



Black River Vegetation: Changes through time of a Unique Western Washington River

Prepared by

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Cover Photos

*Top: Black River from the Wagon Bridge, Gate City, September 27, 1898. University of Washington
Libraries, Special Collection, UW27684z. A.H. Waite*

Bottom: Approximately the same place as 1898 photo. February, 2008.

All color photos by Richard Easterly.

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INTRODUCTION

The Black River drainage is a low gradient, low elevation system in the south Puget Sound (Figure 1). Its unique geomorphic setting results in an unusual assemblage of Ecological Systems and supports a variety of rare and at risk species and habitats. Although the importance of the Black River and its associated wetlands is evident, there is little knowledge of current and especially historical condition of riparian and wetland vegetation in the Black River watershed. This project is intended to provide insights into the historic conditions along the river and assess the degree of change and degradation in the wetland and riparian conditions in the watershed since the 1850s. Primary objectives are (1) to expand knowledge of the historical and current condition and extent of riparian and wetland vegetation in the Black River watershed and (2) to develop a methodological approach to assess vegetation using General Land Office surveys, aerial photography interpretation and ground-truthing.

Several significant parcels have conservation status in the drainage, some of which are undergoing active management to maintain and/or reestablish native vegetation. These include Black River Unit, Nisqually Wildlife Refuge (US Fish and Wildlife Service), Glacial Heritage Preserve (The Nature Conservancy), Mima Mounds Natural Areas Preserve (WA Department of Natural Resources) and the Black River Habitat Area (WA Department of Fish and Wildlife).

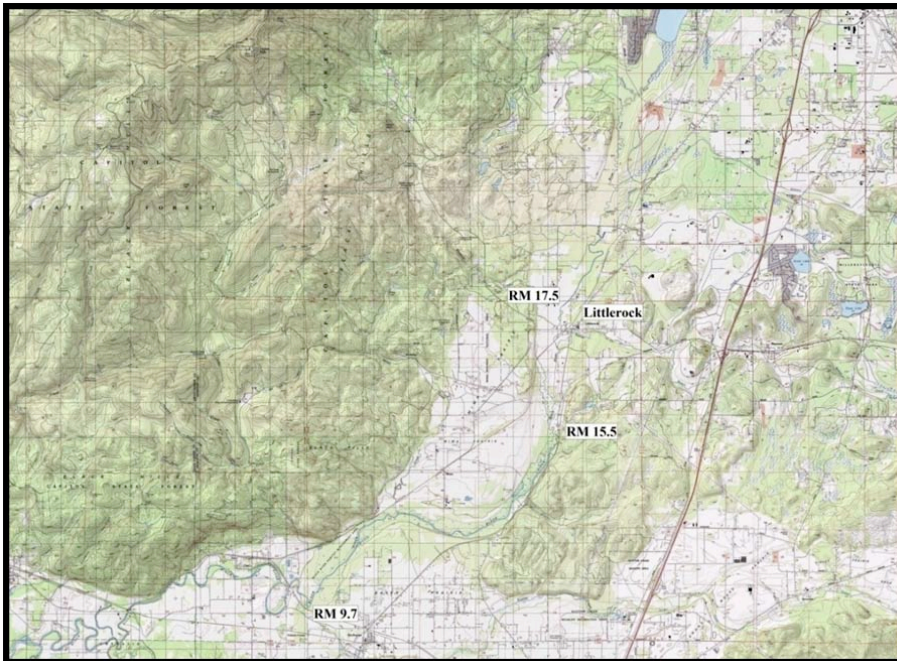


Figure 1. Black River drainage and vicinity. South Puget Sound of Thurston and Grays Harbor counties, Washington

Site Description

The Black River is located within and below the maximum southern extent of Pleistocene continental glaciations west of the Cascade Mountains. The north end of the Black River drainage, including Black Lake and the upper reaches of the river, were under ice during the last glacial maxima. During early glacial retreat, meltwater was blocked by ice from flowing northward, and glacial meltwater from much of the entire lobe was channeled southward through a shifting series of outwash channels, including the Black River channel (Figure 2), to the Chehalis drainage, and then out to the Pacific Ocean. Routes of the outwash channels were controlled by the slowly retreating glaciers, the underlying outcrops of Eocene sandstone and basalt in the area, and the overlying topography of moraines and glacial till. The combination of huge volumes of meltwater and blockages by earth and ice caused the water to pond and form a series of temporary lakes, including Lake Russell (Figure 3, Bretz 1913). Fine-textured sediment deposited during this process blanketed portions of the landscape. Sand was also deposited by overbank deposition during flood surges caused by hydraulic damming associated with the sandstone and basalt bedrock in the channel-ways. Within flood channels, the flow of meltwater sorted outwash sediments, leaving gravel. The series of alternate flood routes in the study area included the Beaver Creek drainage, a major tributary to the Black River from the east, and a later channel-way past Olympia and down the main stem of the Black River.

The outwash events created, eroded and reshaped terraces in the massive amount of sediment in the outwash channels. The resulting Black River occupies a channel that is oversized and has a very low gradient (average of 9 inches/mile). Associated with this channel are a series of terraces that are likewise low gradient, some including perched wetlands on outwash terraces above the Black River channel. Overbank deposition of sand from the outwash events is primarily perched on or above remnant terraces on the edges of the immediate study area, as at Olympia Airport and south of Maytown (west of Tilly Road). Mima mounds on both sides of the river appear to be related to/associated with some "middle" terraces of the outwash channels.

The oversized drainage basin creates a broad wetland zone along much river, especially in the upper reaches. The low gradient side-slopes produce an overall relatively stable landform, and landslides are rare in the main stem of the river (Smith and Wenger 2001). The lower reaches of the Black River (below River Mile 9.7) are within the historical floodplain of the Chehalis River.

The major tributaries of Black River are Mima, Waddell and Dempsey creeks that originate in the Capital Forest to the west and Salmon and Beaver Creek that enter from the east. The glacially-formed, low-gradient landscape east of the Black River and north of Beaver Creek is noteworthy for the series of seasonally flooded or saturated small drainages and swales that also include Allen Creek and Blooms Ditch. Beaver Creek occupies a major glacial outwash channel that fed into the Black River just below the confluence of Waddell Creek. At this area, sediments from post-glacial outwash and Holocene flooding cause the Black River channel to become choked with sediment, resulting in a braided river channel system from Shotwell's Landing to nearly the 123rd Ave Bridge (River Miles 15.5-17.5). Upstream from River Mile 17.5 to the head of the river at Black Lake, the river is relatively

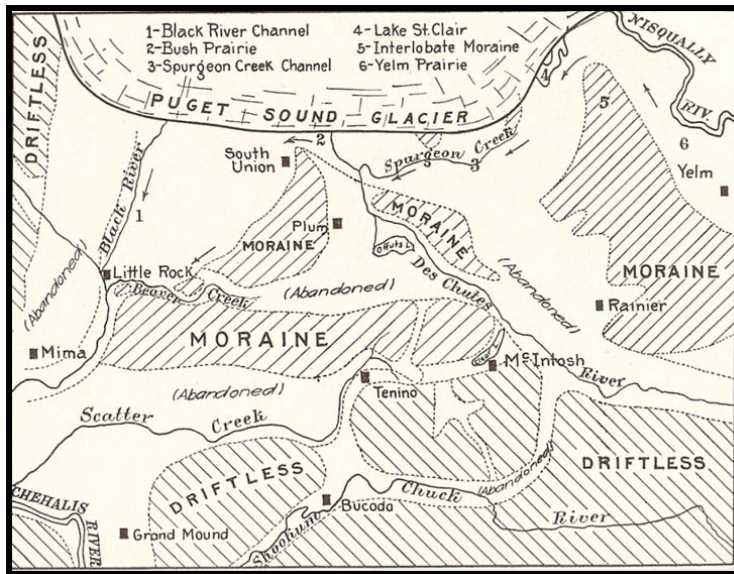


Figure 2. Glacial drainage from the eastern lobe of the Puget Sound Glacier. Arrows indicate drainage courses at this stage of glacial retreat. From Bretz (1913).

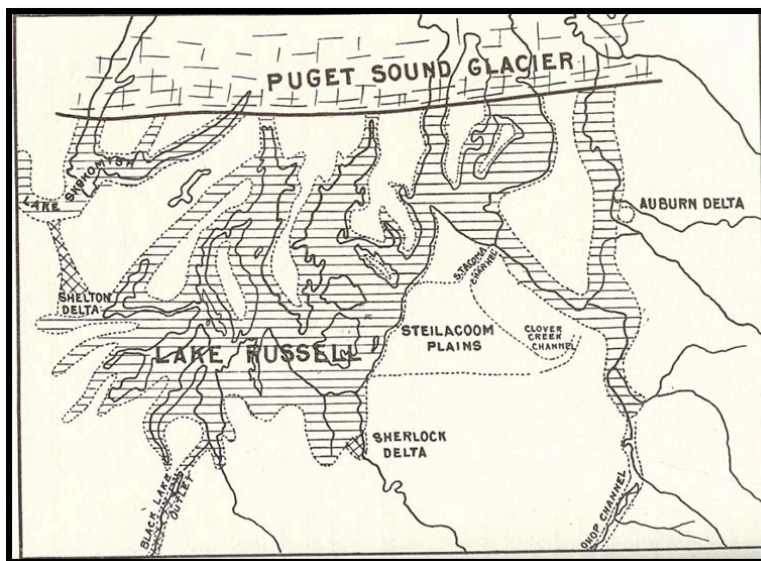


Figure 3. Lake Russell, created by meltwater ponded behind earth and ice blockages during glacial retreat. Black Lake outlet to lower left. From Bretz (1913).

narrow with a series of bogs and wetlands. Downstream, the reach from River Mile 15.5 – 9.7 includes a broad wetland floodplain with secondary channelways bracketed by upland forests and prairies. In its lowest reaches (below River Mile 9.7), the river is slightly incised into the abundant outwash deposition and river sediments of the historic Chehalis River floodplain. In this area, wetlands are generally narrow and reduced to select low, unfarmed areas such as oxbows and abandoned river channels.

Partially because of the low gradient and broad floodplain of the wetland and bog portion of the Black River north of River mile 9.7, portions of the riparian corridor have been partially buffered from development, while suburban development has accelerated in recent years and agriculture and livestock grazing have a widespread history.

Historic Records

Descriptions of conditions along the river near the beginning of European settlement are provided by official records made by early explorers in the area. During the first half of the nineteenth century, two expeditions paddled the Black River. The first of these was in 1824, when the Hudson Bay Company¹ sponsored the James McMillan Expedition, a 41-man expedition to the Frasier River from the Columbia River in search of sites for trading forts. The second expedition through the area was in 1841, when Charles Wilkes commanded the earliest US Exploring Expedition to reach the Oregon Country. Wilkes sent a party of nine men in July of that year from the Hudson Bay Company's Fort Nisqually to Grays Harbor by way of the Black River.

More quantitative historic information was provided by surveys done for the General Land Office and Donation Land Claims,² which were done during the 1850s in the study area. For the GLO surveys, transects were made first to establish Township boundaries; later surveys established the corners of each Section within the Township. Included in those records was bearing tree information: species, diameter and distance to the nearest tree more than 4" dbh in each compass quadrant (Section corners) or to each side of survey line (quarter-corners). DLC surveys located the corners of each claim, with at least two bearing trees recorded per corner. Size and location of trees located on the survey line were also recorded on both surveys.

In addition, at each section corner GLO surveyors recorded notes about the vegetation encountered along the line in the previous mile segment. Records included the following: species encountered (generally trees and shrubs); presence, extent and/or sign of fire along the GLO transect; and general composition of the understory (sparse/dense). Also noted was the transition points between prairies, hills, marshes (or bottomlands), timber and burnt timber, usually with the bearing direction of the ecotone/margin noted. The locations, width and direction of rivers and streams were also recorded.

¹ Hudson Bay Company employees consisted of people with a mixture of heritages including English, French Canadian, Indians from eastern North America (including Abenaki and Iroquois) and Hawaiians. For the most part, these people lived and mixed with the local Indians, sharing knowledge.

² Donation Land Claim surveys were done after claims were made for a parcel and do not represent all settlement in the region, as some claims were bought outright or settled after the initial flush of immigration. For example, neither Shotwell nor Bush, prominent early settlers in the area, had Donation Land Claims.

Township maps were then drawn using GLO field notebook data.³ These maps showed the section line locations of rivers, streams, prairies, hills and marshes, and the estimated direction or shape of the feature.

Current Conditions

Post-contact management in the basin includes drainage, agriculture, livestock grazing, development and timber farming. Much of the area that is dry for at least part of the year was likely cleared at some point and either grazed, farmed and/or logged. The intensity of each activity likely fluctuated with the economy and the demand of the marketplace, both regional and international. Economic activity occurred on virtually all the basin, with grazing being the dominant use in areas that are seasonally inundated. From Smith and Wenger (2001):

“Landuse in the drainage ranges from suburban residential development around Black Lake, wetland and marsh in the floodplain for six miles below the lake and for eight miles below the community of Littlerock, downstream to the agricultural land in the lower nine miles of floodplain. The uplands above the wetland habitat downstream of Black Lake are rapidly developing, with the remainder of uplands west of the river managed for commercial timber. The lowlands east of the upper river are primarily agricultural or rural residential property....

In 1922, a flood control ditch was excavated from the north end of Black Lake, into Percival Creek, which then drains [north] into Puget Sound near Olympia. Deepening of the ditch in 1952 and 1976, along with progressive down-cutting, have resulted in the Black Lake Ditch becoming the primary outlet of the lake [instead of into the Black River to the south]. In the 1960s, a gas pipeline was excavated across the Black River, 1.5 miles downstream of the lake. The excavation left spoils in the stream, which resulted in vegetation growth along with beaver dam debris accumulation.” [Smith and Wenger 2001]

METHODS

Historic Vegetation and Conditions

General Land Office survey notes and maps were from online sources (BLM 2006).

From the historic GLO Township maps, digital layers were created for the perimeter of prairies (from Easterly et al. 2005), marshes and those hills depicted on the maps.

In addition, a digital layer was created from bearing tree data from the GLO and DLC surveys. Another digital layer was created for summaries of the vegetation encountered for each mile segment from the GLO field notes. Information in these summaries included dominant tree species encountered, areas with burnt timber, and understory characteristics (species composition and density).

We used information contained in those layers and topography to identify areas that had evidence of having been maintained by frequent, low intensity fires, generally located near mapped prairies. This included woodland and wet prairie habitat that appeared to have had a pulse of tree reproduction, possibly due to a reduction in the frequency of landscape management by Indians (see Easterly et al.

³ DLC data was not used in making those maps.

2005). Woodlands were identified by bearing trees that averaged more than 20 inches diameter and more than 70 links⁴ (approx. 46 feet) distance. Near mapped prairies, the woodlands were extended to potential firebreaks such as to wetlands, creeks, or to areas where higher density forest had undergone intense, stand-replacement fire (i.e., did not have a frequent fire interval historically). Where insufficient information was available to draw polygons, the information was recorded as point data.

Other vegetation types were the following. *Forest* indicated conifer-dominated with tree densities greater than in woodland. Bearing tree species included fir, hemlock, cedar, maple, vine maple, alder, ash and pine. *Deciduous woodland* had more deciduous trees than fir and included ash, maple, dogwood, vine maple, and hawthorn. This area occurred primarily in lowland riparian areas. *Shrub swamp* was used to indicate lowlands with bearing trees that included willow, cascara, hawthorn, crabapple, and ash; wet areas with spruce⁵ and pine were also given this designation.

In addition, library, online and local resources and historians were employed to access references to the Black River by early explorers, residents, and others.

Current Vegetation

Digital aerial imagery of townships was used to create a GIS layer⁶ on which preliminary polygons represent visible changes of vegetation patterns; the polygons were drawn to depict the finest level of detail that could be seen on the digital photos. Digital imagery of 1941 aerial photos was also consulted to better understand historic land use in the wetland and prairie areas. Occurrences of oak and grasslands mapped by Chappell (2003) were assessed and incorporated as appropriate.

Field visits were made to representative areas within publicly accessible land within a two-three mile corridor along the Black River during the spring and summers of 2006 and 2007; riverside vegetation was surveyed by canoe during July and August, 2007. Riverine vegetation was prioritized for mapping and field visits; upslope areas other than Glacial Heritage and Mima Mounds preserves were mostly privately-owned and were generally not visited.

During field visits, vegetation within the pre-drawn polygons was identified and polygons were redrawn and merged as necessary.⁷ The vegetation was periodically characterized with informal plots noting species composition and coverages. Polygons were later reconciled with the National Vegetation Classification System (NVCS; NatureServe 2008), using a multi-thematic approach with the goal of depicting and describing the vegetation at the finest scale possible.

⁴ Measurements were made in chains and links: 80 chains = one mile and 100 links = one chain (one link = 7.92 inches)

⁵ Spruce was variously indicated in the surveys as 'swamp fir' and 'yellowwood'. Pine was occasionally called 'Scotch pine'. Names for cascara included 'bearberry', 'chittenwood' and 'shittenwood'. Cottonwood was referred to as 'Balm of Gilead.' Fir was commonly referred to as 'pine' in the notes from the early explorers, but was referred to as 'fir' by the time of the GLO surveys.

⁶ Digital imagery was from 2003. GIS layers were either created or georectified to NAD 1983 HARN, State Plane, Washington South, FIPS 4602 Feet.

⁷ Areas that had been developed and/or had timber harvested since the imagery was made was not updated for this map.

RESULTS

Historic Records

Explorer Accounts

The McMillan Expedition, November and December, 1824, had two clerks, J. Work and F. Annance, both of whom recorded their experiences and observations. A number of their comments from the Black River leg of the trip are summarized here.

Padding bateaux⁸ and traveling upriver from the confluence with the Chehalis River, they went "6-8 miles" on their first day and made the following observations.

"The Black River so named from the colour of its water, is from 20 to 30 yards wide, towards its lower end the navigation is very good, the water is deep and the current is not strong, but about 5 or 6 miles up it the navigation gets troublesome as the current becomes strong and in many places so shallow that the boats could scarcely be dragged through it. The river was also in two places blocked up with driftwood, at one of which a portage was made, a passage cut through the other, a great deal of drift wood is piled on the shore at many places along the river. The banks of this river are in some places elevated and in some places low, the high banks are generally clothed with lofty pine [fir] and the low one with poplar, ash, alder, etc., and the low points with thick willows...

This river would not be passable for such craft as ours in the dry season. A great many dead salmon are in the river and many are just alive and barely able to move through the water. Passed an Indian house belonging to the Holloweena⁹ nation, I counted 12 persons at it, probably some more were in the house."¹⁰ [Work 1824]

Their first night was spent camped near an Indian village and "a fine prairie" across the river (Annance 1824), which would have been in the prairie that currently includes Gate City. The second day they proceeded about "nine miles" upriver:

"... In places the river was very shallow and our progress was sometimes obstructed by driftwood. In other parts the navigation was good as the water was deep and the current slack. The appearance of the country is changing considerably as we advance. The low points are covered with willows and small poplars, plane [?] and some oak trees, while the higher banks have pine [fir], and some distance appear hills thickly clothed with pine, between these hills and the river there are in some places fine plains. Saw several marks of beaver....

Passed two houses of the Holloweena Nation at which I counted 10 men and as many women besides children, probably some more were in the houses. Saw some more Indians some of whom had horses." [Work 1824]

⁸ Bateaux are shallow-draft, flat-bottomed boats which were used extensively across North America, especially in the colonial period and in the fur trade. They were traditionally pointed at both ends and came in a wide variety of sizes.

⁹ This name applied to the Upper Chehalis (Crooks 2001). It was used only by Work to describe the people along the Black River.

¹⁰ When the expedition was travelling along the Chehalis River, some Indians were seen fleeing into the woods upon spotting the foreigners, possibly wary of being raided. Hence, Work did not assume that he was seeing all residents of the houses as they passed.

They made early camp on "Buttes" Prairie (a prairie with Mima Mounds). This encampment was located somewhere between Mima Creek and Shotwell's Landing, possibly at the convenient landing off the backwater in the middle of Glacial Heritage. They waited here for three days while Annance was "sent to the principal Halloweena village a few miles off, for the trader Pierre Charles who had been with the Indians for some time"¹¹ (Work 1824).

Work (1824) also noted

"Since we have been here several of the Halloweena Indians from the neighboring village have visited us. Their mode of life, manners, language, etc. differ little from the Chihailis, indeed, they may be considered a detached part of that tribe."

After breaking their encampment of three days they proceeded upriver "about five miles", a reach in which the channel is "pretty deep and the current not strong except at some points". At that point,¹² the river became

"...so narrow and nearly choked up with willow and trees that we found it necessary to make a portage....a distance of 2,980 yards. The boats were brought up by water which was such a tedious business, a road having to be cut for them in many places through the bushes...
...the shores are complete thickets of willows and different kinds of deciduous trees, mostly ash. The portage is a fine road through a handsome plain. Saw several marks of beaver by their cuttings they seem to be fonder of the ash than other trees." [Work 1824]

From the portage site, the river

"...widened a little... but was in many places nearly choked up with willows, but on account of the recent rain there was plenty of water. Pine [fir] trees lined the shores which are low at some distance from the water, the intervening space is covered with thick willows and small trees of different kinds." [Work 1824]

Additional prairies and native (long) houses were later noted around Black Lake, including an "old indian lodge" where during the night Annance was driven out by 'proprietors of the soil [fleas]' (Annance 1824).

For the 1841 Wilkes Expedition, the record keepers were Geo. M. Colvocresses, Midshipmen Henry Eld, and W. D. Brackenridge (a botanist). The following observations are taken from Colvocresses and from Wilkes' official "Narrative" of the trip, which apparently includes Eld's comments, whose diary did not survive.

Using HBC relationships with native leadership at the fort, they met with a "Woman Chief...of the Sachal tribe, who has promised to meet us at the first 'portage' [Eld Inlet] and act as our guide to the Sachal [Black] River." (Colvocresses 1855, p 242)

Carpenter (1986) and McBride (undated) informs us that this is likely "Queen" (also known as What-co-blote, Kai-Kai-Sum-Lute and other names), who's "influence and leadership were quite extraordinary for

¹¹ Pierre Charles was a mixed blood Abenaki Native / French Canadian (as was Annance) who had come to the region in 1818 with the North West Company.

¹² At approximately River Mile 15.5, near Littlerock and the braided reach of the river.

her time" (McBride, undated). Colvocresses (1855) noted that "She is a woman of great energy of character, and exercises greater authority over those around her than any man chief I have met since we have been in the country." The "Queen" was said by Huggins (of the HBC at Ft. Nisqually) "to be a great Ta-mah-nus woman, or dealer in magic" (Carpenter 1986).

Wilkes' (1844) composite narrative describes travelling from Lake Sachal (Black Lake) and entering the river of the same name.

"This appeared at first almost impassable, for it was for four miles almost choked up with Sparganium, Nup[h]ar, &c., so that it was difficult to pass even with the small canoe. Its breadth was from twenty to sixty feet, and it was from three to twelve feet deep. The turns were sometimes so short, that the large canoe would be in contact with the thickets on the banks at both ends, and it required much force to drag her along, by pulling by the branches, and caused great labour in cutting their way. They also unfortunately lost their hatchet, which afterwards proved a serious mishap.

They were obliged to continue their course down the river, until nine o'clock at night, before they could find any place to encamp, on account of the bog and jungle. At that hour they came to a small green spot, occupied by a party of Indians. Here Mr. Eld obtained some altitudes of the north star for latitude; and the next day, being compelled to make a portage of two miles to avoid an impassable part of the river, he employed himself, during the time it was making, in getting a full set of equal altitudes. By 6 P.M. they had carried every thing across and embarked; but the river was full of sand-bars, shallow rapids, and sunken snags, which often compelled them to drag the canoe over by main force. The land on both sides of the river is flat, marshy, and well wooded. Among the trees were many ash." [Wilkes 1844, pp 132-133]

Upon entering the River, they encountered the same combination of driftwood or trees and bushes as the McMillan Expedition, and later found that the reach of the river was best negotiated using poles instead of their paddles. Finally, after a day that included a "portage of two miles," they had by the second night had reached the same principal village or "the town belonging to the Sachel tribe of Indians." Eld said they appeared to be "more cleanly and industrious than the tribes of the region" and estimated the population at 40. The chief would not accompany the group downriver because he was afraid to go among the "Chenooks". Colvocresses (1855, p245) noted that "The country about this town afforded good pasturage. And we observed numbers of horses grazing."

During the next afternoon, they

"...were compelled to make two long portages... (during which) we observed several deserted huts. About 5 P.M. we were overtaken and passed by our old friend the (Woman) Chief, and her husband. She informed us that they were going to pay a visit to her sister, who resided on the banks of the Chapel/Chalap [Satsop] River. Her canoe was large and handsomely painted, and was paddled by five slaves, two of whom were women." [Colvocresses 1855, pp 245-246]

Another record of early navigation along the Black River was that of a steamship:

"In 1866, Chehalis Valley residents built the steamer 'Satsall' in Montesano, which navigated the Chehalis River picking up produce on the way. The Boat then entered the Black River and landed at what's known as 'Shotwell's Landing' just south of Littlerock." [Stevenson 2006]

And finally, Cooper made the following comment about the Black River after having travelling extensively in the Territory for the North Pacific Railway Survey during 1854.

“Around this is the most extensive swamp I have seen in the Territory, partially covered with forest, and doubtless producing many plants not to be found elsewhere. I had no opportunity of collecting anything there.” [Cooper 1860]

General Land Office and Donation Land Claim Surveys

The General Land Office Township maps with information incorporated from all the bearing tree data, field notes and Donation Land Claim surveys are presented in Figure 4. The GLO records indicate stand-replacement or hot woodland fires in 17 separate areas within the study area. Burned areas indicated on the map are presented with a high degree of confidence, although the polygon boundaries in the interior of Sections were inferred and have a lower confidence level. Within some of the burned areas, bearing tree information indicated that the fire had been either through woodland that had had some conifer regeneration or through more dense forest that apparently had undergone a stand replacement fire.

A careful interpretation of the GLO field notes and bearing trees between these burnt timber areas and nearby prairies (with no intervening streams) often had woodlands with large, widely spaced fir (usually) and/or oak trees. In addition, some settings along reaches in the southern portion the river had data indicating understory fires in woodlands near prairies, and which extended to the transition into wetlands, with no associated ‘burnt timber’ noted. As implied above, some areas with ‘burnt timber’ had bearing tree with distances, size and/or species that indicate that the site was probably woodland that hadn’t burned in some time, rather than stand-replacement fires. Some bearing trees within these areas were similar in size, probably representing post-fire cohorts. Definitive interpretation of this was not possible due to the limited data points and their variability. Understory vegetation in these areas was often recorded as being as light (little or no undergrowth and ‘nearly open barrens’).

Numerous wetland swales and creeks were interspersed with areas recorded as burnt timber, especially in the area north of Beaver Creek. The quantity and density of prairies within the basin, in addition to areas that appear to have supported woodland and/or the apparent stand-replacement fires in more upland sites, suggest that the fire and prairies were closely juxtaposed with the wet settings. The topography and complex outwash patterns in much of the study area created vegetation patterns that vary on a fine scale, especially relative to the broad gravel plains of Fort Lewis, for example. This fine-scale variability created ‘noise’ in the data set that was frequently not captured by the relatively coarse GLO and DLC surveys. Wet prairie, woodland and burnt timber polygons represent only those areas captured by the course level of the survey grid and data gathering. Therefore, these polygons likely under-represent the extent of wet prairie, woodland and burnt timber habitat that existed in the 1850’s.

While General Land Office Surveys in some areas were subject to bias and fraud (Gelatowitsch 1990), the surveys in the study area appear to have been of high quality, although the extent of observations