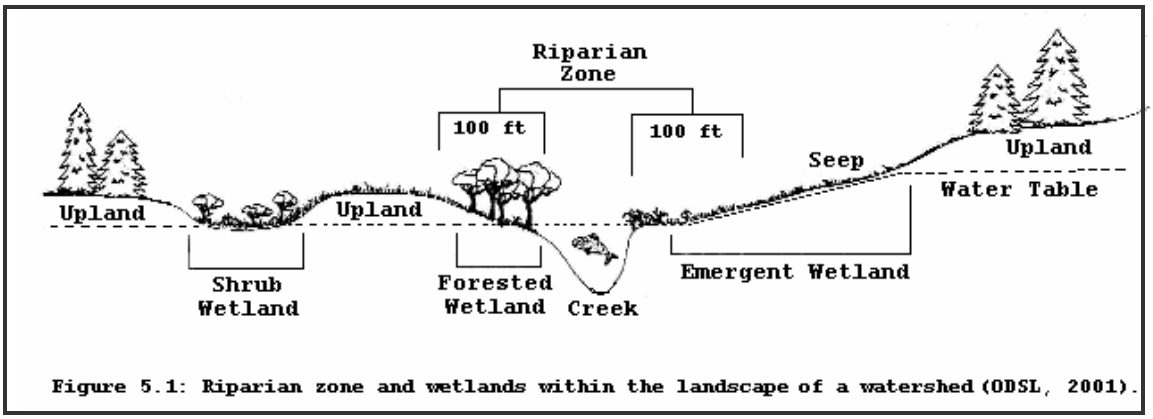

Figure 5.1: Riparian zone and wetlands within the landscape of a watershed (ODSL, 2001).

V. Riparian and Wetland Assessment

Introduction

Riparian zones in the western United States tend to be narrow, linear features of the landscape, often lining streams with steep gradients and narrow floodplains. The water table within riparian zones is typically high due to proximity to aquatic ecosystems or subsurface water (Mitsch and Gosselink, 1993). Riparian ecosystems are uniquely characterized by high species diversity, high species density, and high productivity. The variety of plant species includes conifers, hardwoods, herbaceous flowering plants, grasses, sedges, rushes, mosses and algae. The abundance and diversity of plant life supports a complex assemblage of insects, amphibians, fishes, birds, and mammals.

Riparian habitats provide multiple functions that benefit aquatic ecosystems. Through canopy shading, riparian trees help to moderate the light regime and temperature fluctuations of stream water. Salmonids and other aquatic life forms are sensitive to extreme temperature fluctuations caused by disturbance of the riparian canopy. Extended exposure to high stream temperatures has been shown to cause stress and lead to mortality in salmonids (Hicks et al., 1991). Riparian vegetation also provides habitat for a variety of salmonids. Trees that fall across the stream channel provide cover from predators and refuge from fast currents. The ability of downed woody debris to provide these essential stream features is dependent on the size of the material and the size of the stream. Research has shown that conifers greater than two feet in diameter are more likely to create instream habitat for salmonids. The term large woody debris is used to refer to woody debris that is at least two feet in diameter.

The obstruction of stream flow resulting from large woody debris provides a refuge not only from predators but also from high velocity flows. Juvenile salmonids may spend from one to several years in fresh water before migrating to sea. Large woody debris provides a buffer from winter and spring freshets that can flush exposed juveniles downstream. Another significant contribution made by riparian vegetation is an input of food to aquatic ecosystems. Leaves, woody debris, and nutrients from runoff all enter the aquatic food chain and contribute substantial amounts of energy to the stream of the northwest. Headwater streams are particularly dependent on terrestrial inputs due to a denser canopy cover and lower production by aquatic plants.

The term wetland applies to a wide range of habitats that are seasonally or perennially inundated with water. Within these habitats there are unique plant and animal species adapted to the wetland environment. Wetland habitats are characteristically located in areas where there is a high water table because of proximity to an aquatic ecosystem or subsurface water. Wetlands can be either a source of nutrients to other aquatic systems or a sink. A wetland isolated by topography from other surface waters is an example of a sink; nutrients from wetland species may seep into the groundwater but dispersal to other aquatic systems is limited. However, isolated wetlands do receive nutrients from the surrounding terrestrial ecosystems. Wetlands that are connected to the riverine system are perhaps more important to the health and longevity of aquatic species.

Riverine wetlands are the interfaces between terrestrial and aquatic ecosystems. Continuous interactions occur between riparian, aquatic, and upland terrestrial ecosystems through exchanges of energy, nutrients, and species. Energy and material from the surrounding landscape converge and pass through riparian ecosystems in much greater amounts than those of any other wetland ecosystem; that is, riparian systems are open systems. Riverine wetlands are functionally connected to upstream and downstream ecosystems and are laterally connected to upslope (upland) and downslope (aquatic) ecosystems (Mitsch and Gosselink, 1993).

Riparian and wetland habitats often overlap or are connected within the floodplain of riverine ecosystems. The interrelationship between riparian and wetland habitats gives reason for a consideration of the two habitats together in this section of the watershed assessment.

Methodology

Riparian Conditions Assessment

Through digital aerial photograph interpretation, two features of the riparian zone have been characterized throughout the subbasin: shade and recruitment potential. The riparian vegetation was characterized within one hundred feet of the stream bank for every stream within the subbasin (Figure 5.1). The reason for using a one hundred foot width is that the majority of large woody debris recruitment comes from within one hundred feet of the stream bank. If the stream bank was not visible, then the zone within one hundred feet of the stream route, as defined by USGS digital line graph data, was used. The aerial photographs consisted of black and white photographs for Columbia County (acquired from USGS) and color photographs for Clatsop County (acquired from Clatsop County). All photographs were taken in the spring of 1994, and have a one-meter pixel depth.

Initial Vegetation Characterization

The first step in the riparian conditions assessment was to delineate the current riparian conditions based on the digital aerial photographs. Riparian vegetation characteristics were delineated in ArcView GIS by overlaying the streams layer on the digital aerial photographs, and segmenting the streams into Riparian Condition Units (RCUs) of similar vegetation type, size, and density. Separate classifications were given for right and left stream bank riparian conditions. Riparian zones often contain a distinct inner ban of vegetation that may be less than one hundred feet in width. If an inner zone

is present then the width of the inner zone is noted and vegetation characterization includes separate definitions for the inner and outer zones within one hundred feet of the stream bank. The width of the inner zone is noted as well. For this assessment, standard widths of twenty, forty, sixty, and eighty were used to identify an inner zone.

Table 5.1 lists the vegetation type, tree size, and stand density characteristics identified in this assessment. Tree size and stand density only apply to the conifer, hardwood, and mixed classifications. In addition to vegetation type, stream shading was identified for each riparian segment. In this assessment, there are three classifications used for shading: high, moderate, and low. Table 5.2 outlines the estimation criteria for these three shade classifications.

Field visits were conducted to verify aerial photograph interpretations. Stream survey data was also used as a quality check of the interpretations.

Vegetation Type	
C	Mostly conifer trees (>70% of area)
H	Mostly hardwood trees (>70% of area)
M	Mixed conifer/hardwoods
B	Brush species
G	Grass/meadow
N	No riparian vegetation
Tree Size Classes	
R	Regeneration (<4 inch average diameter at breast height (DBH))
S	Small (4 to 12 inch DBH)
M	Medium (12 to 24 inch DBH)
L	Large (>24 inch DBH)
N	Nonforest (applies to vegetation Types B, G, and N)
Stand Density	
D	Dense (<1/3 ground exposed)
S	Sparse (>1/3 ground exposed)
N	Nonforest (applies to vegetation Types B, G, and N)

Table 5.1: Codes and description of vegetation characteristics identified through aerial photograph interpretation (WPN, 1999).

Indicator	Shade	Classification
Stream surface not visible, slightly visible, or visible in patches	>70%	High
Stream surface visible but banks are not visible	40-70%	Moderate
Stream surface visible; banks visible or visible at times	<40%	Low

Table 5.2: Shade estimation criteria based on the Oregon Watershed Assessment Manual (WPN, 1999).

Assessment of Recruitment Potential

The potential for recruitment of large woody debris is dependent on the presence of coniferous trees with a 24-inch or larger diameter at breast height (DBH). Since various conditions exist within the riparian zones of the subbasin a decision matrix was formed to evaluate whether the riparian zone has an adequate supply of LWD for future maintenance of stream habitat. Table 5.3 listed the riparian conditions that were identified as adequate for LWD. The criteria are based on professional judgment. The recruitment potential is considered to be adequate if either the inner zone or the outer zone meet the criteria listed in Table 5.3. For example, if the inner zone is a forty foot wide meadow and the outer zone is large dense conifers then the conditions are adequate for recruitment.

Inner Zone			
Vegetation Type	**Tree Size**	**Stand Density**	**Width**
Conifers	Large	Dense	At least 40ft
Conifers	Large	Sparse	At least 80ft
Mixed	Large	Dense	At least 60ft
Mixed	Large	Sparse	100ft
Outer Zone			
Vegetation Type	**Tree Size**	**Stand Density**	**Width**
Conifers	Large	Dense	At least 40ft
Conifers	Large	Sparse	At least 80ft
Mixed	Large	Dense	At least 60ft

Table 5.3: Riparian conditions classified as adequate for recruitment of LWD based on professional judgment.

The presence of roads within the riparian zone was identified during the aerial photograph interpretation. Roads can effectively limit the recruitment of large woody debris by presenting a barrier. If the presence of a road is indicated in the riparian vegetation classification then the situation was evaluated based on the position of the road. For example, if there is a road within twenty feet of the stream then the vegetation on the opposite side of the road would not contribute to large woody debris regardless of vegetation type. The permanent discontinuity created by a road inhibits recruitment of large woody debris.

Identification of Ecoregion Conditions

In addition to the aerial photograph work, riparian zone conditions were evaluated based on ecoregion descriptions. The riparian conditions are not expected to consistently meet the requirements for recruitment of large woody debris; environmental conditions may limit the ability of large conifers to become established within the riparian zone. The potential vegetation of the riparian zone is dependent on several factors of which climate, topography, and soils are key. Ecoregion descriptions from the Oregon Watershed Assessment Manual describe the potential vegetation and environmental conditions that may limit the establishment of large conifers (Table 5.4). The subbasin is

contained within three ecoregions: Willapa Hills, Volcanics, and Portland/Vancouver Basin (Section 1: Introduction, Figure 1.5). The potential riparian vegetation in each of these ecoregions can be assessed based on channel confinement, slope stability, soil water content and soil infiltration capacity as outlined in the ecoregions descriptions. From these descriptions it is apparent that in some situations the natural vegetation would not have been adequate for recruitment of LWD. The potential streamside vegetation is relevant in assessing the impacts from land use on riparian conditions. "Potential streamside vegetation does not include description of streamside vegetation following infrequent (average intervals of one to many centuries) and major disturbances such as floods, windstorms, wildfire, or earthquakes. Potential vegetation can be viewed as the vegetation after 120 years of growth with no major natural disturbances and no human-caused disturbances (tree removal, animal grazing, and encroachment or buildings or roads) (WPN, 1998)".

Channel Confinement	**Ecoregion**		
	Volcanics	**Willapa Hills**	**Portland/Vancouver Basin**
Constrained	Narrow band of red alder (or other hardwoods and brush) nearest stream with mainly western hemlock, Sitka spruce, western Redcedar, Douglas-fir and alder beyond. Few conifers where slopes are unstable or perpetually wet. Vegetation seldom modified by beaver browsing and dam building.	Narrow band of red alder (or other hardwoods and brush) nearest stream with mainly western hemlock, Douglas-fir and some alder beyond. Few conifers where slopes are unstable	Bordered by yards or narrow band of natural hardwoods and brush.
Semi-Constrained	Narrow band of red alder (or other hardwoods and brush) nearest stream with mainly western hemlock, Sitka spruce, western Redcedar, Douglas-fir and alder beyond. Mostly conifer for some well-drained streamside areas. Few conifers where slopes are unstable or perpetually wet. Vegetation seldom modified by beaver browsing and dam building. Usually no conifers except spruce on low terraces.	Moderately-wide band of red alder (or other hardwoods and brush) nearest stream with mainly western hemlock, Douglas-fir and alder beyond. Mostly conifer for some well-drained streamside areas. Few conifers where slopes unstable or perpetually wet. Vegetation sometimes modified by beaver browsing and dam building. Usually no conifers on low terraces.	Bordered by yards or natural hardwoods and brush.
Unconstrained	Narrow band of red alder (or other hardwoods and brush) nearest stream with mainly western hemlock, Sitka spruce, western Redcedar, Douglas-fir and alder beyond. Mostly conifer for some well-drained streamside areas. Few conifers where soils are perpetually wet. Vegetation sometimes modified by beaver browsing and dam building. Usually no conifers except spruce on low terraces.	Moderately-wide band of red alder (or other hardwoods and brush) nearest stream with mainly an alder and Douglas-fir mix beyond. Mostly conifer for some well-drained streamside areas. Few conifers where soils are perpetually wet. Vegetation sometimes modified by beaver browsing and dam building. Usually no conifers on low terraces.	Bordered by natural hardwoods and brush. May include stream-adjacent wetlands with low vegetation or ash.

Table 5.4: Potential streamside vegetation based on ecoregions descriptions from the Oregon Watershed Assessment Manual (WPN, 1998).

A set of criteria was developed to assess the riparian situation based on the potential streamside vegetation as outlined in the ecoregion descriptions. The initial recruitment classification of adequate or inadequate established in the preceding section was further analyzed using the ecoregion descriptions listed in Table 5.4.

Ecoregion	Confinement	Perpetually Wet	Unstable Slopes
Willapa	Constrained		X
	Semi-constrained	X	
	Semi-constrained		X
	Unconstrained	X	
Volcanics	All	X	
	All		X

Table 5.5: Ecoregion specific conditions where the potential for recruitment of LWD would naturally be less than adequate based on ecoregion descriptions. These situations are included in the adequate classification category for riparian zone conditions.

Through map overlay analysis in ArcView the ecoregion, channel confinement, soil infiltration capacity, presence of hydric (wet) soils, and slope stability of each riparian segment was identified. Table 5.5 lists riparian situations that would naturally lead to inadequate conditions for recruitment of LWD. Channel confinement classes are those described in the Channel Habitat Assessment chapter.

PSU was not satisfied with the ecoregion description for the Portland/Vancouver Basin; therefore the streams that are contained within this ecoregion were not evaluated for potential streamside vegetation. The description of the Portland/Vancouver Basin Ecoregion from the Oregon Watershed Assessment Manual does not appear to be complete. Potential streamside vegetation should not include yards. There are very few streams contained within the Portland/Vancouver Basin Ecoregion and the overall effect of not including them in this step is insubstantial.

Defining Riparian Recruitment Situations

The preceding analyses have identified the riparian conditions as either adequate or inadequate for recruitment of LWD based on riparian zone conditions and ecoregion descriptions. The next step is to identify the underlying reasons why some areas are inadequate and to develop a way to group RCUs for restoration purposes. A set of riparian recruitment situations has been defined based on the recruitment potential, vegetation type and size, and land use (Table 5.6).

The descriptions in Table 5.6 are based on frequently occurring riparian habitat conditions within the subbasin. Many of the RCUs have conditions that meet more than one of the riparian recruitment situations. To avoid the confusion of assigning more than one recruitment situation to an RCU, a priority was assigned to the riparian recruitment situations. Recruitment situations were ranked from highest priority to lowest and are listed in Table 5.6 in that order. Roads (infrastructure) can cause a permanent discontinuity within the riparian zone that effectively cuts off the supply of LWD. Meadows are areas interpreted as grass or a mix of grass and brush from the aerial photographs and are not associated with pasture.

Riparian Recruitment Situation	Description
Adequate	No enhancement needed (large-sized stands of conifers or mixed conifer/hardwood)
Infrastructure	Areas where roads have created a permanent discontinuity within the riparian zone.
Ecoregion	Conditions specific to ecoregion description that are naturally inadequate for recruitment of LWD.
Crop	The land use associated with these stands is crops. These areas have very narrow buffers or no buffer at all.
Pasture	The land use associated with these stands is pasture. These areas have very narrow buffers or no buffer at all.
Development	The land use associated with these areas is urban and rural residential. Buffers are either absent, small hardwoods, brush, or lawns.
Meadow	Wetland conditions limit riparian recruitment. The associated vegetation is typically grass or a mix of grass and brush.
Small timber	Stands that are generally too small to provide recruitment under current conditions. The land use associated with these stands is mostly forestry.
Hardwood/brush	These stands are typically associated with forestry land use. These stands are primarily areas of hardwoods of various ages sometimes mixed with brush.

Table 5.6: Riparian recruitment situations describing the underlying conditions leading to inadequate recruitment potential.

Wetland Assessment

The purpose of the wetland identification is to gain information on the location and extent of potential wetlands within the subbasin, through analysis of soil classifications, channel habitat types, National Wetland Inventory (NWI) maps, Local Wetland Inventory (LWI) maps, and USGS maps. Aerial photographs are also used to identify potential wetlands. The steps followed to create a wetlands map are outlined below:

1) Gather and evaluate existing data.
2) Integrate resources to create a preliminary wetland map.
3) Add potential wetlands identified during CHT analysis.
4) Add potential wetlands identified from soil surveys.
5) Generate table of wetland attributes.

Existing data was gathered from city planning departments, the U.S. Fish and Wildlife Service (USFWS), the USGS, and the National Resource Conservation Service (NRCS). Local wetlands inventory maps were acquired from the cities of Clatskanie and St. Helens. These maps contain the extent and characteristics of wetlands within the urban growth boundary. NWI maps were obtained from the USFWS as GIS data. The extent of these data is the Columbia River floodplain including, to a limited extent, part of the interior of the subbasin. Half of the Lower Columbia-Clatskanie Subbasin has NWI GIS data available.

Soil surveys were obtained from the NRCS, in addition to hydric soils classifications. The distribution and extent of hydric soils is used to predict potential wetlands within areas not covered by the NWI GIS data. In addition to soil surveys,

USGS digital line graph data and topographical maps were used to identify potential wetlands, especially within the interior of the subbasin. Channel habitat types identified in the previous section of the assessment were used to identify areas where riverine wetlands are most likely to occur.

The following steps were taken to create the potential wetland distribution map for this watershed assessment.

Step 1: Create a map of NWI GIS data within the subbasin excluding riverine wetlands from the coverage. For the purposes of this project, the characterization will not include most rivers as wetlands (with the exception of those identified during the channel habitat type assessment).

Step 2: Add wetlands identified from USGS digital line graph data and USGS topographic maps. These data were used to create the routed stream coverage used throughout this assessment. Lakes, ponds, marshes, sloughs, and other aquatic habitats, including streams, are contained in the USGS digital line graph data.

Step 3: Add hydric soils to the potential wetlands map. "A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA, NRCS, 1996 and 1998)."

Step 4: Add channel habitat types (from the Channel Habitat Types Assessment) that are most likely to contain riverine wetlands (see box). Floodplains, low gradient moderately confined, and moderate gradient moderately confined channel habitat types are used to map potential riverine wetlands.

Channel Habitat Types Most Likely to Contain Riverine Wetlands

Code	Description
FP2	medium sized floodplain
FP3	small floodplain
LM	low gradient moderately confined
MM	moderate gradient moderately confined

Step 5: Determine connectivity of wetlands to stream network. USGS maps and aerial photographs are used to identify if a wetland is connected through surface features to the stream network.

Step 6: Determine if the wetland has been disturbed by land development activities using aerial photographs and USGS maps. This step is conducted for the non-riverine wetland types only. Disturbance levels for riverine wetlands have not been estimated; channel modifications are assessed in a separate section of the watershed assessment. Wetlands that have been more than 70% developed or disturbed by human activity are identified.

Results

Recruitment Potential

Figure 5.2 and Table 5.7 show the proportions of recruitment situations throughout the watersheds of the Lower Columbia-Clatskanie Subbasin. The data for Figure 5.2 can be found in the Table 5.7. These data represent the proportions of total stream length for mainstem and tributary streams within each of the thirty-two watersheds. The first three categories in Table 5.7 represent those areas where there are adequate large conifers for recruitment of woody debris or the conditions are such that an abundance of large conifers would not be expected. These three columns therefore represent sufficient riparian conditions based on the analysis of aerial photographs. The last row of the table gives the totals for each recruitment situation at the subbasin scale. Based on the riparian analysis, 7.6% of the riparian zones are sufficient for LWD recruitment, and an additional 5.4% is not expected to contain large coniferous vegetation (ecoregion and meadow recruitment situations). Small timber associated with forestry land uses represent 42.6% of the riparian areas within the subbasin, and hardwood/brush, also associated with forestry land uses, comprises another 13.8% of the riparian zones. Fewer than 10% of the riparian zones within the Clatskanie River watershed have adequate recruitment potential. Nearly 60% of the recruitment situations within this same watershed are small timber, and hardwood/brush make up another 10.8% of the riparian units. The Plympton Creek watershed fairs the best with 38.5% of the riparian zones containing large conifers and adequate recruitment. Ecoregion exceptions comprise another 10.5% of the recruitment situations in the Plympton Creek watershed.

The distribution of recruitment situations is important to an evaluation of riparian conditions. Figure 5.3 is a map of the riparian recruitment situations throughout the subbasin with the watersheds delineated by a dotted line. Within the Clatskanie River watershed adequate recruitment situations are concentrated in the Conyers Creek subwatershed southwest of the town of Clatskanie. To a lesser extent there are concentrations of adequate recruitment within the upper Clatskanie River. The Plympton Creek watershed has adequate recruitment situations within the headwaters of the watershed.

Potential Shading

Shading is summarized in Table 5.8 and Figure 5.4. The data for Figure 5.4 is contained within Table 5.8. The riparian shading within the mainstem and tributaries of each watershed is divided into the three shade classes outlined in the methodology section. A subbasin total for each shade class is given in the last row of Table 5.8. High shading is found in 11% of the riparian units throughout the subbasin. Moderate and Low shading make up equal proportions of the riparian units at the subbasin level. The greatest concentration of 'Low' shading can be found in the watersheds within the floodplain of the Columbia River. These watersheds are comprised primarily of agricultural lands where trees are largely absent from the riparian zone.

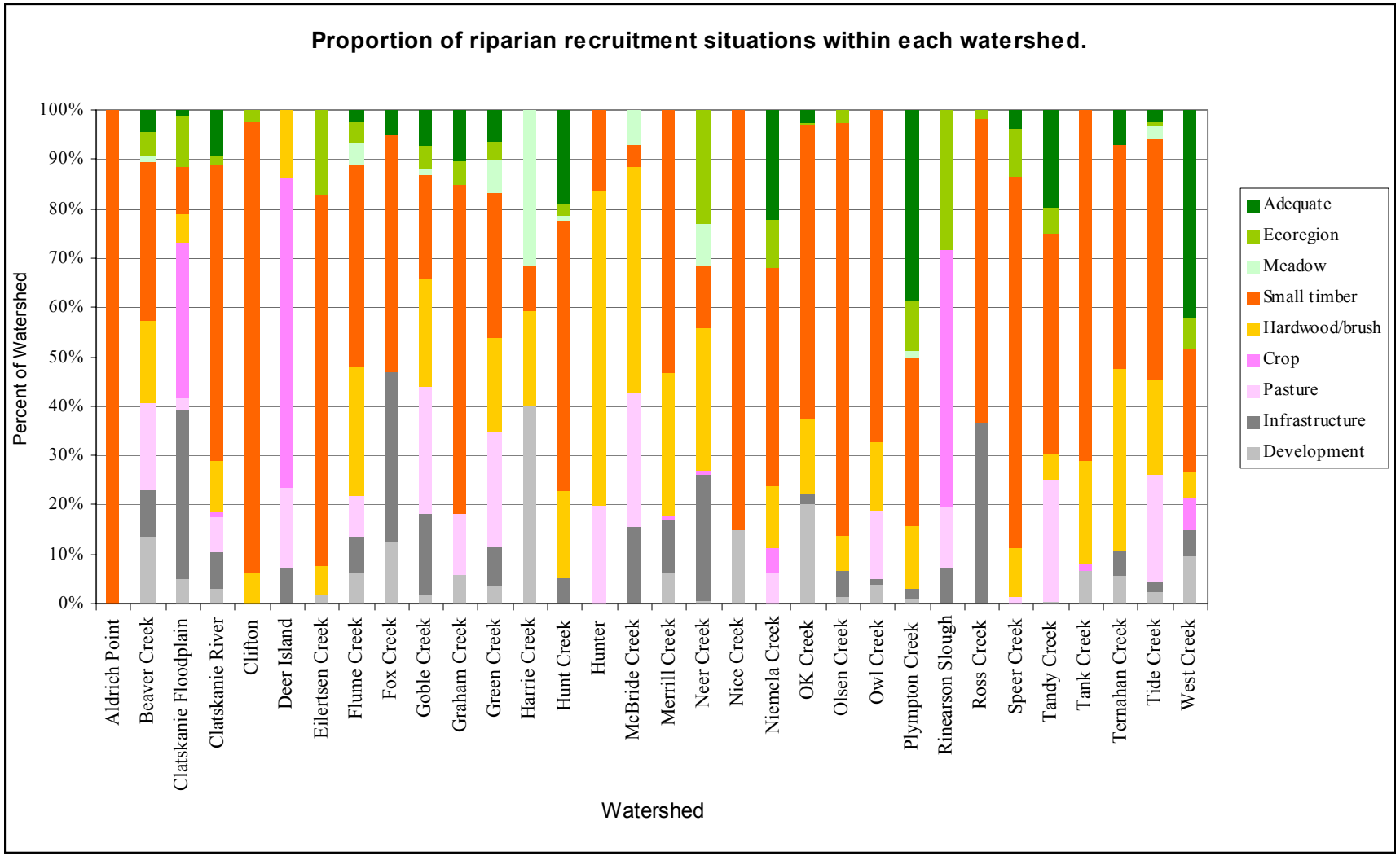

Figure 5.2: Riparian recruitment situations within the thirty-two watersheds of the Lower Columbia-Clatskanie Subbasin expressed as percent of total watershed riparian zone.

Watershed	Recruitment Situation								
	Adequate	Ecoregion	Meadow	Small timber	Hardwood/brush	Crop	Pasture	Infrastructure	Development
Aldrich Point	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Beaver Creek	4.2%	5.2%	1.3%	32.0%	16.7%	0.2%	17.6%	9.4%	13.5%
Clatskanie Floodplain	1.1%	10.4%	0.1%	9.4%	5.6%	31.6%	2.4%	34.5%	4.8%
Clatskanie River	9.1%	1.7%	0.4%	59.6%	10.8%	0.7%	7.1%	7.6%	3.0%
Clifton	0.0%	2.4%	0.0%	91.5%	6.1%	0.0%	0.0%	0.0%	0.0%
Deer Island	0.0%	0.0%	0.0%	0.0%	13.8%	62.6%	16.4%	7.2%	0.0%
Eilertsen Creek	0.0%	17.1%	0.0%	75.2%	5.7%	0.0%	0.0%	0.0%	2.0%
Flume Creek	2.3%	4.1%	4.7%	40.7%	26.5%	0.0%	8.2%	7.2%	6.2%
Fox Creek	5.0%	0.0%	0.0%	48.0%	0.0%	0.0%	0.0%	34.4%	12.6%
Goble Creek	7.3%	4.6%	1.4%	20.8%	22.0%	0.0%	25.8%	16.4%	1.8%
Graham Creek	10.2%	5.0%	0.0%	66.6%	0.0%	0.0%	12.2%	0.0%	6.1%
Green Creek	6.2%	4.2%	6.5%	29.2%	18.8%	0.0%	23.5%	7.9%	3.8%
Harrie Creek	0.0%	0.0%	31.8%	8.6%	19.8%	0.0%	0.0%	0.0%	39.8%
Hunt Creek	18.8%	2.6%	1.0%	55.0%	17.6%	0.0%	0.0%	5.2%	0.0%
Hunter	0.0%	0.0%	0.0%	16.1%	64.1%	0.0%	19.8%	0.0%	0.0%
McBride Creek	0.0%	0.0%	6.9%	4.7%	45.7%	0.0%	27.1%	15.6%	0.0%
Merrill Creek	0.0%	0.0%	0.0%	53.0%	29.4%	1.0%	0.0%	10.4%	6.3%
Neer Creek	0.0%	23.2%	8.6%	12.5%	28.8%	0.8%	0.0%	25.6%	0.6%
Nice Creek	0.0%	0.0%	0.0%	85.1%	0.0%	0.0%	0.0%	0.0%	14.9%
Niemela Creek	22.0%	9.9%	0.0%	44.4%	12.5%	4.8%	6.4%	0.0%	0.0%
OK Creek	2.8%	0.3%	0.0%	59.6%	15.0%	0.0%	0.0%	2.1%	20.2%
Olsen Creek	0.0%	2.5%	0.0%	83.7%	7.1%	0.0%	0.0%	5.4%	1.3%
Owl Creek	0.0%	0.0%	0.0%	67.4%	13.8%	0.0%	13.7%	1.0%	4.0%
Plympton Creek	38.5%	10.5%	1.1%	34.2%	12.8%	0.0%	0.0%	2.0%	0.9%
Rinearson Slough	0.0%	28.4%	0.0%	0.0%	0.0%	51.9%	12.5%	7.2%	0.0%
Ross Creek	0.0%	1.6%	0.0%	61.8%	0.0%	0.0%	0.0%	36.6%	0.0%
Speer Creek	3.7%	9.9%	0.0%	75.1%	9.9%	0.0%	1.3%	0.0%	0.0%
Tandy Creek	19.7%	5.3%	0.0%	44.7%	5.3%	0.0%	24.6%	0.0%	0.4%
Tank Creek	0.0%	0.0%	0.0%	71.0%	21.2%	1.2%	0.0%	0.0%	6.7%
Ternahan Creek	6.8%	0.0%	0.0%	45.7%	37.1%	0.0%	0.0%	4.7%	5.7%
Tide Creek	2.3%	0.9%	2.7%	49.0%	19.2%	0.0%	21.3%	2.3%	2.4%
West Creek	42.0%	6.6%	0.0%	24.7%	5.1%	6.9%	0.0%	5.2%	9.5%
Grand Total	7.6%	4.3%	1.1%	42.6%	13.8%	5.5%	10.0%	10.1%	5.0%

Table 5.7: Riparian recruitment situations listed by watershed as a percent of total riparian zone. The subbasin totals are included in the last row.

Data source: USGS digital line graph files; USGS digital orthophotographs.

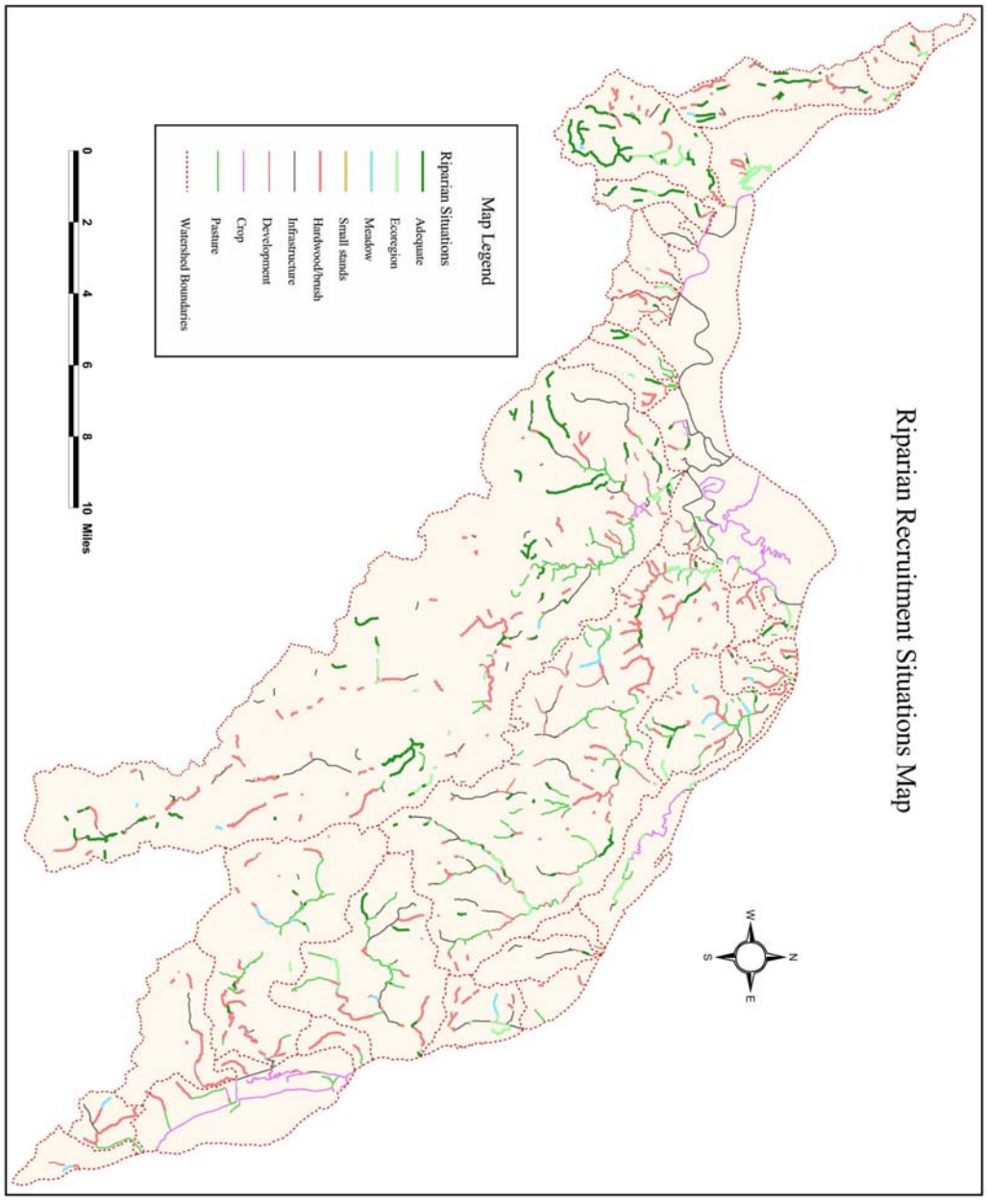

Figure 5.3: Riparian situations for recruitment of large woody debris into stream channels.

Figure 5.5 is a map of the shade classes throughout the subbasin. Watershed boundaries are indicated by a dotted line. As with recruitment potential, shading is also a reflection of the land uses. The disturbance level is a major factor in the distribution of large dense stands that providing adequate shade. Similarities between shading and recruitment potential are obvious. Small timber and hardwoods/brush often do not provide adequate shade.

Potential Wetlands

Wetland distribution and conditions are summarized in Table 5.9 and Table 5.10. Two tables are needed to summarize the potential wetlands data since riverine wetlands are defined by length and the other wetlands are defined by area (i.e. acres). The data in these two tables is also displayed in Figures 5.6 and 5.7.

Table 5.9 and Figure 5.6 summarize the total acres of potential wetlands based on an evaluation of disturbance. If more than 70% of the wetland has been developed for any land use then it is given the rating of disturbed. Three of the watersheds do not contain wetlands that are connected to the stream network and therefore are not included in Table 5.9 or Figure 5.6. Of the 15,769 acres of potential wetlands, 3,122 acres are undisturbed and may be providing valuable habitat to fish and wildlife. Watersheds found within the floodplain of the Columbia River have an abundance of potential wetlands. Many of these areas have been developed for agricultural, industrial, and residential uses.

Table 5.10 and Figure 5.7 summarize the linear miles of streams that have a potential for riverine wetlands. This type of wetland is typically narrow and contained within the active floodplain of the stream network. Some of the watersheds do not contain channel habitat types that meet the criteria listed in the methodology for riverine wetlands. Watersheds that do not contain potential for riverine wetlands are not included in Table 5.10 or Figure 5.7. The Clatskanie Floodplain watershed is dissected by numerous meandering sloughs that have been altered for agricultural uses. These features, which are not included in the hydrology layer because of the man made barriers that inhibit fish passage, comprise 42 miles of riverine wetlands that hold potential for salmonid habitat.

The Clatskanie River watershed also has an abundance of potential riverine wetlands. Figure 5.8 is a map of the distribution of potential wetlands including riverine wetlands throughout the watersheds of the Lower Columbia-Clatskanie Subbasin. The mainstem of the Clatskanie River is a meandering, gentle gradient stream that would naturally contain abundant riverine wetlands. Beaver Creek, Tide Creek, Green Creek, and Merrill Creek also contain a high proportion of channel habitat types favorable for riverine wetlands.

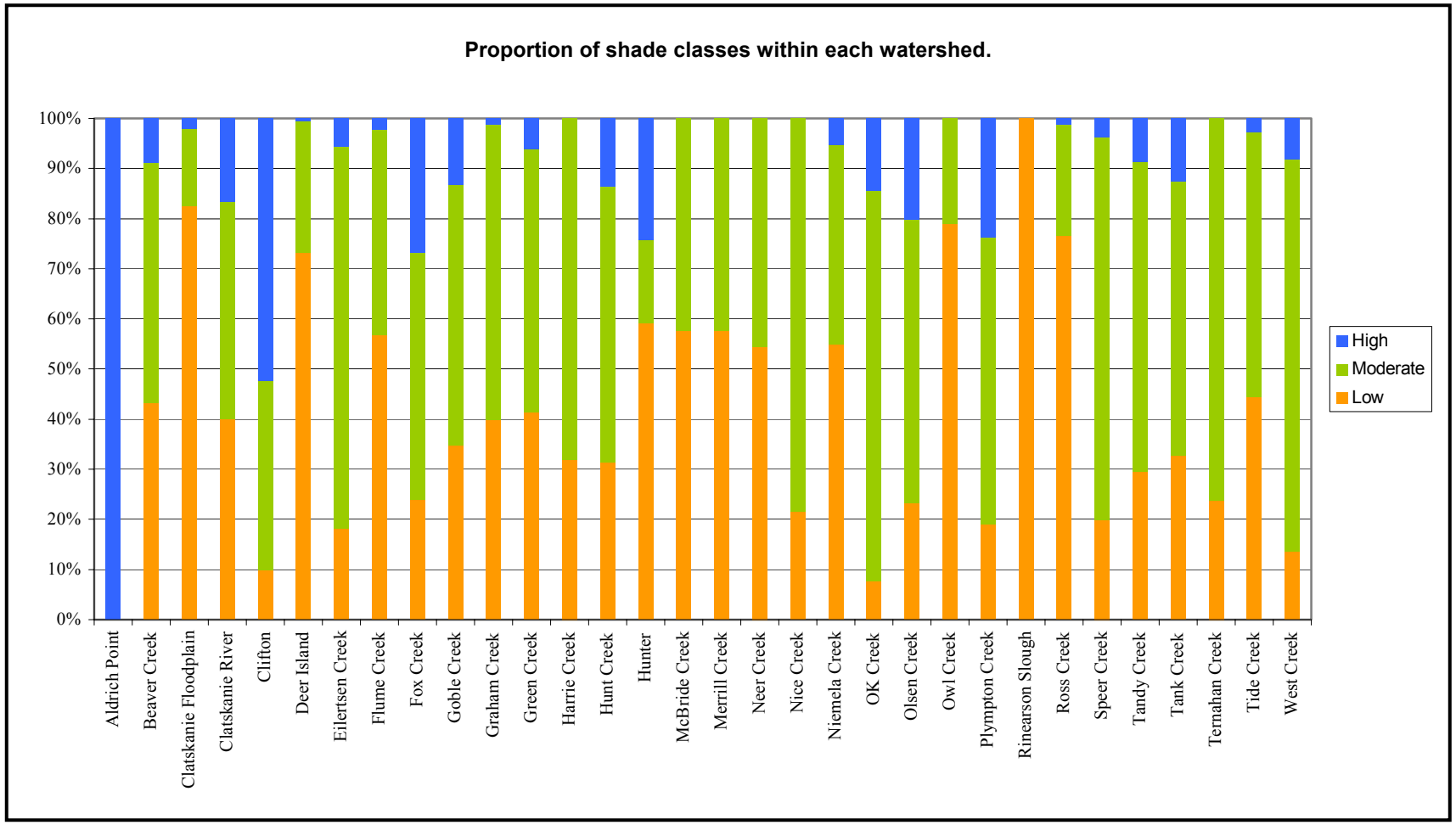

Figure 5.4: Riparian shade classes for the thirty-two watersheds of the Lower Columbia-Clatskanie Subbasin given as percent of total watershed riparian zone.

Watershed	Riparian Shading		
	Low	Moderate	High
Aldrich Point	0.0%	0.0%	100.0%
Beaver Creek	43.2%	47.9%	8.9%
Clatskanie Floodplain	82.5%	15.3%	2.2%
Clatskanie River	40.0%	43.3%	16.7%
Clifton	9.9%	37.7%	52.4%
Deer Island	73.3%	26.2%	0.6%
Eilertsen Creek	18.2%	76.2%	5.6%
Flume Creek	56.8%	40.9%	2.3%
Fox Creek	23.9%	49.4%	26.8%
Goble Creek	34.8%	51.9%	13.2%
Graham Creek	39.8%	59.0%	1.2%
Green Creek	41.5%	52.3%	6.2%
Harrie Creek	31.8%	68.2%	0.0%
Hunt Creek	31.4%	54.9%	13.7%
Hunter	59.3%	16.5%	24.2%
McBride Creek	57.6%	42.4%	0.0%
Merrill Creek	57.6%	42.4%	0.0%
Neer Creek	54.4%	45.6%	0.0%
Nice Creek	21.5%	78.5%	0.0%
Niemela Creek	54.9%	39.7%	5.4%
OK Creek	7.6%	77.9%	14.5%
Olsen Creek	23.2%	56.7%	20.1%
Owl Creek	78.9%	21.1%	0.0%
Plympton Creek	19.0%	57.1%	23.8%
Rinearson Slough	100.0%	0.0%	0.0%
Ross Creek	76.6%	22.2%	1.2%
Speer Creek	19.9%	76.4%	3.7%
Tandy Creek	29.5%	61.8%	8.7%
Tank Creek	32.7%	54.8%	12.5%
Ternahan Creek	23.8%	76.2%	0.0%
Tide Creek	44.5%	52.6%	2.9%
West Creek	13.7%	78.1%	8.2%
Grand Total	44.5%	44.2%	11.4%

Table 5.8: Riparian shade classes summarized as percent of total riparian zone per watershed. The last row in the table contains the subbasin totals.

Conclusions

Riparian zones are highly productive systems consisting of a diverse assemblage of vegetation. Within the Pacific Northwest riparian habitats often consist of an inner band of hardwoods, brush, or grass bordered by an outer zone of conifers or hardwoods.

Channel confinement and slope stability are features of the landscape that influence the riparian vegetation characteristics. Unstable slopes will prevent the establishment of mature coniferous stands. Faster growing vegetation such as brush and hardwoods will often dominate these areas. The soil water content and drainage potential of the soil also influence the type and distribution of vegetation within the riparian zone. Soils that are perpetually wet or have poor drainage may limit establishment of coniferous stands.

Data source: USGS digital line graph files; USGS digital orthophotographs.

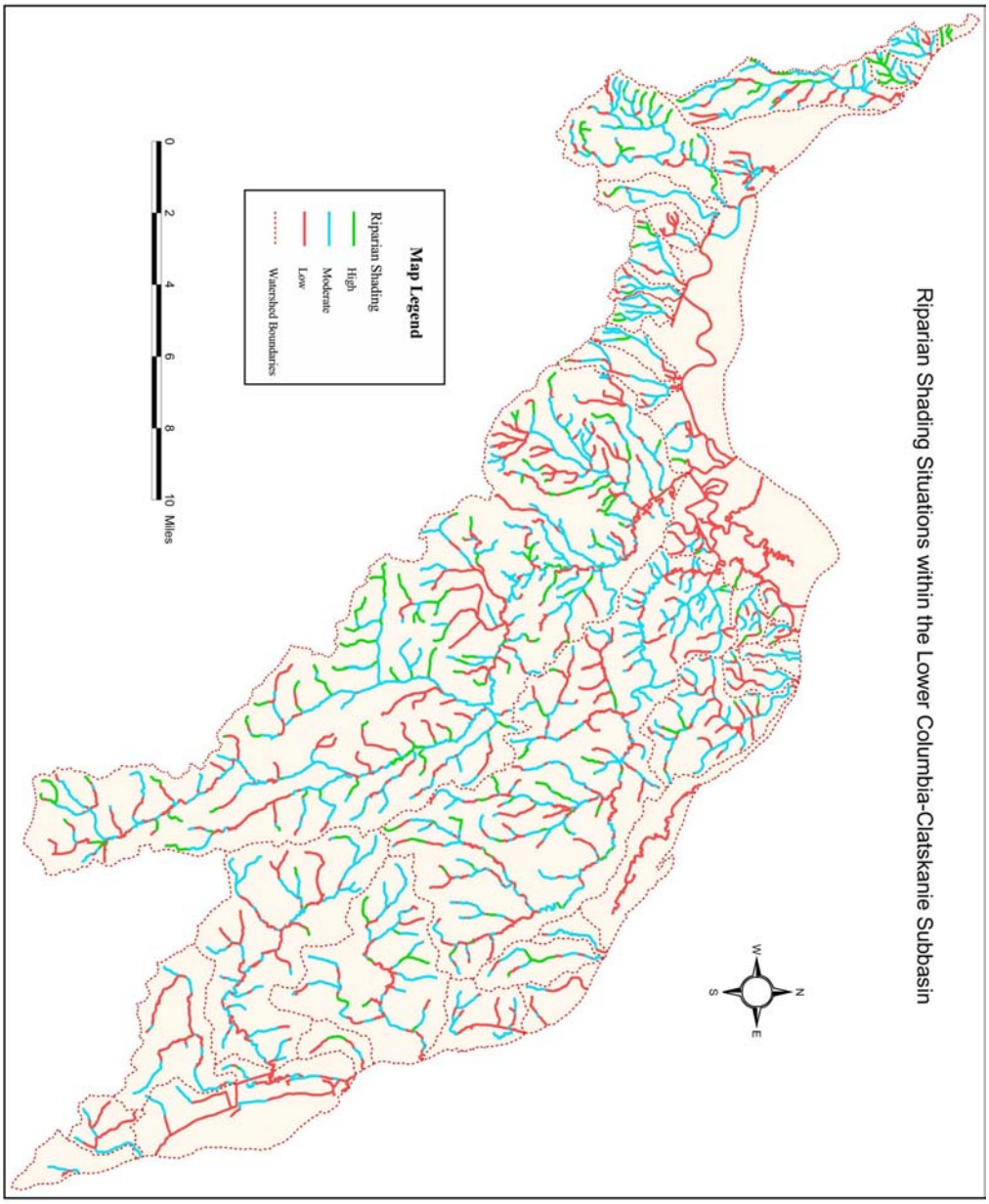

Figure 5.5: Map of potential riparian shading.

Recruitment potential is a characterization of the number of large coniferous trees within the riparian zone that may eventually contribute to instream large woody debris (LWD). Recruitment of LWD is through natural events such as wind throw or erosion that cause trees within the riparian zone to fall across the stream channel. The tree size and species that are most likely to enhance instream habitats for salmonids are conifers greater than two feet in diameter (WPN, 1999). The riparian recruitment situations, as outlined in Table 5.6, are mainly a reflection of land use. Adequate stands of large conifers are most common in forestry land use areas, however within these same areas small timber and hardwoods/brush are the dominant riparian situation. Throughout the subbasin, the proportion of riparian zones with adequate, ecoregion, and meadow recruitment situations is 13%. Land uses have had a substantial impact on the abundance and distribution of large conifers within the riparian zones.

Shading is a measure of how well the riparian canopy filters direct sunlight from reaching the stream surface. Riparian shading can effectively reduce temperature fluctuations and help to maintain adequate water temperatures for salmonid growth and survival. Shading has also been influenced by land uses however to a lesser extent. Nearly half of all the riparian units do not provide adequate shading to prevent high stream temperatures. The Oregon Forest Practices Act does not require a riparian buffer on small non-fish bearing streams unless they are a drinking water source. This fact may influence the results of the riparian analysis leading to the impression that the situation is very poor. Recruitment situations and shading will be compared with fish distribution and channel habitat types in the final watershed condition evaluation to give an overall picture of the health of the subbasin.

Wetlands serve many functions within a watershed. Of primary importance is the overwintering habitat and flood augmentation provided by wetlands that are connected to the stream network. Riverine wetlands provide shelter to juvenile salmonids during winters high flows. Wetlands also serve to protect water quality by trapping sediments and non-point source pollutants carried in runoff from forest and rural roads, agricultural lands, and urban areas. Land uses have impacted the wetlands within the subbasin resulting in a loss of more than 13,000 acres of wetlands. The majority of these losses have occurred within the floodplain of the Columbia River where wetlands have been diked, drained, and converted into farmlands. Migrating adult and juvenile salmonids, including the ESUs that are currently listed threatened and endangered under the Endangered Species Act, use floodplain habitats of the Columbia River. Restoration of floodplain habitats would benefit salmonid populations within the Lower Columbia-Clatskanie Subbasin as well as upper Columbia River and Willamette River species that utilize these areas during migration.

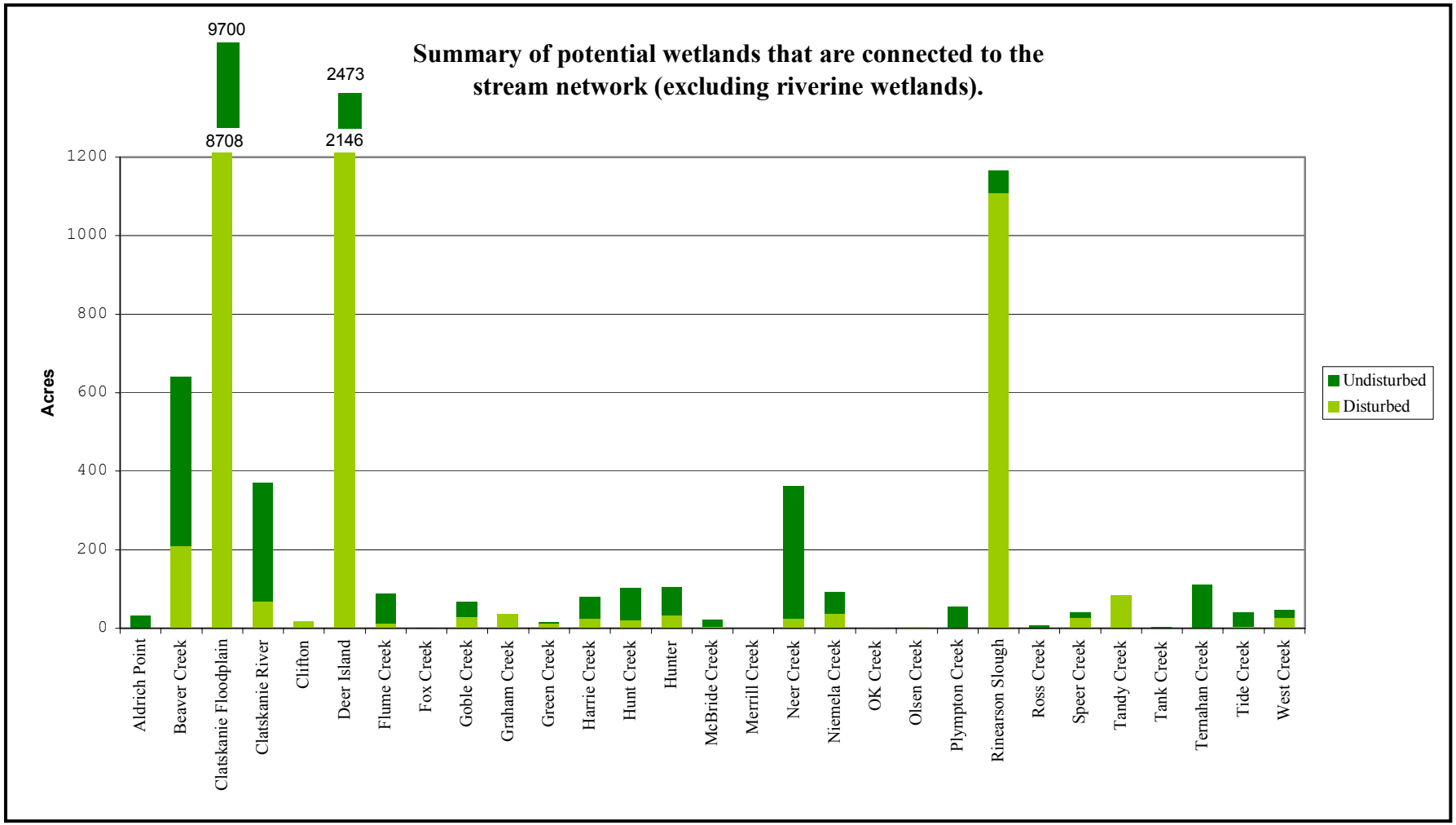

Figure 5.6: Summary of potential wetlands based on NWI maps, hydric soils classifications, and USGS topographic maps. Data does not include riverine wetlands identified from channel habitat types and NWI maps.

Watershed	Condition		Grand Total
	Disturbed	Undisturbed	
Aldrich Point		33	33
Beaver Creek	209	431	639
Clatskanie Floodplain	8708	991	9700
Clatskanie River	67	303	371
Clifton	17		17
Deer Island	2146	327	2473
Flume Creek	14	76	90
Fox Creek		1	1
Goble Creek	30	38	68
Graham Creek	37		37
Green Creek	12	5	16
Harrie Creek	25	55	80
Hunt Creek	21	82	104
Hunter	34	71	105
McBride Creek	4	19	22
Merrill Creek		0	0
Neer Creek	24	338	362
Niemela Creek	38	54	92
OK Creek	1		1
Olsen Creek	2		2
Plympton Creek	3	52	55
Rinearson Slough	1108	58	1166
Ross Creek	0	8	8
Speer Creek	28	14	42
Tandy Creek	84		84
Tank Creek	1	3	4
Ternahan Creek	2	110	112
Tide Creek	6	35	41
West Creek	26	19	45
Grand Total	12647	3122	15769

Table 5.9: Summary of potential wetlands not including riverine wetlands. Totals are in units of acres.

Watershed	Channel Habitat Type				Grand Total
	FP2	FP3	LM	MM	
Beaver Creek	10.16	9.73	18.84	12.21	50.94
Clatskanie Floodplain	59.85	22.79	0.88	0.30	83.83
Clatskanie River	12.02	18.06	13.93	19.79	63.80
Clifton			0.25		0.25
Deer Island	6.13	9.46	0.15	1.29	17.03
Flume Creek		0.22			0.22
Fox Creek		0.05	0.92		0.97
Goble Creek	2.17	1.83	4.77	1.31	10.07
Graham Creek		0.15			0.15
Green Creek		2.47	0.30	4.87	7.64
Harrie Creek		0.62			0.62
Hunt Creek		0.66	0.14	1.59	2.39
Hunter		0.45			0.45
McBride Creek		0.17		0.64	0.80
Merrill Creek		0.05	6.07	1.99	8.11
Neer Creek		3.00	0.03		3.03
Nice Creek			0.33		0.33
Niemela Creek		0.10			0.10
Owl Creek		0.03			0.03
Plympton Creek		1.61	0.04	3.17	4.82
Rinearson Slough		6.60			6.60
Speer Creek		0.53	0.42		0.95
Ternahan Creek		0.18			0.18
Tide Creek		6.98	3.23	2.84	13.05
West Creek		0.24			0.24
Grand Total	48.26	85.95	50.31	49.99	276.59

Table 5.10: Summary of riverine wetlands identified from channel habitat types. Totals are given in linear miles. For a definition of the channel habitat types see the methodology section.

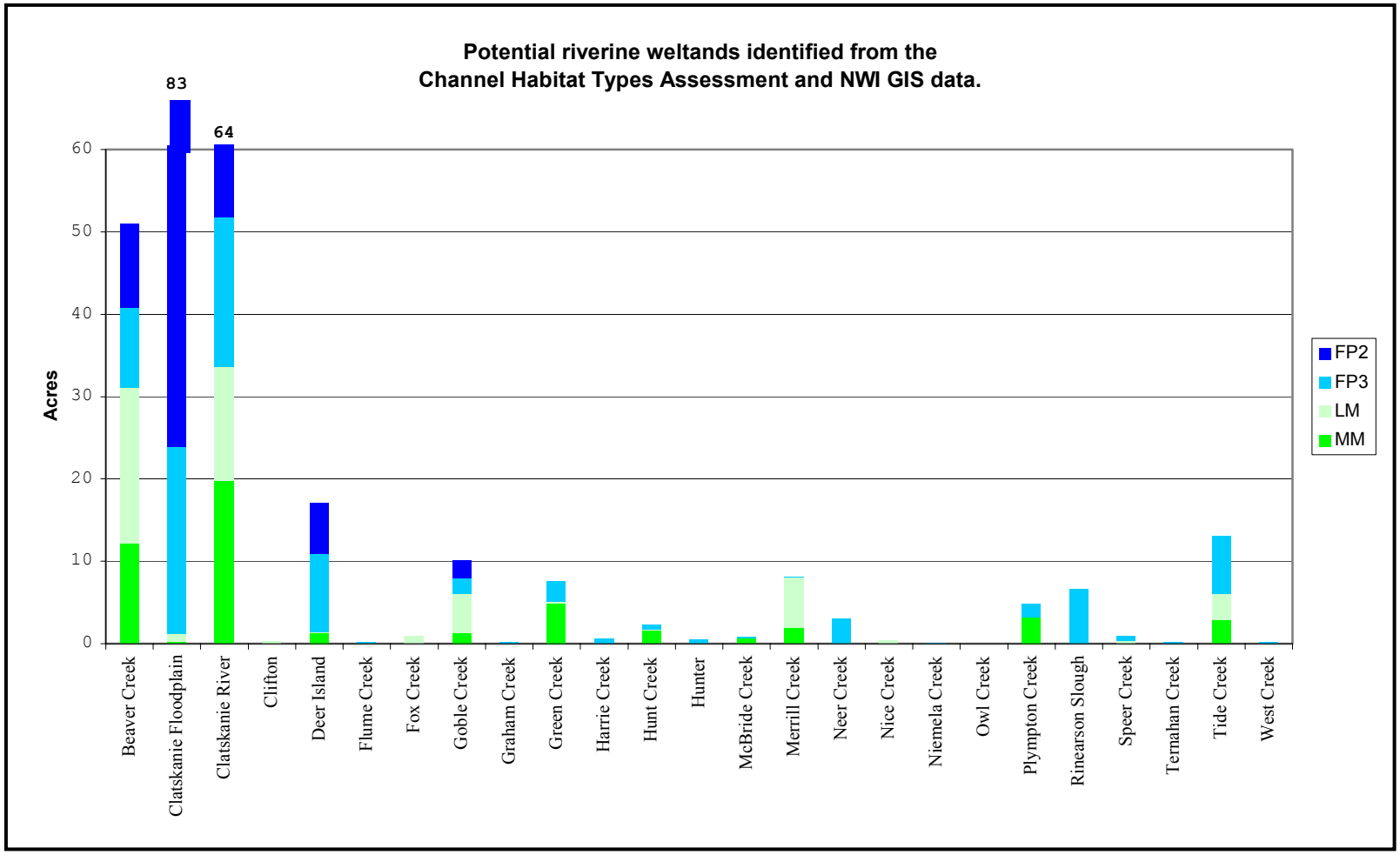

Figure 5.7: Summary of potential riverine wetlands by watershed. Seven watersheds lack the channel habitat types indicative of riverine wetlands and are not included in this chart.

Data source: USGS digital line graph files; USFWS National Wetlands Inventory mapping; USNRCS soil mapping; Channel Habitat Types from Section lll of this watershed assessment.

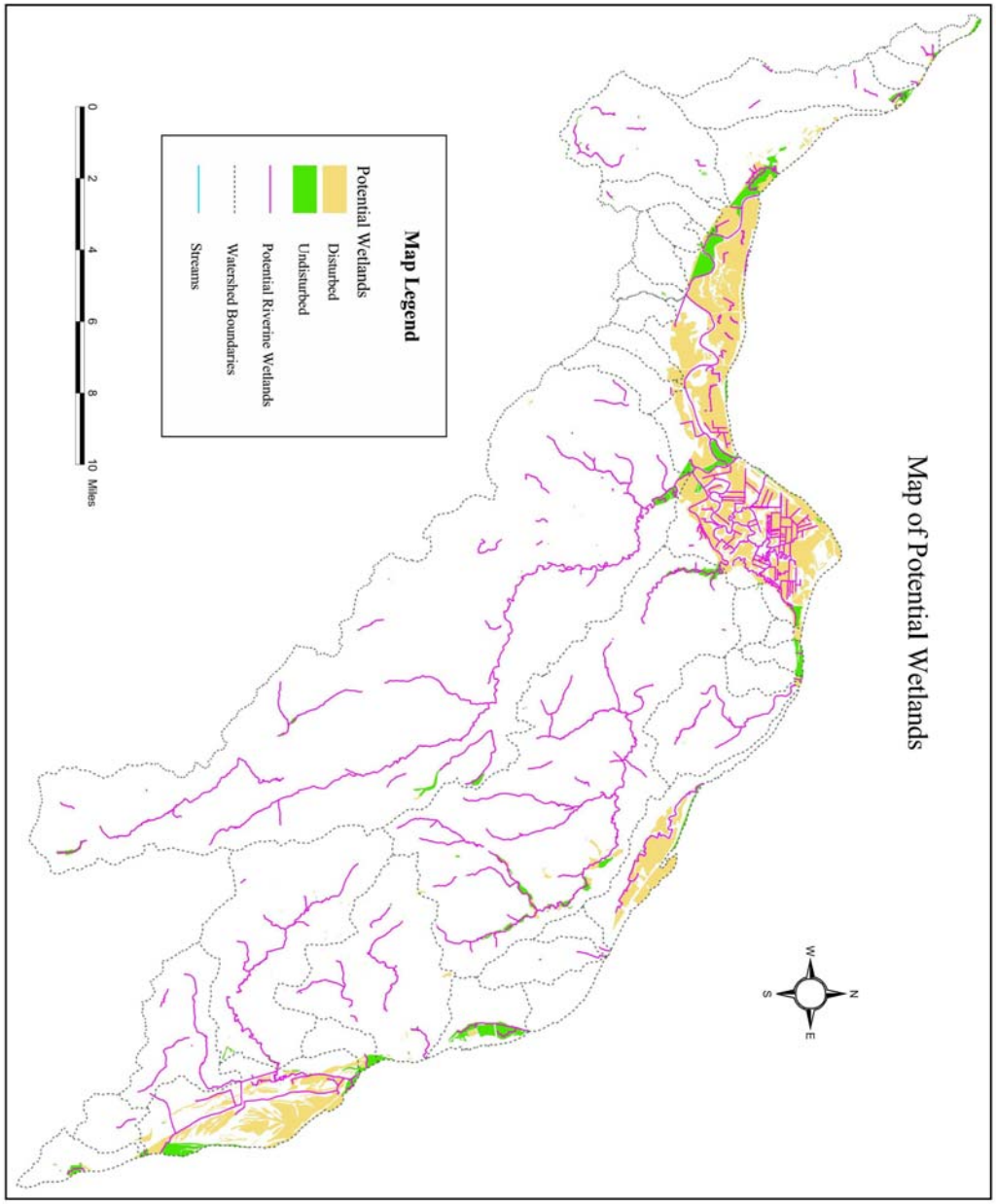

Figure 5.8: Map of potential riverine, palustrian, lacustrine, and estuarine wetlands.

Data Gaps

The evaluation of riparian conditions was completed using USGS aerial photographs from 1994. It is reasonable that some of the conditions on the ground have changed since 1994 and may alter the overall assessment of recruitment potential and potential shading. However, the changes are not expected to be widespread nor would it be likely that developments have altered a high percentage of either riparian characteristic measured in this assessment.

Field verification of potential wetlands was not conducted. The time and expense for such an effort would be unreasonable considering that salmonid distribution is limited to only a portion of the streams. A field evaluation for site-specific restoration activities is necessary.

Confidence Evaluation

Confidence in the riparian recruitment potential and shading is high. A number of data sources were utilized in the vegetation interpretation including field visits to a representative sample of riparian conditions. Data sources included: aerial photographs, satellite imagery, digital elevation models, and stream survey data.

Confidence in the potential wetlands assessment is moderate given the absence of field verification. Within the watershed evaluation, the final evaluation of all components, identification of key areas can lead to planning of field visits wetland delineations. The potential wetland distribution will be useful in planning of restoration and monitoring activities.

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