Ecological site group R008XG720WA
Riparian Complex

Last updated: 09/21/2023
Accessed: 05/10/2025

Key Characteristics

None specified

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.

Physiography

Hierarchical Classification
Major Land Resource Area (MLRA): 8 – Columbia Plateau

LRU – Common Resource Areas (CRA):
8.1 - Channeled Scablands
8.2 - Loess Islands
8.3 - Okanogan Drift Hills
8.4 - Moist Pleistocene Lake Basins
8.5 - Moist Yakima Folds
8.6 - Lower Snake and Clearwater Canyons
8.7 - Okanogan Valley

Site Concept Narrative:

NRCS Washington has never had an ecological site for riparian areas in MLRA 7, 8 and 9, so this is a starting point. Riparian complex is extremely general and will continue to be a work in progress for some time. There are precipitation ranges for these sites, but precipitation is not the main driver of the site development.

Diagnostics:

A bottomland tree-shrub site, Riparian Complex sits in the floodplain position of the landscape as a narrow, linear corridor along perennial streams or spring fed reaches on intermittent streams. It also occurs as a small patch near ponds, lakes and springs, or on bottoms, depressions and basins.

This site receives seasonal flooding and/or discharging groundwater from sites uphill. Riparian complex is part of the lotic or flowing water ecosystem. Soils are often cobbly and well drained, so they remain saturated for only a short period. The soils are not hydric, nor is this ecological site a wetland.

In the sagebrush steppe and grassland steppe regions, bunchgrasses, shrubs and forbs are common, but trees are rare. Riparian Complex stands out because of trees and tall shrubs.

Principle Vegetative Drivers:

The vegetative expression of Riparian complex is driven by three situations. First, this site receives off-site water - overbank flooding and surface runoff for some sites or, discharging groundwater for sites influenced by springs or seeps. Second, the soils are deep and have unrestricted rooting. Third, the soils are well drained and supports trees and shrubs instead of aquatic plants

Influencing Water Features:

A plant’s ability to grow on a site and overall plant production is determined by soil-water-plant relationships:
1. Whether rain and melting snow run off-site or infiltrate into the soil
2. Whether soil condition remain aerobic or become saturated and anaerobic
3. How quickly the soil reaches the wilting point

Most sites experience overbank flooding and surface runoff. But for sites influenced by springs or seeps, discharging groundwater is the important driver. The soils are deep, well drained, and often cobbly, and thus, remain saturated for only a short period in late winter to early spring. With adequate cover of live plants and litter, there are no water infiltrating restrictions on Riparian Complex.

Physiographic Features:

The landscape is part of the Columbia basalt plateau. Riparian complex sites occur as a narrow, linear corridor on floodplains and terraces along perennial streams or spring fed reaches of intermittent streams. There are also Riparian Complex patches on draws, basins, depressions, and near ponds, lakes or springs. In the upland setting ecological sites are often expansive, and thus, can be delineated and separated on aerial photos. But in the landscape position of bottoms, basins and depressions this is rarely the case as small changes in soil chemistry, the water table and elevation or aspect results in significant changes in plant community composition. In short distances there are often big swings of available water holding capacity, and soils can go from hydric to non-hydric, or from saline-sodic to not. So, in bottoms, riparian areas and depressions, ecological sites and community phases occur as small spots, strips and patches, or as narrow rings around vernal ponds. Generally, in a matter of steps one can walk across several ecological sites. On any given site location, two or more of these sites occur as a patchwork – Loamy Bottom, Alkali Terrace, Sodic Flat, Wet Meadow, Herbaceous Wetland and Riparian Complex. These ecological sites may need to be mapped as a complex when doing resource inventory.

Physiographic Division: Intermontane Plateau
Physiographic Province: Columbia Plateau
Physiographic Sections: Walla Walla Plateau Section

Landscapes: Valleys, hills and plateaus
Landform: floodplains, drainageways on concave positions

Elevation: Dominantly 1,000 to 3,600 feet
Slope: Total range: 0 to 5 percent
Central tendency: 0 to 3 percent
Aspect: Occurs on all aspects

Geology:

This MLRA is almost entirely underlain by Miocene basalt flows. Columbia River basalt is covered in many areas with as much as 200 feet of loess and volcanic ash. Small areas of sandstones, siltstones, and conglomerates of the Upper Tertiary Ellensburg Formation are along the western edge of this area. Some Quaternary glacial drift covers the northern edge of the basalt flows, and some Miocene-Pliocene continental sedimentary deposits occur south of the Columbia River, in Oregon.

A wide expanse of scablands in the eastern portion of this MLRA, in Washington, was deeply dissected about 16,000 years ago, when an ice dam that formed ancient glacial Lake Missoula was breached several times, creating catastrophic floods. The geology of the northernmost part of this MLRA is distinctly different from that of the rest of the area. Alluvium, glacial outwash, and glacial drift fill the valley floor of the Okanogan River and the side valleys of tributary streams. The fault parallel with the valley separates pre-Tertiary metamorphic rocks on the west, in the

Cascades, from older, pre-Cretaceous metamorphic rocks on the east, in the Northern Rocky Mountains. Mesozoic and Paleozoic sedimentary rocks cover the metamorphic rocks for most of the length of the valley on the west.

Climate

The climate is characterized by moderately cold, wet winters, and hot, dry summers, with limited precipitation due to the rain shadow effect of the Cascades. Taxonomic soil climate is either xeric (12 – 16 inches PPT) or aridic moisture regimes (10 – 12 inches PPT) with a mesic temperature regime.

Mean Annual Precipitation:
Range: 10 – 16 inches
Seventy to seventy-five percent of the precipitation comes late October through March as a mixture of rain and snow. June through early October is mostly dry.

Mean Annual Air Temperature:
Range: 44 to 54 F
Central Tendency: 48 – 52 F
Freezing temperatures generally occur from late-October through early-April. Temperature extremes are 0 degrees in winter and 110 degrees in summer. Winter fog is variable and often quite localized, as the fog settles on some areas but not others.

Frost-free Period (days):
Total range: 90 to 200
Central tendency: 110 to 160
The growing season for Riparian complex is March through September.

Soil features

Edaphic:

Riparian areas are generally an inclusion in a soil map unit and not mapped separately.
Soils are well drained and often cobbly, so they are saturated for only a short period. Riparian complex commonly occurs adjacent to Loamy bottom, Herbaceous wetland and one of the Loamy ecological sites.

Representative Soil Features:

This ecological site components are dominantly Cumulic, Fluventic and Torrifluventic taxonomic subgroups of Haploxerolls, Endoaquolls great groups of the Mollisols taxonomic order but also includes some Entisols. Soils are dominantly very deep. Average available water capacity of about 5 inches (12.7 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly mixed alluvium.

The associated soils are Bridgewater, Colville, Weirman, Xerofluvents and similar soils.

Dominate soil surface is silt loam to cobbly loamy coarse sand, with ashy modifier sometimes occurring as well.

Dominant particle-size class is fine-silty to coarse-loamy but includes limited sandy-skeletal.

Fragments on surface horizon > 3 inches (% Volume):
Minimum: 0
Maximum: 5

Fragments within surface horizon > 3 inches (% Volume):
Minimum: 0
Maximum: 35
Average: 5

Fragments within surface horizon ≤ 3 inches (% Volume):
Minimum: 0
Maximum: 30
Average: 10

Subsurface fragments > 3 inches (% Volume):
Minimum: 0
Maximum: 30
Average: 10

Subsurface fragments ≤ 3 inches (% Volume):
Minimum: 0
Maximum: 50
Average: 15

Drainage Class: Range from poorly drained to somewhat excessively drained.
Water table depth: 10 to greater than 60 inches

Flooding:
Frequency: Rare to frequent

Ponding:
Frequency: None to frequent

Saturated Hydraulic Conductivity Class:
0 to 10 inches: Moderately high and high
10 to 40 inches: Moderately high and high

Depth to root-restricting feature (inches):
Minimum: Dominantly greater than 60, but strongly contrasting textural stratification can occur up to 20 inches
Maximum: greater than 60

Electrical Conductivity (dS/m):
Minimum: 0
Maximum: 2

Sodium Absorption Ratio:
Minimum: 0
Maximum: 5

Calcium Carbonate Equivalent (percent):
Minimum: 0
Maximum: 5

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 6.1 to 8.4
10 - 40 inches: 6.1 to 9.0

Available Water Capacity (inches, 0 – 40 inches depth)
Minimum: 1.0
Maximum: 9.1
Average: 5

Vegetation dynamics

Ecological Dynamics:

Riparian complex produces about 2000 pounds/acre of biomass annually up to 4.5 feet

Understory production is dependent on canopy cover.
Low canopy = high production. High canopy = low production

Ecological Dynamics Overview:

Riparian areas are heavily influenced by fluvial processes. This provisional ecological site concept is composed of a variety of different riverine systems and will require more detailed field investigations to refine the site concepts and likely develop several new sites that are correlated to similar geologic structure and processes, hydrologic regimes, and vegetation characteristics. This ecological site concept captures variety of typical riparian vegetation expressions. The band of riparian vegetation may be broader if part of a larger river system, or narrower if part of a small stream system.

Basic Understanding of Riparian Systems – Abiotic Factors/Primary Disturbance
(from Kendra Moseley, NRCS):

Riparian forests are a complex interaction of many various physical and biologic factors, including function of valley morphology, physical processes, vegetative legacies, and life history strategies. The watershed geomorphology and physical processes form the basis for understanding the spatial extent of the riparian forests, which includes the valley shape, hillslope processes, fluvial processes, soil processes, and hydrologic processes. Soil development within alluvial environments is highly variable. Frequent erosional and depositional disturbances from flooding create a complex mosaic of soil conditions in the active floodplain that fundamentally influences vegetation colonization and establishment. Well-drained soil or recently deposited mineral alluvium may be found adjacent to very poorly drained organic soils in abandoned high-flow channels. This variability in soil conditions is a major factor in maintaining the high plant diversity typical of riparian ecological sites.

The disturbances that drive this ecological site concept are dependent on the type, frequency, predictability, extent, magnitude, and timing of the disturbance. The fluvial processes that are dominant in this riparian ecological site concept include stream power, basal shear stress, channel migration, and sediment deposition. The characteristic vegetation pattern of these low-gradient valleys is maintained by fluvial disturbances and geomorphology. The amount of force exerted on the channel bed and vegetation growing in the active channel and floodplain during a flood is a product of fluid density, gravitational acceleration, flow depth, and water surface slope.

Basic understanding of Channel Evolution
(From Stream Visual Assessment, Version 2, December 2009:

Some understanding of stream geomorphology helps our understanding of the ecological dynamics of these fluvial systems.

Channel slope is directly related to topography, geology, sinuosity, bed material and watershed size. Straight stream channels are indicative of strong geologic structure (bedrock) or human control. Braided streams have multiple interwoven channels. Meandering channels are highly variable and sinuous.

The shape of a stream channel changes constantly, imperceptibly, or dramatically, depending on the condition of the stream corridor (channel, riparian area, and flood plain) and how it transports water and materials. Channel condition is a description of the geomorphic stage of the channel as it adjusts its shape relative to its flood plain. Channel adjustments resulting in a dramatic drop in streambed elevation (incision or degradation) or excessive deposition of bedload that raises the bed elevation (aggradation) affect the degree of bank shear and often decrease stream channel stability. Such channel adjustments can have substantial effects on the condition of streams, adjacent riparian areas, associated habitats, and their biota. For example, the greater the incision in a channel, the more it is separated from its flood plain, both physically and ecologically. Conversely, the greater the aggradation, the wider and shallower a stream becomes, which can affect riparian vegetation, surface water temperatures, and stream and riparian habitat features.

Conceptual models of how a channel evolves or adjusts over time illustrate the sequence of geomorphic changes in a stream that result from disturbances in the watershed. Such sequences are useful for evaluating trends in channel condition. The stages of the Schumm Channel Evolution Model (CEM), as shown in figure 3, provide a visual orientation of the pattern of streambed adjustment in an incising stream, its gradual detachment from the existing flood plain, and eventual formation of a new flood plain at a lower elevation. A similar model by Simon (1989) is also described in the Stream Corridor Restoration Handbook (FISRWG 1998) available in most NRCS field offices.

Evolution of a Stream:

Stage I channels are generally stable and have frequent interaction with their flood plains. The relative stability of the streambed and banks is because the stream and its flood plain are connected, and flooding occurs at regular intervals (Q2). Consequently, the stream’s banks and flood plain are well vegetated. The Stage I channel undergoes initial incision. In Stage II the bed degrades, and banks are stable. During Stage III the bed aggrades, banks are unstable, and the channel goes through the widening phase. Stage IV is the stabilizing phase where the bed continues aggrading, but the banks are stable. Then in Stage V the slow aggrading continues but now banks are stable, and the new floodplain is forming. The new floodplain is lower and narrower than the original floodplain.

Especially on larger streams, variations on riparian areas (clumps and strips) are common. Variations are controlled by valley width, sediment type and overbank flooding. Clumps and strips of dominant trees species found on riparian areas can include – black cottonwood, aspen, water birch, white alder and several different willow species. Smaller streams are less diverse than larger streams. Overbank flooding and gravel bars are required for tree regeneration for many riparian trees, especially for black cottonwood.

Ecological Dynamics (from Frank G.):
The riparian woodland sites in MLRAs 7, 8, and 9 will vary based on their locations in various watersheds of the region and available moisture and soil texture/depth of the sites. Sites that have sufficient soil texture and depth will have a tall tree component like black cottonwood and/or quaking aspen. Sites that are drier will have a short tree or shrub component like hawthorn, chokecherry or mockorange. Also, the size of the watershed that drains an area and adjacent land cover will influence the amount of water entering the riparian area.

Riparian woodlands are essential to keep streambanks stable, stream temperatures cool, and buffer potential impacts from adjacent land uses. Riparian woodlands provide valuable wildlife habitat for a variety of species. Native riparian woodlands can recover from low intensity fires through tree/shrub root sprouting or seed regeneration. Serious impacts can occur when these areas are continually overgrazed or removed/reduced for another land use.

Fire Ecology:

Forested riparian areas (Riparian Woodlands) are unique ecosystems which provide critical habitat for many species of terrestrial and aquatic species. Forested riparian zones occur adjacent to two broadly associated upland ecosystems. In dryer areas, the adjacent upland type was historically steppe or shrub/steppe, and in areas of increasing rainfall, the adjacent upland was dominated by coniferous forests. In large scale watersheds with appreciable climatic gradients, the riparian zone passes through and connects these two upland types.

Riparian areas are subject to a number of ecologic disturbance influences, including wildfire. Wildfire frequency (the historic intervals between various types of fires), severity (the impacts of any given fire episode), and the type (surface, crown, mixed) of fire occurring within these riparian zones was highly variable.

Riparian ecosystems that were adjacent to prairie vegetation experienced a relatively frequent surface fire return interval. Fire typically entered into the riparian zone from fires originating in the upland grass dominated vegetation. Black cottonwood hardwoods were likely the only true tree species, growing along with adapted understory shrubs and grass species.

Riparian areas adjacent to upland conifer forests have a wider expression of tree and understory species. These areas would typically burn in the same upland fire event, and experience the impacts similar to the surrounding upland forests, especially when upland the fire episode was more severe.

Fire impacts, and natural adaptation to common riparian tree, shrub and grass species:
Black cottonwood is easily killed by fire, but coppice sprouting is common. Fire can improve seedling establishment by increasing light penetration and exposing mineral soil to allow seedling establishment if moisture is available. It can endure on site as well as invade following fire.

Ponderosa pine is resistant to fire by the development of thick, platy bark which begins to form at a young age. It naturally prunes the lower bole, decreasing the likelihood of crown ignition, and the open nature of the needles resist damage when upper crow fires do occur. It is also long lived, and will regenerate on open, sunny areas which are often produced by surface fire.

Quaking aspen regenerates by clonal regeneration following light to moderately severe fire.

Various species of willows, sedges and grasses regrow following all but severe fires, from root crowns or underground rhizomes.

Lupine, manzanita and Ceanothus produce hard shelled seeds that require fire scarification to germinate and become established.

Many other plant species produce light weight seeds which easily travel on wind currents to disturbed areas.

In the past century, in what is referred to as the period of post-European settlement, riparian forests have undergone many human caused changes. Logging up to the edge of the stream, conversion to agriculture, fire exclusion, forest fragmentation and especially unregulated livestock grazing have all contributed to the degradation and proper function of riparian woodlands. These factors have all contributed to changes from the historic fire regimes and impacts of native riparian woodland forests.

Major Land Resource Area

MLRA 008X
Columbia Plateau

Subclasses

- R008XY720WA–Riparian Complex

Stage

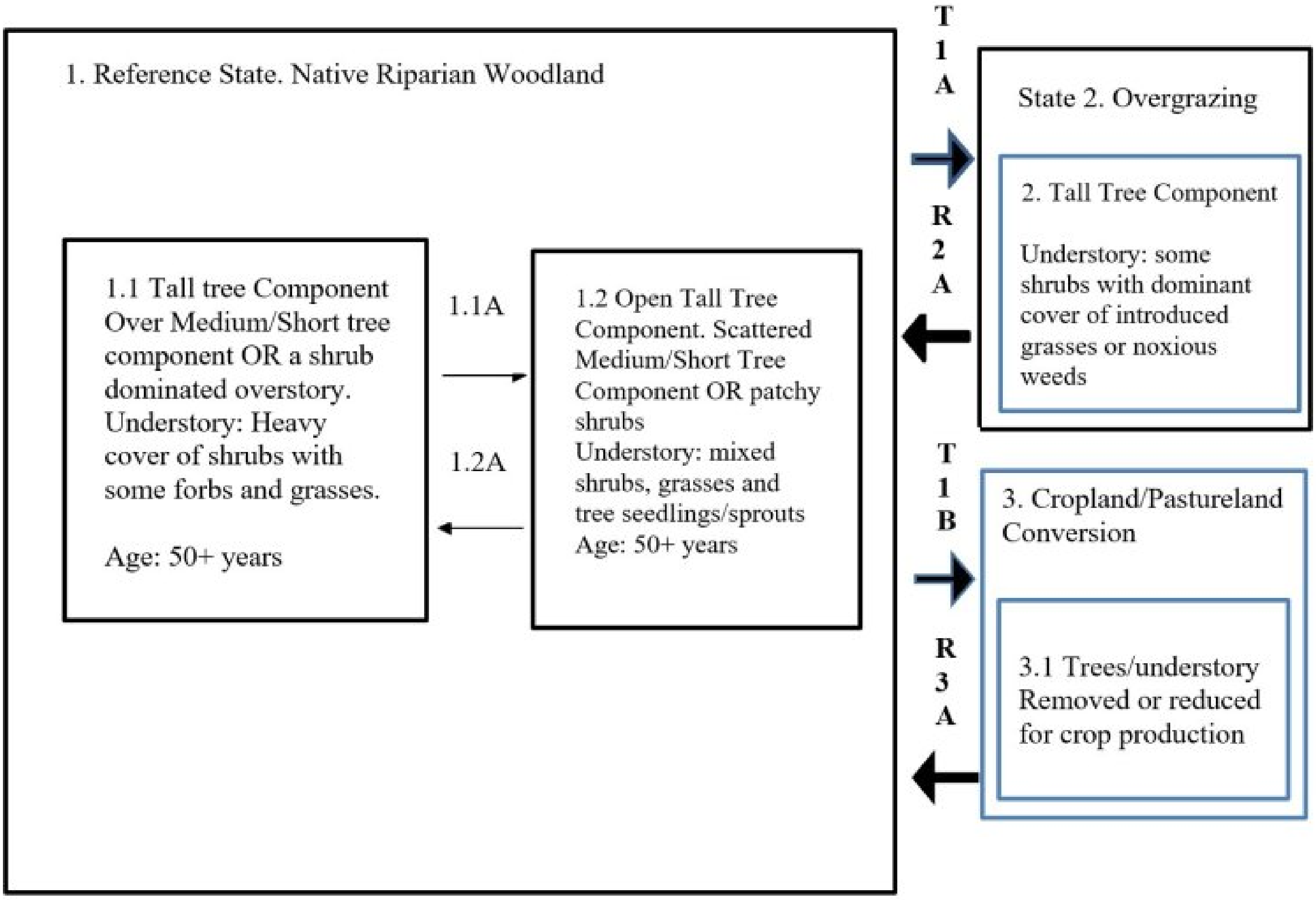
Provisional

Contributors

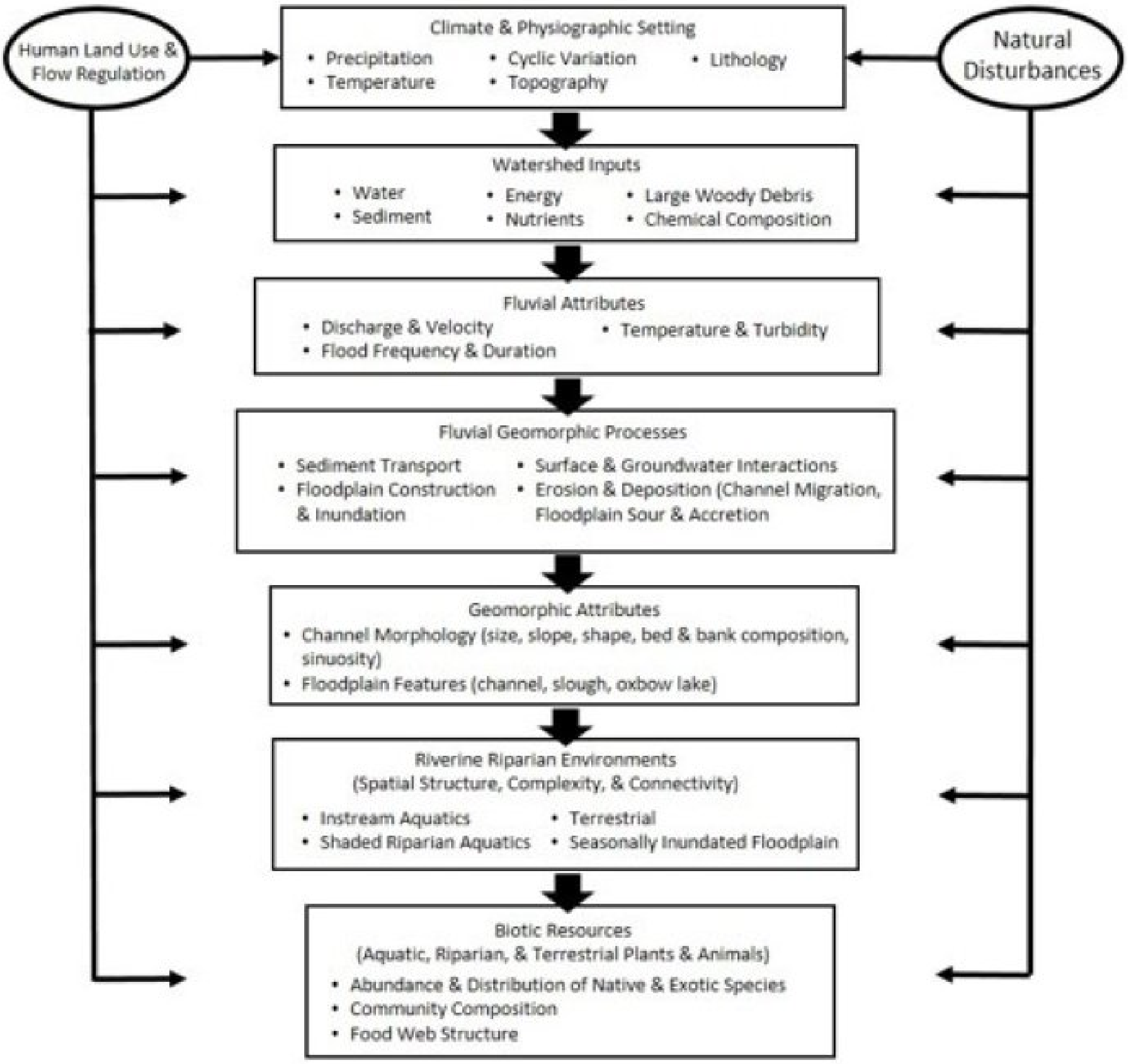
Provisional Site Author: Gary Kuhn, Frank Gariglio, Kevin Guinn
Technical Team: R. Fleenor, K. Paup-Lefferts, C. Smith, W. Keller, K. Bomberger

State and transition model

State Transition Model Riparian Woodland MLRAs 7, 8, 9 (from Gary K.)
Note: this STM applies when hydrology is unaltered from the Reference State.

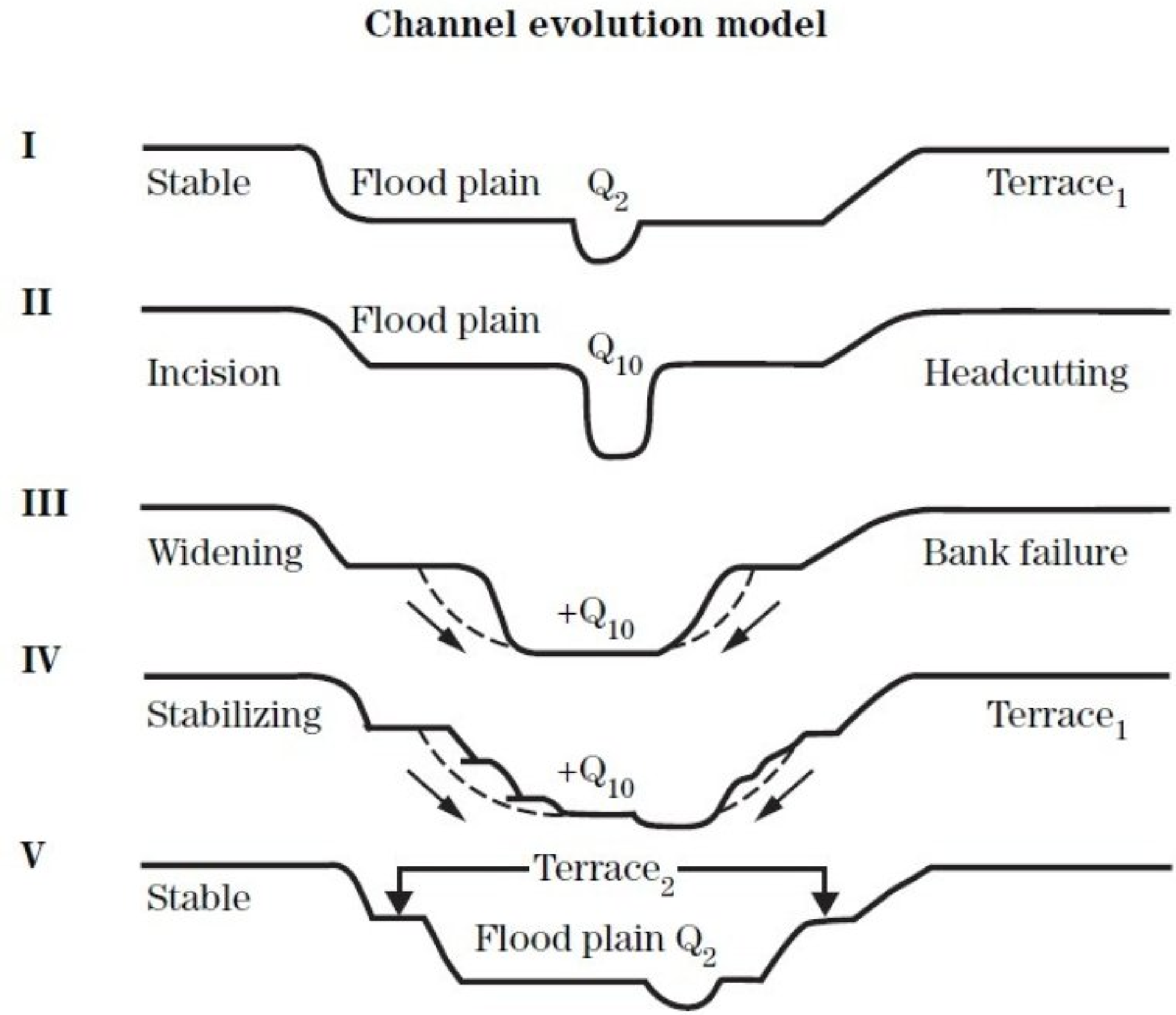


The diagram below outlines the complexity of abiotic factors that play a role in these mostly alluvial river systems and the riparian vegetation expression and dynamics that are associated with them.



Conceptual physical and biological framework of alluvial river systems. Adapted from Barbour et al 2007.

Figure 3 Channel Evolution Model, after Schumm, Harvey and Watson (1984). Q_2 indicates a flood interval of 2 years; Q_{10} indicates an interval of 10 years



State 1
Reference State. Native Riparian Woodland

In its native state riparian woodlands have a dynamic mix of either a tall tree component mixed with a medium or short tree component and understory of dense shrubs with grasses, sedges, and forbs. In drier areas the dominant overstory will be shrubs or shrubby willows. Mortality can occur through natural influences such as insects, disease, floods, and fire. Low intensity ground fires will open these riparian woodlands, however will recover quickly through root sprouting or seed regeneration. Severe fires can kill much of the vegetation and may take longer to recover if native seed sources are scarce or adjacent land uses impact these areas through intensive grazing, erosion from crop production, and invasion of introduced or exotic species. Below is a list of species that may be encountered in these MLRAs. Black Cottonwood and quaking aspen will be seen throughout the region if moisture is plentiful. Ponderosa pine more prevalent in the north areas and in the Palouse. Oregon White Oak is unique to the Yakima and Klickitat area. Black hawthorn is well adapted to the Palouse region. White alder and Netleaf hackberry common in the Southeastern portion of the state. The junipers will be suited to the driest portions of these MLRAs. The short willows and shrubs will occur throughout the state. For specific plant lists relative to riparian plant associations in Washington MLRAs refer to the following references: Riparian Vegetation Classification of the Columbia Basin, WA. Rex C Crawford, Ph.D. March 2003 Washington Natural Heritage Program. Washington Dept. of Natural Resources in Coordination with Bureau of Land Management, Spokane, WA and the Nature Conservancy Trees and Shrubs for Riparian Plantings. USDA, NRCS Washington. Plant Materials Technical Note 24. Key Tall Tree Species: Black Cottonwood (*Populus balsamifera* spp. Trichocarpa) Quaking Aspen (*Populus tremuloides*) Ponderosa pine (*Pinus ponderosa*) Oregon White Oak (*Quercus garryana*) Water Birch (*Betula occidentalis*) Medium/short Tree Species: White Alder (*Alnus rhombifolia*) Thinleaf Alder (*Alnus incana* spp. Tenuifolia) Black Hawthorn (*Crataegus douglasii*) Rocky Mt. Juniper (*Juniperus scopulorum*) Western Juniper (*Juniperus occidentalis*) Netleaf Hackberry (*Celtis laevigata* var. reticulata) Willow spp. (Salix spp.) Shrub Species: Snowberry (*Symphoricarpos albus*) Red Osier Dogwood (*Cornus sericea* ssp. Sericea) Mockorange (*Philadelphus lewisii*) Sandbar (Coyote) Willow (*Salix exigua*) Wood's Rose (Rosa woodsia) Chokecherry (*Prunus virginiana*) Serviceberry (*Amelanchier alnifolia*) Oceanspray (*Holodiscus discolor*) Big Sagebrush (Artemisia tridentate)

Community 1.1
Tall tree Component

This would be the non-disturbed reference plant community with a tall tree overstory with a possible mid-level canopy of medium or short trees. A heavy cover of shrubs will be in the understory along with some native grasses, sedges, and forbs. Drier areas will not have a tall or medium tree component. These areas will be dominated by shrubs or shrubby willows. Mortality will occur through natural processes such as insects, disease, floods, and low intensity ground fires. If not impacted by outside influences such as overgrazing, land use change, or severed fire these riparian woodlands will recover through tree/shrub root sprouting or seed.

Community 1.2
Open Tall Tree Component

Tall Tree canopy is opened up with some mortality. Medium tree mid-level canopy and understory shrub cover is reduced. Site will recover quickly with tree/shrub root sprouting or through seed. Native Grass and forb cover may increase. Site recovery will depend on adjacent land use not influencing riparian area with invasion of exotic species, overgrazing, and riparian area removal or reduction.

Pathway P1.1A
Community 1.1 to 1.2

Low intensity ground fire opens up understory. Some tall tree, medium/short tree, and shrubs killed. Tree overstory canopy is opened up. Grasses and forbs may increase.

Pathway P1.2A
Community 1.2 to 1.1

Tree/shrub sprouts increase. Some trees/shrubs increase by seed. Grasses and forbs reduced as tree/shrub overstory advances.

State 2
Overgrazing

Riparian woodland subjected to frequent grazing in spring and early summer causing loss of native shrubs, grasses, and forbs. Tall, medium, and short tree components become stressed and some mortality occurs. The overstory tree component becomes more open allowing introduce grasses and noxious weeds to enter and compete with native species.

Community 2.1
Overgrazed community

Open stand of overstory trees over mix of native shrubs and introduced cool season grasses or noxious weeds. Little or no tree/shrub sprout or seedling development.

State 3
Cropland/Pastureland Conversion

Many riparian woodland areas of MLRAs 7, 8, and 9 have been removed or their widths reduced for crop production. The Palouse Area would be a good example with riparian areas of black hawthorn, ponderosa pine, snowberry, and other native shrubs that have been removed or reduced.

Community 3.1
Cropland/Pastureland Conversion

Riparian woodland removed or reduced leaving a narrow strip of trees, shrubs, and grass.

Transition T1A
State 1 to 2

Overgrazing severely reduce native shrubs, grasses and forbs. Introduced cool season grasses invade and dominate understory. Tall tree component remains. Some medium/short tree components may still remain. No tree regeneration or root sprouts.

Transition T1B
State 1 to 3

Riparian converted to pasture or cropland land use. Trees removed. Riparian width reduced.

Restoration pathway R2A
State 2 to 1

Livestock exclusion with possible site preparation and tree/shrub planting and seeding of native species.

Restoration pathway R3A
State 3 to 1

Riparian forest buffer planted and livestock excluded. Seed understory to native grasses to minimize weed invasion. References: Crawford, Rex, Riparian Vegetation Classification of the Columbia Basin, Washington, Washington State Department of Natural Resources, Natural Heritage Report 2003-03, March 2003 Dwire, Kathleen A. and Kauffman, J. Boone. Fire and riparian ecosystems in landscapes of the western USA. In Forest Ecology and Management 178 (2003) p. 61-74. 14. Environmental Protection Agency, map of Level III and IV Ecoregions of Washington, June 2010 Natural Resources Conservation Service, map of Common Resource Areas of Washington, 2003 NRCS Stream Visual Assessment Protocol, Version 2, December 2009 Rocchio, Joseph & Crawford, Rex C., Ecological Systems of Washington State. A Guide to Identification. Washington State Department of Natural Resources, October 2015. Pages 156-161 Inter-Mountain Basin Big Sagebrush. Soil Conservation Service, Range Sites for MLRA 9 from 1980s Trees and Shrubs for Riparian Plantings. USDA, NRCS Washington. Plant Materials Technical Note #24

Citations