract between the Confederated Tribes of the Umatilla Indian Reservation and Pyramid Botanical Consultants. Marchel Munnecke was the lead for Pyramid Botanical Consultants. Carolyn Wiarda, of Terra West Soils, collected soil data, created mapunits, and entered soil data into NASIS for this project. Dave Trochell, retired NRCS soil scientist, collected soil data and provided guidance on soil map unit design. Todd Kramer, from Pacific Watershed Associates, conducted stream measurements and created cross section profiles for this report. CTUIR provided several personnel to assist with data collection.

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	
Approved by	
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:**