PREDICTING HISTORICAL LOGGING CAMP LOCATIONS IN THE CAPITOL STATE FOREST, WA

by

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Abstract

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Historical logging camps represent an important period in the resource extraction history of the United States. Logging camps can provide historical context about the people who inhabited these camps. Identifying and locating historical logging camps allows archaeologists to collect data from them, furthering research about these specific site types. Finding historical logging camps also helps land managers protect those sites from major disturbances. Due to their temporary nature, many historical logging camps were undocumented, making them difficult to locate and manage around. Demonstrating there is a measurable variable for site locations would improve the ability of archaeologists and land managers to identify and protect undocumented sites. One possible variable is the distance between camps. The Mason County Logging Company (MCLC) was the largest logging company that operated in the Capitol State Forest located near Olympia, Washington, during the late nineteenth and early twentieth centuries. To date, 15 known and assumed logging camps used by MCLC have been identified, but there are large gaps in the forest where no MCLC camps are known to have existed. Calculating the average distance, plus or minus one standard deviation, between known and assumed MCLC camps could identify other undocumented logging camps used by the company. Average distances were obtained by mapping the known and assumed MCLC logging camps in ArcMap and calculating the distance between them by rail line. Each distance segment was field verified for signs of past habitation. Although artifacts and features were discovered during field verification, no definitive evidence of historical logging camps was found. Factors such as topography and proximity to water sources, among others, may have been more central to camp location than distance from previous camp sites. There remain more opportunities to test this average distance theory; however, spatial modeling using common site characteristics may prove more successful.

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Chapter 1 – Introduction

Historical logging camps represent an important period in the resource extraction history of the United States. As one of America's first exports, logging provided hope of prosperity and financial security to thousands of early immigrants and settlers. Many early logging operations developed into thriving towns, but as the easily accessible timber was removed, logging companies had to travel farther into the wilderness and mountains to acquire timber to feed the lumber mills. As railroads became the standard method of transporting logs to mills in the 1850s, accessing more remote sites became increasingly easier; however, transporting loggers to these remote sites from towns was becoming more costly to company owners in relation to work time lost. To address this issue, logging camps were constructed away from company towns to reduce travel times to work sites.

Thousands of loggers from the mid-nineteenth through the mid-twentieth centuries spent time living in these isolated logging camps connected to the rest of society, including their families, only by railroads. These logging camps can provide historical context about those people who inhabited the camps and what life may have been like for them during, possibly, the greatest logging era in America. Studying the artifacts and features of these sites could provide valuable information to archaeologists, anthropologists, historical ecologists, historians, environmental historians, genealogists and more.

Most logging camps were temporary and remain undocumented and unsurveyed. Identifying historical logging camp locations has typically been completed by researching historical maps and documents as well as interviews with former camp inhabitants or family members. The number of historical maps and books which depict logging camp locations is limited and, as time goes on, the number of people who could provide first- or second-hand knowledge of these camp sites becomes smaller and smaller. Therefore, in the absence of these historical sources, establishing a potential method to better locate historical logging camps based on patterns would be valuable to archaeologists and land managers, allowing them to document and protect these historical sites. Can the distance by rail line between known camps be used to identify the location of additional undocumented camps? Also, does it matter how distances between camps are calculated: from the edges of a camp extent, from a central point within a camp, or a combination?

This research aims to identify historical logging camp locations used by the Mason County Logging Company (MCLC) in the Capitol State Forest near Olympia, Washington, based on the distance between known and assumed camps along the railroads that connected them. Assumed camps were inferred based on historical evidence and by comparing the characteristics existing in the assumed camp area with those common among the known MCLC camp sites. The reasoning behind using an average distance is because logging company owners and managers selected camp locations in advance of operations, they likely determined an approximate distance a logging camp should be built from the company town or previous camp in order to maximize production. This approximate distance may have been calculated through some sort of cost analysis based on one or more of the following factors: how long it takes to transport workers to a work site; how long it takes to harvest an area based on topography, timber size (e.g. diameter and height), and logging technology; or how long it takes to deliver the timber back to the mill in order to keep the mill operating at capacity. Engineers traversing new rail lines through the forest would have used this approximate distance to identify the most feasible camp site nearest that distance. The average distance plus or minus one standard deviation provides a range where one might expect that engineers would have identified the best location(s). It is predicted that other undocumented MCLC camp sites could be found within this average distance range.

In the case of the MCLC, the distance between logging camps by rail may not have been a determining factor for logging camp location. Insufficient evidence was discovered in any calculated distance range to definitively label a site as a logging camp. Average distance in relation to MCLC camp spacing appears to be coincidental and logging camp locations may be related to other factors such as topography, proximity to water resources, technology changes, and land ownership. Also, there was no clear difference in success among the three methods for calculating distance between camps, likely due to the small differences between averages. Altering the methods used in this thesis to determine distance between camps may provide more definitive results; however, spatial modeling based on common logging camp site characteristics may prove to be more successful in determining potential historical logging camp locations in the absence of historical documentation.

There remain more opportunities to test this theory in Washington and other states where large-scale logging operations occurred. Ideally, this theory should be tested in an area that was operated on or owned by a single logging company and was a large enough area to require multiple logging camps. An average distance would vary by logging company; therefore, two or more logging camp locations need to be known in order to calculate a potential, company specific, distance between camps.

Chapter 2 – Literature Review

Introduction

Although logging is no longer looked upon as favorably as in the past and many towns and cities once supported by logging have faltered in recent history, it can be argued that logging is as important to America as any other long-standing industry. Logging helped construct early America by providing fuel, shelter, and transportation along with countless other products. Logging provided a glimpse of the American Dream to thousands of early Americans. The companies who harvested the vast tracts of forest that once covered much of the United States provided homes to many of those people chasing financial security. After railroads became the primary mode for transporting logs from forest to sawmill, areas once inaccessible to logging became available, occasionally at great distances from existing sawmills (Cox, 2010, pp. 62 & 138). Large landholding and logging companies built satellite work camps away from main sawmill sites because the cost of transporting workers to the timber, as well as the valuable work time lost during transport, outweighed the cost of building the work camps (CALTRANS, 2013). These work camps, or logging camps, can provide details about the lives of early loggers who harvested America's timber.

Federal archaeological guidelines require the identification and protection of sites with cultural or historical significance (NPS, 2002). Following these federal guidelines, archaeologists can determine the significance of a site only after obtaining important site information such as who used a site, when, and for what reason. Locating, documenting, and, if significant, protecting historical logging camps should be primary goals of archaeologists as forest managers begin harvesting the second or third growth timber in the forests where early loggers once worked. Locating these historical sites is not always an easy task since many logging camps were short-lived and often went undocumented (CALTRANS, 2013). Some historical logging camps have been documented in literature written by former loggers while other camps, having still been in existence at the time of drafting, are denoted on historical maps. Other potential methods for locating historical logging camps include remote sensing and spatial modeling. Management of archaeological sites can only take place once they are located and varies depending on the relevant significance of each site.

Section I of this literature review will examine the early history of logging in America to demonstrate the important role logging played in the founding of the nation. Attention will be paid to the methods and technology used by early loggers to cut trees and to transport felled timber to markets. Section II will focus on logging camps and will include details about the necessity of such camps as well as what life may have been like for workers inhabiting logging camps in order to detail the significance of logging camps in the lives of thousands of early American settlers. Section III will introduce archaeological methods such as remote sensing and spatial modeling used to identify sites of cultural or historical significance. The literature review will conclude with a look at Cultural Resource Management (CRM) in Section IV and will touch on methods used by archaeologists and land managers to protect cultural and historical sites.

Section I

Logging to Build a Nation

The history of logging in North America starts well before the founding of the United States. Literature discussing the history of logging in America can often be separated into two categories; those that discuss the vast environmental degradation as a result of irresponsible practices and those that glorify the logging era and the people involved. Studies of the environmental impacts caused by logging have been ongoing following the major logging era as problems related to poor management became evident. The history of logging in regards to the people and the methods they used can be found primarily in books written during or not long after the major logging era was over.

Books discussing logging history are often written by people who took part in those early logging operations or who were fascinated by early loggers and the ingenuity they showed providing timber to the nation with limited, and sometimes unsophisticated, technologies. The trio of books written by Ralph Andrews: *This was Logging!*, *Glory Days of Logging*, and *Timber: Toil and Trouble in the Big Woods*, provide nearly every detail of the inner workings of life and labor in the logging towns and camps of western North America during the late nineteenth and early twentieth centuries. Andrews (1954, 1956, & 1968) speaks fondly about the people he met during his time in logging camps, showing the regard he had for them and the job they did.

There have been numerous books providing insight into the great logging era in the Pacific Northwest. These books include *Railroads in the Woods* (Labbe & Goe, 1961), *When Timber Stood Tall* (Pierre, 1979), *Capitol Forest: the Forest That Came* Back (Felt, 1975), and *Logging Railroads in Skagit County* (Thompson, 1989). Books written primarily about single logging companies also provide great details about logging history and the people involved. These books include *The Pine Tree Express* (Henderson, 1990) about the Cascade Lumber Company in eastern Washington, *The Oregon-American Lumber Company: Ain't No More* (Kamholz et al., 2003), *Time, Tide and Timber: A Century of Pope and Talbot* (Coman & Gibbs, 1949), and *Family Trees, Simpson's Centennial Story* (Spector, 1990) about the Simpson Logging Company in western Washington. There are few sources, however, that attempt to cover both environmental impacts and the historical aspects of logging in America. One such work, Thomas Cox's (2010) book *The Lumberman's Frontier*, provides an objective and comprehensive history of logging in the United States from pre-colonial times through the early twentieth century while focusing on the people and their practices.

Timber was the main source of fuel and a common material for structures and goods as well as a prime source of material for Royal Navy ships; however, it was not the vast acres of forest that drew settlers to North America (Cox, 2010, pp. 1-3). Many early-American farmers wanted to model their life in The New World after what they knew in Europe; open land free of forest except for scattered trees, an "agricultural society" (Cox, 2010, p. 1). Incoming settlers cleared much of the forests of North America to create farms because they viewed the forests as an impediment to successful agriculture; however, not all farms were successful in these early times. Many farmers settled away from larger towns, which allowed them few opportunities to trade their goods for other necessities (Cox, 2010, pp. 1-11). For this reason, many farmers began to utilize the timber in and around their land to supplant income not gained from agriculture. Farmers could sell their timber, for money or goods, to other settlers or to budding towns where they needed wood to supply builders and craftsman (Andrews, 1954, p. 78; Labbe & Goe, 1961, p. 9; Cox, 2010, pp. 1-11).

Although colonists mainly viewed the never-ending forests of North America as a hindrance to the life they wanted to create for themselves, the value of the timber in those forests quickly shifted the focus of many early settlers from agriculture to logging. In the seventeenth century, demand for wood products in North America and England became so great that settlers began constructing sawmills in great numbers all over the east coast of North America (Cox, 2010, pp. 23-9). Early sawmills first supported only those who harvested and milled the timber along with their families, but as demand and production of lumber increased, so too did the needs of the mill workers. Shops and manufacturers met these demands by providing essential items to families supported by sawmills. The introduction of commercial goods and services around thriving sawmills created towns and new markets, which, in turn, drew families from other areas in search of opportunity (Coman & Gibbs 1949, pp. 163-73; Cox, 2010, pp. 23-9).

As sawmills increased production and profits, and as the towns being erected around sawmills grew, so too did the demand for commercial timber. Early loggers moved through the forests of eastern North America to satisfy the needs of the flourishing timber industry quickly and with little care for anything other than profit (Cox, 2010, p. 28). Logging operations removed forests in close proximity to sawmills and, by the early eighteenth century, the logging machine moved into the interior forests along the East Coast.

Technology required to get logs to mills changed rapidly during this time. A common practice until the late nineteenth century, horses and oxen provided the power to pull the logs once cut (Andrews, 1956, p. 64 & 1968, pp. 69-70 & 85; Labbe & Goe, 1961, p. 9; Cox, 2010, pp. 12-5, 57-72). To make moving them easier, loggers stockpiled logs until the winter months when they could be sledded over frozen ground (Cox, 2010, pp. 12-5). The abundance of timber near large rivers allowed logs to be floated to mills located along those rivers or their tributaries (Andrews, 1956, pp. 130-2). This method included the use of splash dams where a build-up of logs and water are held behind a dam typically constructed from logs. When the time came to transport logs to mills, splash dams were removed, allowing the excess water once impounded by those dams to carry the logs downstream. Large amounts of cut timber could be kept until needed at the mills by organizing them into collections of floating logs or 'booms' (Labbe & Goe, 1961, pp. 9-10; Cox, 2010, pp. 12-5 & 57-72).

Getting timber to rivers became increasingly difficult as loggers removed the more accessible forests; they needed new technologies to access forests located further from the rivers and streams used to transport the timber (Spector, 1990, p. XV). Railroads allowed the transportation of cut timber from the most remote forests and initiated the greatest logging era in United States' history (Labbe & Goe, 1961, pp. 5 & 9-10; Cox, 2010, pp. 62 & 138). Logging operations supported by railroads moved even more swiftly through America's vast forests. The logging practices and methods used to transport timber to mills had major impacts on the landscape of the United States. The construction of logging railroads left miles of scars across once forested hills where workers filled in areas to make level grades and blasted or cut through hills to make way for rail lines (Labbe & Goe, 1961, p. 29). Rivers had their normal processes disturbed or altered by the dams used to build up water supplies for mills and to provide adequate transport for logs. The construction of canals to connect major water ways in order to transport logs to specific mills and markets left permanent reminders of past logging activities (Cox, 2010, pp. 57-63 & 88-91).

The California Department of Transportation (CALTRANS, 2013) recognizes technology as being the major factor influencing costs of labor for early logging. Horses and oxen required fewer workers than those operations using rivers to transport timber. When the common method for transporting timber to rivers and sawmills shifted to railroads in the mid-nineteenth century, the need for a "larger and more highly skilled workforce" became apparent (Labbe & Goe, 1961, pp. 5, 9, & 29; CALTRANS, 2013, p. 96). The industry now required engineers to design rail lines and more workers to construct the miles of rail lines throughout the forests. These workers commonly occupied construction camps located in remote locations. Construction camps were often temporary, moving along with the progression of construction (Labbe & Goe, 1961, pp. 29 & 149; CALTRANS, 2013).

As logging operations moved further from mill sites, the costs to transport loggers to timber stands increased as did production time lost due to that transportation (CALTRANS, 2013). The high costs of constructing railroads in the forest – Cox (2010) states mainline construction could cost as much as $50,000 per mile (p. 317) – needed to be balanced by finding measures to save costs and increase production. This led to the construction of satellite logging camps, which reduced the amount of potential work time lost from transporting loggers long distances. Camp locations were selected before logging operations began as part of log transportation planning to ensure a profit could be made (Andrews, 1954, p. 74). This fact could point to there being a more systematic approach for choosing camp locations.

Logging practices that began along the east coast of the United States eventually spread to the Great Lakes states, the southern United States, and finally to the West Coast (Labbe & Goe, 1961, p. 5; Robbins, 1985; Cox, 2010, pp. 125-89 & 213-89). Common themes arose in every location, beginning with removal of trees for agriculture; however, the main drivers of the industry became timber speculation and utilization. Companies and entrepreneurs from states such as Maine and Minnesota hired people to find untapped stands of timber near burgeoning markets where greater profits could be made (Cox, 2010, pp. 125-89 & 213-89). With its massive timber and coastal access, Washington State came to the forefront of the logging industry in the nineteenth century (Labbe & Goe, 1961, p. 5).

Logging in Washington State

By the time major logging began in Washington State, railroad logging had become the primary extraction method; however, some small landowners still used horse and oxen to transport timber (Labbe & Goe, 1961, pp. 5 & 9). With less favorable topography and fewer navigable rivers, delivering logs by river may not have been as common in many areas of Washington. Puget Sound, however, provided a suitable means for transporting logs to mills (Labbe & Goe, 1961, p. 211; Felt, 1975, p. 26). In reviewing maps showing historical logging rail lines, logging railroads appear to be constructed along many of the major stream channels in Washington (Thompson, 1989; Henderson, 1990; Hannum & Hannum, 2002 & 2006). These areas often provided the gentle slopes required for adequate train movement; railroads require sustained slopes of three to five percent. This slope limitation not only restricted the amount of available routes through a forest, but, consequently, limited the number of sites available for logging camps. Rail lines along streams also provided access to a water source, a necessity for workers and operations.

Many small logging companies operated in a single drainage because the cost of land claims was high and many of the larger forested areas had already been purchased or claimed by other timber speculators (Robbins, 1985). These small companies delivered logs to privately-owned mills and may have only had a single logging camp as the base of operations. Small companies with one camp, or no camp at all, would be difficult to locate as there may be no recordings of such small operations. Research on these smaller companies and their associated camps has been limited mainly because of this lack of evidence. Instead researchers have focused primarily on the "large and midscale" operations because of the abundance of evidence left behind on maps, in company records, and remnants on-site (CALTRANS, 2013, p. 98).

Companies that owned or had rights to operate on large acreages constructed sawmills in close proximity to those lands with rail lines spreading throughout their surrounding landholdings (Carlson, 2003, pp. 6-15). Large rail networks were often only financially feasible to large-scale logging companies (Cox, 2010, p. 317). Similar to developments along the East Coast and upper Midwest during the early years of mainstream logging in the United States, major sawmill locations became industrial town sites (Carlson, 2003, pp. 6-15; Cox, 2010, p. 285). Company towns grew to accommodate employees, their families, and the commerce needed to supply its residents. Mills, being in set locations, also required permanent living quarters for workers, leading to companies constructing towns with enduring structures (Carlson, 2003, pp. 6-15; Cox, 2010, p. 285). Having exhausted timber in close proximity to sawmills and company towns, costs of transporting loggers to work sites became increasingly more expensive than constructing satellite work camps (CALTRANS, 2013).

Depending on the logging company and location, logging camps may have been constructed with more permanence in mind, containing more structures with concrete foundations. More often than not, these camps had to be moved as quickly as work progressed through the forest (CALTRANS, 2013). Because of the ephemeral nature of logging camps, their construction allowed for quick removal and transportation to another location (Figure 1; Labbe & Goe, 1961, pp. 29 & 149). In fact, Labbe & Goe (1961) state structures used to house the bachelors in logging camps had to be built on “runners” or skids to facilitate this rapid movement (p. 149). Kitchens could also be built on skids or railcars so they could be loaded onto trains and easily moved. Temporary logging camps may have only existed in a given location for one to three years and many factors likely influenced the duration of camp use, including the amount and size of timber as well as the feasibility of removing it (Cox, 2010, p. 284). More research can be done regarding the duration a camp existed in a specific location, which may also help predict locations of undocumented camp sites.

Figure 1. Example of a logging camp bunkhouse on a railcar. Having moveable structures allowed for quick movement of logging camps to new locations. Photograph by Clark Kinsey (UWL, 2015).

Although temporary, these camps still had to accommodate the needs of the workers for varying amounts of time. Other than a kitchen providing sustenance for the workers, many goods needed for everyday life had to be obtained from company stores (Ayers, 1996; Carlson, 2003, pp. 6-15). This meant workers had to ride the trains back to town or hike back through the forest (Pierre, 1979, pp. 56-64 & 79-80). Dishes from kitchens and bottles once containing condiments or personal use items were indicative of the temporary nature of camps and were commonly discarded at camp sites once they broke or had served their use.

In the 1920s, a shift in technology to logging trucks allowed workers to commute to work, but the shift took time to develop into common practice and railroad logging continued to be the main method for log transportation in the West until the 1940s (Cox, 2010, p. 314; CALTRANS, 2013). Logging camps would no longer be needed as transportation costs fell and technologies such as the chain saw improved tree removal rates. As the amount of available old-growth timber slowly fell to the saws and axes of the twentieth century, so too did the number of railroads and workers needed to harvest the trees (Robbins, 1985). All that remains are the scars on the landscape and remnants of the wares left by the people who spent their lives working in the forests during a great period in the history of the United States. Locating former logging camps and analyzing what remains could provide great insight into the lives of former inhabitants. This research project attempts to identify a method to locate more of these sites in what is now known as the Capitol State Forest, Washington, United States.

Section II

Historical Logging Camps

To be eligible for listing in the National Register of Historic Places (NRHP), a site must contain information that can contribute to the overall understanding of a specific aspect of human history. The specific criteria for a site to be eligible for the National Register are (NPS, 2002, p. 2):

> *The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association,*
> *and:*
> - *A. That are associated with events that have made a significant contribution to the broad patterns of our history; or*
> - *B. That are associated with the lives of persons significant in our past; or*
> - *C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*
> - *D. That have yielded, or may be likely to yield, information important in prehistory or history.*

It could be argued that historical logging camps fit all criteria except criteria B. Logging camps are representative of a very finite, but important time period in the history of the United States. Identifying and locating these sites can improve our understanding of the living conditions and lives of these early-American forest workers. Judge et al. (1988) notes archaeologists have been solely focused on identifying sites and the artifacts found, spending little time working out possible reasoning for site locations and what life may have been like for the inhabitants of those sites. Locating sites and describing remnants and artifacts are a necessary facet of archaeology; however, determining the overall context of a site will better "contribute to [the] scientific understanding" of archaeological sites (Judge et al., 1988, p 3).

Work camps such as logging camps offer archaeologists an opportunity to analyze "discrete data…related to ethnicity, assimilation, acculturation, rural life, immigration, labor, and socioeconomics" and attempt to answer questions about the daily lives of camp residents (CALTRANS, 2013, p. 11). This section will cover some dynamics of camp life and include findings from research related to each factor discussed for the purpose of demonstrating the significant historical context logging camps represent. Much of the research in relation to logging camps has focused on the social aspects, including the inclusion of workers' families, differences in ethnic backgrounds, and the general lifestyle in rural work camps.

Some of the most common data related to logging and other work camps discuss the workers, typically men, living in the camps. Ayres (1996) details information about work camps of the Standard Timber Company who operated in Utah. The report discusses the types of workers inhabiting camps as well as the inclusion of women, and possibly children, in some camps. Ayres (1996) mentions that two types of men worked in the camps: professional and amateurs. Amateurs were often farmers needing to substitute their income during the "winter months when their agricultural responsibilities" had been reduced (p. 180). The Standard Timber Company preferred professional loggers because they "clearly out-produced" the seasonal loggers (p. 180). Ayers (1996) also notes that Swedish immigrants comprised the majority of the professional loggers and represented the "largest ethnic group" of all the workers (p.180). Ayers (1996) finds that the 'Swedes' typically worked longer hours than other workers, which could point to either their financial needs or work ethic (p. 180).

A common theme in much research is that single men in need of work comprised much of the logging work force, some of these men were former soldiers returning from overseas (Andrews, 1968, p. 61). Many bachelors enjoyed the lifestyle of a logger, working simply for money to spend at the closest tavern on alcohol, women, or both (Andrews, 1954, pp. 53 & 101 & 1968, p. 55). Andrews (1954) also notes many bachelor loggers were as “touchy as prima donnas,” quick to leave camp if the quality of food declined or after the first instance of mistreatment (p. 53). Because of this lifestyle, some managers thought of single male laborers as unreliable loners, only working to fulfill a need (Ayres, 1996; Carlson, 2003, p. 11; CALTRANS, 2013).

Camp managers and company owners sometimes attempted to curtail the drinking aspect of the logger lifestyle by not allowing liquor to be sold in the company stores (Carlson, 2003, pp. 10-1). Company owners attempted to keep camps as dry as possible by not allowing saloons to be constructed or liquor to be sold in town. As Carlson (2003) notes, “dry camps” typically had fewer occurrences of fights and also resulted in fewer accidents (p. 11). Not all companies tried to limit alcohol sales in town; some company owners allowed drinking based on the understanding that activities such as drinking kept the single workers happy and coming back to work (Carlson, 2003, p. 11). Regardless if a company allowed liquor to be sold in their town or not, rarely were locations for purchasing alcohol far enough away to deter loggers from finding a drink.

Hiring single men may have been a necessity based on the dangerous type of work involved, work for which a family man might not be willing to risk his life. Because of the view that single, often transient, workers were unreliable loners, some logging companies specifically hired married men. Other workers traveled with their families simply because they had nowhere else to go or had emigrated from a distant location. The inclusion of workers' families adds another aspect relating to the overall significance of historical logging camp life.

A Family Affair

As discussed above, loggers of the era tended to be single men trying to earn a wage. A fair amount of people going to work in the forests of the West came from other states in an attempt to make a better life for their family (Rohe, 1994); this often entailed traveling with their families to work sites and settling in company towns. Major mill and company town sites made accommodations for families, but satellite work camps mainly remained free of women and children. Exceptions existed and Ayres (1996) notes that the Standard Logging Company listed a total of 20 women living in seven different work camps.

Some logging companies specifically hired married men for multiple reasons; the main reason being that companies viewed married men as more dependable because they had to ensure steady employment to provide for their families (CALTRANS, 2013). The inclusion of families in camps could be dependent on job status as well. Maniery (1996, as cited by CALTRANS, 2013) notes workers such as managers had their families with them, but the common workers did not. An account written by George Woodward (1894) confirms this stating, by rule, the foreman was a married man and his family occupied a home in the camp. CALTRANS (2013) mentions that proper accommodations remained limited in camps, especially satellite work camps, leading to the exclusion of families. Some companies may have encouraged hiring men with families because the managers considered them "less mobile" and because the women and children could provide free or relatively cheap labor for the camps (Brashler, 1991; CALTRANS, 2013, p. 66). Andrews (1968) mentions that skid greasing, where grease was applied to the logs on the ground over which harvested timber was pulled, was a task for "boys exclusively," sometimes as young as 14 (p. 64).

In reviews of other sources such as Brashler (1991) and CALTRANS (2013), women played major roles in everyday camp life. Women usually handled the “domestic economy” in camps and evidence found demonstrates that wives made mindful decisions about certain household needs by paying close attention to family budgets (CALTRANS, 2013). In reviews of historical photographs, women appear to be common fixtures in the kitchens associated with mill sites. Women also had a need to provide for their family, but their labor often went unpaid. Responsible for upkeep of the home, women also prepared meals for their husbands and sometimes other men who boarded with the family (Brashler, 1991; CALTRANS, 2013). Women and children in camps became more prominent during World War II when the government removed restrictions allowing logging companies to hire women and boys in high school. Some women earned minimum wage based solely on managers’ disapproval of having women involved in logging operations. Logging operators based this low pay on the skills and strengths of the women, but perceived levels of skill and strength seem to be based on gender biases (Kamholz et al., 2003, pp. 215-16).

As more workers began bringing their families with them to company town sites, companies had “little choice” but to build infrastructure to support the families, including the building of schools to teach the children (Cox, 2010, p. 285). Ayres (1996) notes that the Standard Timber Company operated a school for the children living in the main camp and many other companies such as the Oregon-American Lumber Company did the same (Kamholz et al., 2003, p. 75). The Mason County Logging Company (MCLC) also built a school within the mill town of Bordeaux in 1903 (OAHP, 1985). The school in Bordeaux remained in operation until the mill, as well as the town, shut down in 1941 when the company had exhausted its timber resources in the Capitol State Forest (Felt, 1975, p. 32; OAHP, 1985).

Being isolated deep in the forest, logging camp occupants had little contact with the outside world. In addition to schools, some companies owned and operated stores and blacksmith shops. Company stores provided household goods and necessities, but at a cost. Stores typically provided food, clothing, hardware, and other personal items, but companies viewed stores as more a form of profit for the company than convenience for camp residents (Ayres, 1996; CALTRANS, 2013). Company stores often dealt in store credit based on a worker's production and pay, and, because of the isolated locations, workers and their families had "little choice but to patronize" the company store (p. 182). Unfortunately for the families, prices at company stores tended to be greatly inflated, something the companies could also get away with because of the isolation of the camps (CALTRANS, 2013).

Families of MCLC workers lived either in the mill town of Bordeaux or in the Hollywood family camp. Field surveys of both Bordeaux and the Hollywood family camp found numerous household items not commonly found at satellite work camps within Capitol Forest (Boire & Stilson, 2006; Ferguson 2011A). Some of these items included colorful ceramic wares and decorative ceramics from countries such as Czechoslovakia, France, Germany, and Japan (Boire & Stilson, 2006; Ferguson, 2011A).

Other artifacts discovered at the Hollywood site included women's and children's shoes and a small wheel, possibly from a tricycle (Ferguson, 2011A). The Mud Bay Logging Company also had women and children living in logging camps (Felt, 1975, p. 35). Felt (1975) writes that Mud Bay Camp 2 contained flowers such as daffodils and lilacs where a woman attempted to "bring civilization to a primitive wilderness" (p. 35). Field surveys of Mud Bay Camp 2 also uncovered a piece of a porcelain doll, indicating the possible presence of a child (Stilson, 2010A).

Amenities constructed in company towns made life more comfortable and appealing to the families of the workers. Companies occasionally constructed churches in town, sometimes even determining the church's denomination (Carlson, 2003, pp. 8 & 11). Companies provided locations for recreation within the town, including recreation halls or baseball diamonds (Carlson, 2003, pp. 6 and 11). Some company towns even had a theater to provide entertainment for workers and their families (Carlson, 2013, pp. 8 & 11). Recreation in the satellite camps remained simple, usually involving card games such as poker (Andrews, 1954, p. 26 & 1968, p. 56).

The presence of families in work camps provides another layer to the significance of life in such camps. Analysis of women and children in camps could further demonstrate their importance as well as the significant role they played in the function of logging camps not only in the industry as a whole, but in different locations as well. Research on loggers can also provide similar details about their life. For most of these workers, everyday life followed common themes. Brashler (1991) points out the historical context of family camps in different states such as the Great Lakes states and Appalachian states can vary. This may also be true of these types of camp sites in

Washington State as life may have been different for the early logging families of Washington compared to other locales. Some of these differences can be related to the many cultural or ethnic differences.

Ethnic Differences

Logging camps of the late nineteenth and early twentieth centuries became homes to thousands of workers representing a myriad of ethnic backgrounds. There is a growing amount of literature on the topic of ethnicity in relation to logging camps. Identifying more sites for examination will only further the understanding of what role ethnicity played among camps and companies. CALTRANS (2013) points out work camps attracted many immigrants because wages in such camps were much higher than what could be earned in their home country. Employers turned to native tribesmen, farmers, miners, “sailors who had jumped ship,” transients, soldiers, and immigrants for laborers in the woods (Andrews, 1968, pp. 55 & 61; Cox, 2010, p. 285). In a discussion of varying ethnic work forces in the Great Lakes area, Rohe (1994) finds that workers from other countries and states, often states along the east coast of the United States where the logging era was coming to an end, comprised the majority of camp residents (Rohe, 1994). In the case of the Great Lakes states, immigrants mainly came from Canada (Rohe, 1994), but other locations included immigrants from Sweden, Finland, China, Germany, New Zealand, and Ireland, to name a few (Andrews, 1954, p. 59 & 1968, p. 55; Franzen, 1992; Rohe, 1994; CALTRANS, 2013).

Franzen (1992) researches logging camps in Michigan, examining diet and ethnicities in the camps. The author finds, in relation to ethnicity, workers tended to retain family and ethnic ties as well as materials significant to their specific cultures

(Paullin, 2007). ‘Finns,’ a major immigrant group in early-Michigan logging, formed their own “religious, literary, and socialist clubs” (Franzen, 1992, p. 84). Finnish immigrants became major players in the social reform of Great Lakes work camps, leading towards a better organized and educated workforce in regards to working conditions and pay (Hoglund, 1960, as cited by Franzen, 1992). Immigrants from Finland helped start camp reform because they required good food and sanitation in their camps. Finnish immigrants also imported the idea of steam baths into logging camps, something Hoglund (1960, as cited by Franzen, 1992) notes was a “distinctive transfer of folkways” from their home country (p. 24). Varying ethnicities in work camps also resulted in different foods being supplied at the camps. Finnish immigrants included “fish and meat stews” more often as part of their diet (Franzen, 1992, p. 84). The inclusion of traditional elements, such as saunas and ethnic recipes, demonstrates how immigrants tended to “influence their new environment” with parts of their culture (Franzen, 1992, p. 94). Finnish immigrants are believed to have made up a significant portion of the logging workforce in southwestern Washington as well.

References to singular ethnic camps can occasionally be found in historical books and maps. The Oregon-American Logging Company hired Japanese workers to construct railroads, but segregated the workers into their own camp; segregating minorities into their own, often isolated, camps was a common practice during this time period (Carlson, 2003, pp. 14-5). The ‘Jap’ camp, approximately a quarter mile from the main logging camp, still included all the amenities of the main camp (Kamholz et al., 2003, p. 75). Japanese workers participated in logging operations for the Oregon-American Logging

Company until Pearl Harbor was bombed, at which time the Japanese workers were sent to internment camps (Kamholz et al., 2003, p. 215).

In Washington, Japanese workers were often employed to construct and maintain railroads. The Rock Creek Lumber Company, later renamed Walville Lumber Company, owned land and a company town named Walville in Lewis and Pacific counties. The Walville Lumber Company employed many Japanese workers, listing 74 in 1909 alone (Stilson, 2004). Japanese workers and their families lived in a section of the town named 'Jap Town' which also had its own cemetery (Stilson, 2004). Walville's Japanese residents introduced part of their culture to other residents of Walville, taking part in Sumo wrestling tournaments (Figure 2). One satellite camp of the Walville operation, a tunnel construction camp, was also found to have been occupied by Asian workers (Stilson, 2010B).

Figure 2. Image from Stilson (2004) showing Walville's Sumo wrestling tournament in 1910. The author notes long johns may have been worn so as not to offend women in attendance.

Similarly to immigration being a key factor in the founding and development of the United States, immigrant workers also shaped the life and working conditions of early logging. This included incorporating traditional foods and technologies as well as working towards better pay and living conditions (Hoglund, 1960, as cited by Franzen, 1992). Logging camps remain a significant source of data relating to immigrant labor forces during the major logging era of the nineteenth and early twentieth centuries (Franzen, 1992; Paullin, 2007). With the exception of the MCLC Hollywood family camp where ceramic dishware pieces were found originating from Czechoslovakia, Germany, and Japan, no evidence was found during research related to worker ethnicity in MCLC logging camps (Ferguson, 2011A). As mentioned above, other companies in Washington State had segregated camps for specific ethnic groups; therefore, locating additional logging camp sites could add to the growing body of evidence regarding the assimilation of immigrant workers to the culture of logging in America as well as American life.

Section III

Locating Historical Logging Camps

As discussed in Section I, logging and railroad work camps tended to be temporary and could be moved as quickly as the work progressed (CALTRANS, 2013). Due to the temporary nature of logging camp sites, numerous camp locations likely remain undocumented. Up to now, no literature or method exists to predict the location of these undocumented historical sites. There are sources from which a logging camp site can be identified, including historical maps, books written either about the logging industry or about specific logging companies, and personal accounts from the people who worked and lived in these camps. Books written about specific logging companies provide some details about the loggers and the camps they lived in. Books about the history of the Oregon-American Logging Company (Kamholz et al., 2003) and the Simpson Logging Company (Spector, 1990), are two such books written specifically about the history of each company. These books, however, focus mainly on the overall logging operations and the major players involved with the companies rather than on specific goings on in the work camps or those who inhabited them.

Books related to specific companies often contain maps of the areas worked, displaying the location of many if not all of the work camps used, occasionally with dates of usage. Maps found in Dennis Blake Thompson's book *Logging Railroads in Skagit County* (1989) and Eugene Henderson's *The Pine Tree Express* (1990) depict logging camp locations and, in many cases, the dates each camp existed. Camp locations in these books are valuable pieces of information as they can lead to the locating and surveying of those sites; however, map and symbol scales can make it difficult to find exact locations.

For instance, the location of a camp on a large scale map may appear to cover a much larger area than it does on the ground, leading to a much larger survey area. Dates associated with camp locations can be especially important in determining other factors involved with those work camps. Dates of usage can help approximate the amount of time it took the loggers in those camps to harvest a given area near the camp based on the known technologies of that time. It is unclear if research related to this theory has been undertaken.

There are a number of resources available containing first-hand accounts from people who inhabited work camps of the late nineteenth and early twentieth centuries. Many works choose to spend more time discussing logging and railroading operations, but some talk specifically about life in the work camps. One such account, written by George Woodward in 1894, discusses the everyday life of loggers in great detail. Woodward (1894) provides details about the different buildings often present at historical work camps, including kitchens and bunkhouses. A good portion of his account relates to the type of people, typically men, who lived in logging camps and the customs they adhered to (Andrews, 1968, pp. 56 & 76). Hazing was, at one time, a common practice in work camps along with theft. The author notes occasions where socks would be stolen off the feet of sleeping loggers (Woodward, 1894). There are also interesting facts about recreation in work camps and the etiquette, or lack thereof, practiced by the workers (Andrews, 1968, pp. 56 & 76). These types of accounts are important for discussing the significance of logging camps, but they mainly focus on everyday life and relate little information as to exact locations of a camp.

Field surveys remain the main method for locating historical camp sites. These methods rely on local knowledge or begin by following a railroad grade or other clue such as the location of a camp on a historical map. Even if a site is displayed on a historical map or some other resource, it remains a simple geographical point. More analysis can be done through site surveys to discern site dimensions. One method involves mapping the occurrences and locations of artifacts or manipulated landscapes (e.g. artificially flattened areas). Another method, attempted by Paullin (2007), to determine the size and dimensions of logging camp sites could possibly be done through dendrochronology, a method of studying the age of trees found on and around a known logging camp site. During their use, camp sites are kept clear of trees while the harvested areas surrounding them would be left to regenerate naturally. Once abandoned, trees reclaim the camp sites, but these trees would be younger than the surrounding areas where regeneration had occurred earlier. Based on this, Paullin (2007) tests whether the dimensions of a logging camp site could be determined by an age difference in the trees in and adjacent to the camp; however, Paullin (2007) could not prove this age difference theory for the research area.

The outcome of Paullin (2007) seems logical since many satellite work camps commonly existed for only one to three years. It is common to have a varying age distribution in naturally regenerated forest stands, making an identifiable line where trees are only a few years younger than the rest of a mixed stand nearly impossible to discern. Determining the extent of a camp site may still be best completed by analyzing modifications in the landscape in concert with artifact accumulations; however, artifact accumulations, or middens, may not be located within the footprint of a camp site.

Schiffer (1983 & 1986) outlines site formation processes, or actions that alter an archaeological site after its establishment, and methods to decipher and understand those processes. The author's points on the positioning of artifacts displays sound logic, specifically noting that large accumulations of artifacts are not always an indication of a site; rather, the location of artifacts could simply be a dump site (Schiffer, 1983 & 1986). Researchers must consider the ideas presented by Schiffer (1983 & 1986) in relation to artifact accumulations and the reasoning behind their formation when attempting to locate historical sites.

Luckily for archaeologists and cultural resource managers, much information has been recorded about locations and dates of usage for sites such as logging camps; however, there remain numerous undocumented historical logging camp sites. Archaeologists and cultural resource managers have developed new methods for locating unknown cultural and historical sites. Remote sensing has been a useful tool for archaeologists for a number of years and analytical tools such as Geographic Information Systems (GIS) allow archaeologists to implement spatial statistical models where multiple variables are compared in attempts to predict possible site locations. Spatial modeling has become an increasingly valuable tool for identifying possible site locations when there are no historical records available.

Remote Sensing/Spatial Analysis for Archaeological Sites

Remote sensing, a way of collecting information about a location without physically visiting that location, has been in use by archaeologists since the 1930s after the first aerial photographs were taken of the United States landscape (Lasaponara & Masini, 2013). Since remote sensing involves analyzing information from afar, it could be argued that archaeologists studying historical maps have been practicing remote sensing techniques well before the 1930s. First used in the 1960s, the term remote sensing provided a name for the "unified technical field" of data collection methods scientists had been using to identify not only archaeological sites, but also environmental information (Judge et al., 1988, p. 430).

Data for interpretation can be obtained from more than aerial photographs and historical maps. New technologies emerging in the 1950s, such as infrared imagery, direct current resistivity, and magnetometry provided archaeologists an abundance of new information to better interpret and identify archaeological sites (Lasaponara & Masini, 2013). Becoming available in the 1980s, satellite imagery greatly added to the sources available for interpretation and further improved the remote sensing capabilities of archaeologists (Lasaponara & Masini, 2013). Image resolution improvements and the development of digital terrain models from Light Detection and Ranging (LiDAR) imaging have occurred in the past 10 years, providing even more interpretable data (Lasaponara & Masini, 2013). The collection of maps and imagery, especially in the past century, allows archaeologists to utilize every source possible to remotely measure and interpret data in order to locate sites and to identify site patterns.

Remotely sensed data are obtained by human interpreters who employ different methods to analyze various sources. The simplest method is to look at maps and images to identify sites. For instance, a historical map depicting the location of a site from 1930 can be compared with an aerial photograph from 1940 to check for any physical evidence of a site. Scale can be a common problem of aerial photography, especially satellite imagery, since these types of images are taken far from the area of interest.

Magnification is often needed in order to view small details in these circumstances. Besides issues of scale, it can also be difficult to remotely survey for archaeological sites due to vegetation depicted on aerial imagery. A source of information that helps combat this limitation is LiDAR (Lasaponara & Masini, 2013). LiDAR uses laser pulses between the laser equipment and the surface of Earth, thus eliminating the issue of vegetation. LiDAR provides a fantastic tool for the identification of archaeological sites because manipulated landscapes are easily visible, even to the untrained observer.

Recently, an abundance of research involving LiDAR has occurred. This research includes extrapolating tree heights and other forest stand characteristics, but LiDAR has also been used to locate cultural sites. A study conducted by Hare et al. (2014) used LiDAR to map structures and features associated with the prehistoric city of Mayapán in Yucatan, Mexico, a site that had been the subject of numerous archaeologic studies. Using high-density LiDAR, the researchers mapped even the smallest features, including benches (Figure 3; Hare et al., 2014). The level of resolution allowed researchers to easily identify structural features and small scale landscape manipulations in comparison to the surrounding landscape features. Results are only preliminary and more data has yet to be analyzed, but at the time of publishing, Hare et al. (2014) had identified 3,429 new features in the research area.

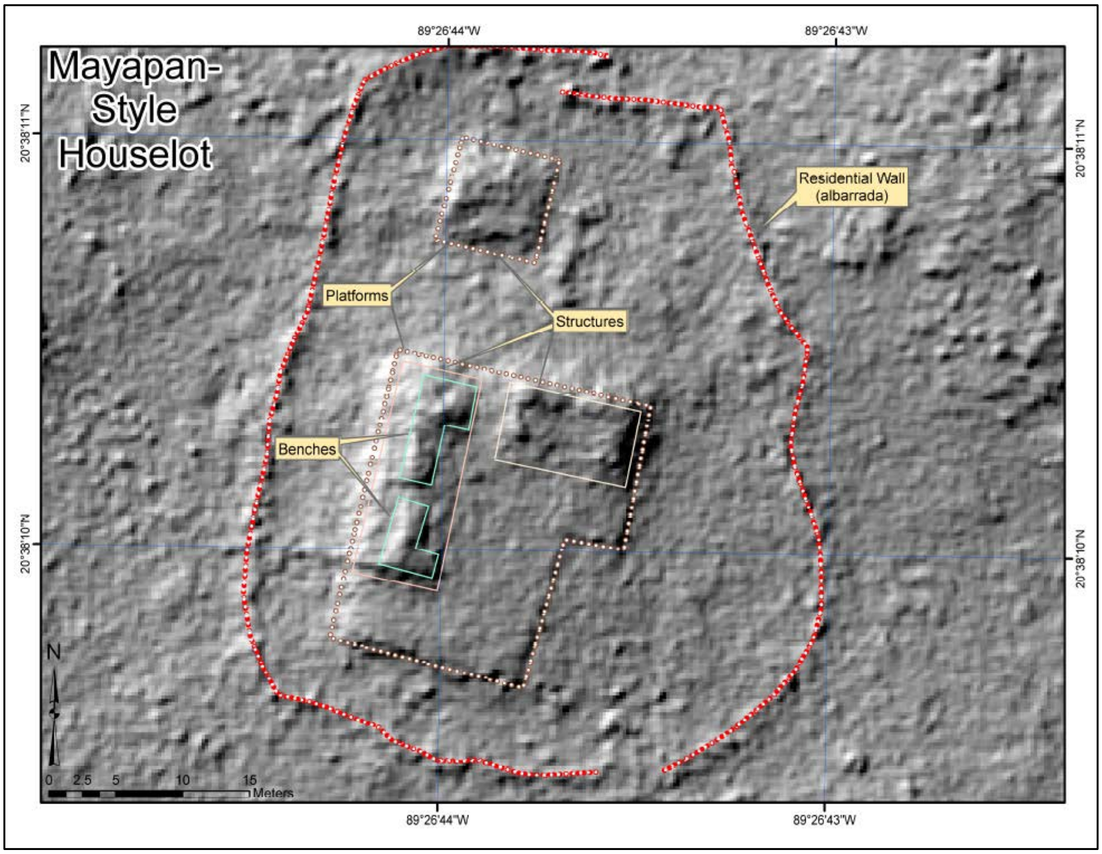

Figure 3. Example of results from the LiDAR analysis completed by Hare et al. (2014).

The research completed by Hare et al. (2014) still had limitations based on the quality of current LiDAR. Field verifications of the site determined multiple features with low-relief could not be identified from the LiDAR data used (Hare et al., 2014). Literature and research utilizing LiDAR for archaeological purposes is still in its infancy, but the possibilities are great. As the data resolution improves, analyses can be completed to determine smaller landscape manipulations with greater accuracy in order to better identify prehistoric and historical sites, including logging camps.

Many of the available map and photograph sources are now accessible digitally for manipulation and analysis in computer programs. GIS allows for the “collection, storage, retrieval, manipulation, and display of spatial data” and has become an invaluable tool for archaeologists (Ebert, 2004, p. 319). Ebert (2004) lists three hierarchal levels applied by archaeologists in regards to GIS: visualization, management, and analysis (p. 320). *Visualization*, as considered by Ebert (2004), is the “lowest level” of GIS application and does not help archaeologists produce theories as much as it creates aesthetically pleasing images (p. 320). *Management* simply refers to data management; cultural resource managers and archaeologists utilize this level of GIS usage to track and manage site locations (Ebert, 2004). Both visualization and management do not utilize the “full analytical capabilities of GIS” whereas the third level, *analysis*, is the best method for developing hypothetical theories (Ebert, 2004, p. 320). Although the use of GIS in archaeological work is increasing, analysis remains the least used level of GIS application (Ebert, 2004). In attempts to predict or locate unknown archaeological sites, many archaeologists have used the analysis capabilities of GIS to create spatial models. The next section will discuss spatial data and describe some of the model types used by archaeologists and cultural resource managers.

Spatial Modeling

Modern archaeology operates under the principles that there are patterns in the behavior of humans and site locations “exhibit non-random tendencies” (Brandt et al., 1992, p. 269). Because of this non-random tendency, archaeologists are able to create spatial models to predict possible site locations. Spatial models use patterns found between the location of a site and variables such as topography and water resources (Brandt et al., 1992, p. 269). Environmental variables such as soil types, geologic and hydrologic patterns, and topography have all been found to influence the settlement patterns of native and post-contact settlers (Brandt et al., 1992). These variables are also considered continuous, which allow models to use “powerful” statistical methods (Brandt et al., 1992, p. 270).

Numerous modeling methods have been constructed with the sole purpose of predicting potential cultural resource site locations. These models range in complexity from simple point-specific analysis to multivariate statistical analyses (Judge et al., 1988). Ebert (2004) discusses two main types of data commonly analyzed spatially: point and areal. Point data is the spatial location of a site, an artifact, or a feature, while areal data can include entire locations or regions (Ebert, 2004, p. 321). Point data can be used to study trends in data as well as discern pattern distributions through “density mapping and interpolation” (Ebert, 2004, p. 321). Density mapping is used to display the dispersal of a particular variable (e.g. artifacts or features) over a given area and would be considered a visualization method in Ebert’s (2004) hierarchal applications of GIS. Interpolation uses multiple “mathematical procedures to convert point distributions to a continuous surface” (Ebert, 2004, p. 322).

Another interpolation method is called kriging and is based on the idea that sites in closer proximity to an area being analyzed have more impact than sites at greater distances (Barceló & Pallarés, 1996; Ebert, 2004). Kriging takes into account both the presence and absence of sites during statistical analysis in order to better predict site locations (Judge et al., 1988; Barceló & Pallarés, 1996; Finke et al., 2008). More in-depth interpolation methods such as kriging are not widely used by archaeologists, but Judge et al. (1988) notes this may be due to a lack of technical understanding by archaeologists.

Judge et al. (1988) goes further in describing spatial models, by grouping predictive models based on their operability, proposing two distinctive categories: intuitive and objective models. Intuitive models use “inductive or deductive logic” based on analyses of patterns of either “human behavior” or known sites (Judge et al., 1988, p. 64). Judge et al. (1988) points out that intuitive models are the primary method used by archaeologists and consequently have a “very high accuracy rate” of predicting site locations (p. 65). This high prediction accuracy is due to archaeologists identifying a specific variable that a singular site has in common with other related sites and then looking for other areas with that same variable. As a result, many sites may remain unrecorded because no one has thought to look in a location that does not share a specific characteristic of known sites (Judge et al., 1988).

Objective models can be broken down into three separate sub-categories based on the characteristics of a site’s dependent variable, the procedural method used, and the weighting of independent variables (Judge et al., 1988). The three sub-categories are termed: “associational, areal, and point-specific models” (p. 63). Table 1 provides a concise description of these three types of objective models. There is overlap among the three sub-categories in regards to the characteristics of objective models that Judge et al. (1988) provides.

Associational models look at the relation of a site to another variable, such as vegetation type or aspect. These types of models utilize statistical methods such as a goodness-of-fit test to determine a level of significance and can be used as a predictive tool (Judge et al., 1988). Areal models are used to “predict certain characteristics” of different sites (p. 68). Specifically, areal models can be used to determine the amount of sites in a given area and are similar to kriging in the sense that areal models use the existence of a variable at one site to predict the occurrence of that variable in neighboring locations (Judge et al., 1988). Areal models often predict site density over a large geographical area based on relationships between variables, both dependent and independent, in a smaller sample area. In contrast to areal models, point-specific models focus on exact locations for potential site predictions. Point-specific models have become the most commonly used model for archaeologists and cultural resource managers because, rather than the model predicting the potential number of sites in a given area without specifying locations, these models can predict whether or not a site exists in a given location (Judge et al., 1988).

Types of objective predictive models of site locations

Model Type	*Primary Procedural Logic* — *Inductive*	*Primary Procedural Logic* — *Deductive*	*Variable Weight*	*Spatial Referent*
Associational	Overlay or composite models	Adaptive types	EQUAL	AREAL
Areal	Map interpolation Pattern recognition Grid prediction	Simulation Discrete probability distributions Hierarchical decision models	RELATIVE	
Point-specific	Pattern recognition Point-specific prediction	Central place models Gravity models Optimum location models Polythetic-satisficer models		POINT

Table 1. Sub-categories of objective models (Judge et al., 1988, p. 64).

Espa et al. (2006) completed an archaeological site prediction model for Cures Sabini located in the Tiber Valley, an area where sites from the Roman historical era have been found. This model utilized both known archaeological sites and sites where no archaeological evidence existed. The model took the point-specific data of these known and "absent" sites and compared them with environmental data such as elevation, slope, aspect, rock type, and water network (p. 151). The researchers created GIS layers for site locations and each environmental variable. Researchers then completed a Classification and Regression Tree (CART) analysis using coded data derived from GIS analysis. The results of this analysis ranked each variable's relative importance to site location. Based on these rankings, researchers created a map in GIS symbolizing areas by a low to high probability of containing a site (Figure 4). Espa et al. (2006) concludes that CART models are unaffected by outliers and make a better analysis tool than logistic regression.

Figure 4. Grayscale map showing the probabilities of potential site location based on multiple environmental variables in the Cures Sabini area of the Tiber Valley. Black polygons represent a high probability of an undocumented site location. Site location probability decreases as the grayscale approaches white (Espa et al., 2006, p. 154).

The vast majority of archaeological modeling has been completed in attempts to better locate prehistoric archaeological sites, which are sites dating to before the European settlement of America. There has been little modeling completed to predict historical site locations. Some of the reasoning behind this lack in modeling is historical sites are often well documented on historical maps, in state and county archives, in company records, and from the personal accounts of former inhabitants or workers of historical sites (Judge et al., 1988). Judge et al. (1988) says time spent developing models to predict historical site locations could be better used researching historical documents. Also, historical site locations may not be based on the same factors as prehistoric sites because of the way lands were surveyed by sections and parceled to land claimants, and thus not as easy to model (Judge et al. 1988).

Effective models can be created to identify potential historical site locations for areas where no historical documentation of such sites exists. These types of models can use multiple environmental "predictors" such as proximity to water sources and topography (Judge et al. 1988, p. 330). Pattern recognition models based on point-specific data may not directly take into account multiple variables when being built, while settlement pattern research can look at site locations based on a site's relation to variables, environmental or other (Judge et al. 1988). Settlement pattern research can also examine the spatial relationship between sites to predict potential occurrences of similar sites (Judge et al. 1988); however, pattern recognition models cannot predict variations in site formation processes that lead to artifacts not being located at an actual habitation site, as mentioned earlier (Schiffer, 1983 & 1986). It could be argued that finding artifact deposits located at a distance from the site of habitation is just as important to understanding what life may have been like at the actual site; therefore modeling site patterns would still lead to further research being needed based on what is known about human waste disposal patterns.

Regardless of the spatial model used, Judge et al. (1988) discusses that success of a model in predicting sites is less important to an archaeologist than if a model makes erroneous predictions. The authors discuss two main types of errors and relate them to Type I and Type II statistical errors. If a predictive model has a null hypotheses claiming an area does not contain a site, a Type I error would occur if one rejected this hypothesis when indeed a site did not exist; a Type II error would occur if one accepted the null hypothesis and the area did in fact contain a site (Judge et al., 1988). In regards to predictive modeling, Judge et al. (1988) refers to Type I errors as “wasteful errors” (p. 62). Wasteful errors are termed as such because management of a site where no actual site exists leads to an “inefficient” use of money and resources, hence wasting these resources (p. 62). Type II errors, or “gross errors” can lead to unintentional damages to a site because a model predicted, and the result accepted, there would not be a site in that location (p. 62). In relation to archaeology and cultural resource management, committing gross errors is more detrimental because it can result in the destruction of a cultural resource. Judge et al. (1988) points out the “ideal predictive model” functions to reduce both types of errors by making accurate predictions (p. 62). Archaeologists and cultural resource managers must be thorough when constructing predictive models and cautious of the results to avoid making either type of error.

In short, spatial models minimize the level of analysis exerted researching historical maps for potential site locations. Spatial models are able to analyze single or multiple variables to determine potential cultural resource site locations for a given geographical area. Whichever method is used to locate a culturally significant site, historical maps, LiDAR, or spatial modeling, the key parts should be recording site dimensions and the data gathered from sites. As discussed in Section II, these data are especially important for historical context. Site locations and dimensions are equally important for cultural resource managers for developing management and protection plans. The next section will discuss cultural resource management in more detail.

Section IV

Cultural Resource Management (CRM)

The National Historic Preservation Act (NHPA) aims to preserve cultural and historical sites throughout the United States. Section 106 of the NHPA requires potential impacts to cultural resources be avoided and mitigated. Section 110 further requires agencies to ensure culturally or historically significant sites are not unintentionally sold, damaged, or destroyed (Judge et al., 1988). Preserving and protecting culturally and historically significant sites is the primary concern of cultural resource managers.

CRM goals also vary depending on location and site type. Some managers may only be concerned with locations of sites strictly for managing their protection while other managers may be more concerned with specific site types more than others (Judge et al., 1988). For the latter type of CRM, site types that require greater attention and protection measures depend on a determination of their significance. Site significance goes back to the NRHP Criterion D discussed in Section II and relates to the information content provided by a site and its features.

Determining Significance

Logging railroad grades located in forests represent a site type that is not typically eligible for listing in the NRHP. These types of sites are often little more than a grade through the forest with occasional through cuts and stream crossings that demonstrate the engineering and construction of the era. On the other hand, logging camps are typically eligible as they meet more than one of the criteria as discussed previously. Conners (1990) developed a ranking system to provide an indicator of significance for logging railroad grades, and associated logging camps, constructed and in use between 1890 and

1930 (Table 2). By following this ranking system, cultural resource managers can easily apply a level of integrity to a site to ensure proper management. Researchers considered sites ranked as ‘excellent’ or ‘good’ to be eligible for NRHP listing under criteria A, C, and D (Conners, 1990).

Integrity Ranking System for Railroad Logging Camps

Integrity	Components
Excellent	A camp with substantial intact patterning. This may include collapsed structures and/or substantially undisturbed structure pads, dumps, and other function areas that are part of the camp property.
Good	A camp with patterning that is still recognizable but that may be substantially deteriorated or disturbed.
Poor	A camp where the original patterning has deteriorated or has been disturbed to the point at which it is no longer recognizable.

Table 2. Railroad logging camp integrity ranking system (Conners, 1990).

Regardless of whether a site is eligible for protection based on NRHP criteria, if a site has been recorded and contains relevant historical or cultural information, the site should be managed as a cultural resource. Site protections can vary due to the significance or integrity of a site and the nature of work in or near a site. Ground-disturbing activities such as excavation often require more explicit protection guidelines and occasionally require an archaeologist or cultural resource manager on-site to ensure protection of cultural resources. Other activities, such as logging, can greatly disturb a site, but protection measures such as limiting equipment operation in certain areas can mitigate disturbance. Since the potential for more information may be available at previously recorded sites, possible destruction is usually avoided. Cultural resource managers and archaeologists continue to follow federal and state guidelines using multiple methods for site protection, but as Judge et al. (1988) states, more time is being spent locating and managing these sites rather than analyzing the data within sites.

Ground or site disturbance can occasionally uncover previously undocumented sites or new artifacts which may have been missed in initial surveys. Christopherson (2008) and Stilson (2010C) surveyed known camp sites following a timber harvest. In both cases, the removal of timber and understory greatly improved the ability of surveyors to locate and document artifacts and landscape manipulations. The Schafer Brothers logging camp recorded by Stilson (2010C) was shown on a 1938 USGS topographical map, but surveys prior to timber harvest were unable to locate any artifacts due to thick understory brush.

Another interesting finding at these sites was that ground-disturbing activities did not greatly disturb or damage artifacts. It could be assumed that large tracked machinery would completely destroy delicate artifacts such as glass bottles and earthenware; however, in both Christopherson (2008) and Stilson (2010C), it could not be discerned whether damage to artifacts occurred through natural events or during harvest activities. With the knowledge that timber harvest may have a lesser impact than believed and that removing timber and brush only enhances the ability to record a site, management of these historical sites can possibly become less stringent. The best management in relation to timber harvests may actually be limiting disturbance in known or presumed areas of artifact accumulations and requiring full surveys to be completed following timber harvest in or near recorded sites to look for artifacts or portions of the site that may have been missed in initial surveys.

Conclusion

Historical logging camps represent an important period in the resource extraction history of the United States. Logging camps provide historical context about the people who inhabited those camps as well as a glimpse into the lives of the many workers and their family members during the late nineteenth and early twentieth centuries. Historical logging camp sites highlight the social, cultural, and gender differences occurring during this specific time period, which could be representative of the country as a whole. Locating historical logging camps can be accomplished through a number of means, including research of historical maps and books as well as acquiring narratives from former inhabitants.

Unfortunately for archaeologists, many logging camps were not documented on historical maps and other sources due to their ephemeral nature and the number of people with first- or second-hand knowledge of camp locations is rapidly decreasing. This lack of documentation coupled with the loss of local knowledge requires research to focus on new methods to better locate these sites. Utilizing LiDAR and spatial modeling may provide methods to better locate historical logging camps; however, spatial modeling does not account for the site formation processes as laid out by Schiffer (1983 & 1986) and, therefore, may only provide limited success. Locating and documenting historical logging camps must be done to ensure the preservation of data only those sites can provide and allow cultural resource managers and archaeologists to better manage the protection of these sites.

Chapter 3 – Research Area Background

Introduction

The focal point of this research, the Capitol State Forest, is located in Grays Harbor and Thurston counties at the very southern tip of Puget Sound. This chapter will discuss the research area in more detail. First, the technologies used to extract timber from the Capitol State Forest during the late nineteenth and early twentieth centuries will be detailed, followed by information about the companies who logged the forest during that same time period. Next, the known and assumed Mason County Logging Company (MCLC) logging camps used in this research will be discussed in greater detail. Characteristics appearing to be common among the known and assumed MCLC logging camps will be identified in order to demonstrate the potential importance those variables may have for locating other camp sites. This chapter will conclude with an introduction of the theory behind using an average distance to locate historical logging camp sites.

Capitol Forest is representative of the peak, and subsequent decline, of logging in Washington State. The history of Capitol Forest was well documented in a publication produced by the Washington State Department of Natural Resources (WADNR), the current manager of the majority of the forest. In this publication, Margaret Felt (1975) detailed the recent history of Capitol Forest, which included early settlers, early logging history, and the replanting and reclamation of the forest by what is now WADNR. The logging history is of great value to this research because it provides details about the companies involved in logging the forest, including images. Felt (1975) also contains a map of the forest with the locations of some of the known logging camps.

Despite its location and proximity to Puget Sound and Olympia (Figure 5), logging in Capitol Forest, or the Black Hills, did not begin until the 1870s (Felt, 1975, p. 17). By the time of the logging boom in the Capitol Forest area, railroad logging was the primary method of delivering logs to mills. As discussed in the previous section, railroads were typically located along streams because of the low grade needed for adequate train movement. Capitol Forest is no different and railroad grades can be found along nearly every major stream in the Black Hills.

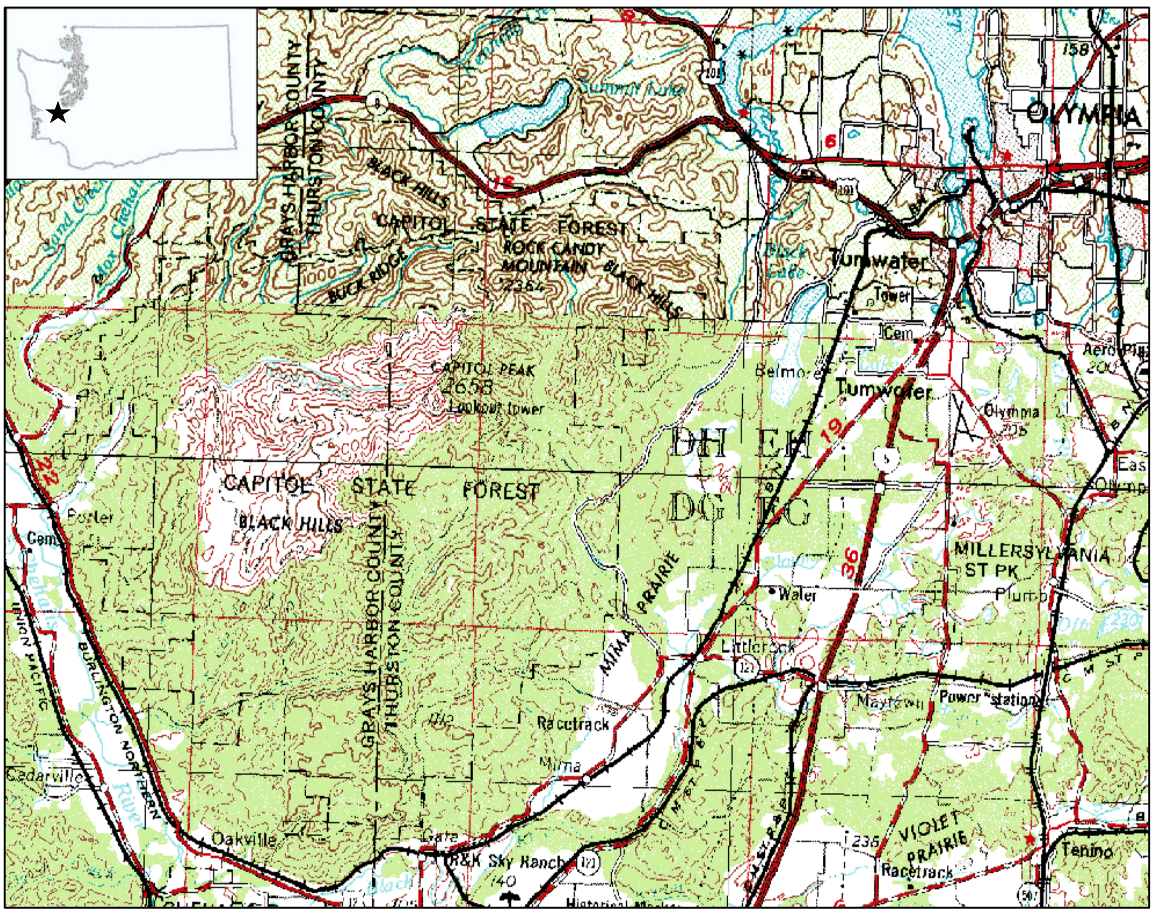

Figure 5. Current USGS topographic map (1994) of the Capitol State Forest in relation to Olympia, Washington.

The topography of the Black Hills ranges from gentle slopes to steep mountainous terrain. This topography required loggers to use a piece of equipment called a steam donkey to pull logs through the forest to where they were to be loaded on trains (Figure

6; Labbe & Goe, 1961, p. 61; Spector, 1990, p. XV). Scars from logs being dragged up hillsides by steam donkey operations can still be found covering the landscape of the forest. Typically comprised of two log skids and a steam-powered engine, steam donkeys used a cable pulley system, which allowed the donkey to pull logs to the machine and pull itself through the forest (Andrews, 1954, p. 64). Steam donkeys could also be built on train cars to pull logs directly to the trains.

Figure 6. Example of a steam donkey. The timber of the West provided an ample supply of large skids such as the ones shown here. Photograph by Clark Kinsey (UWL, 2015).

The main method for falling trees was to use a cross-cut saw after a large 'face cut' was chopped into the tree. Initially used for 'bucking' trees into lengths suitable for transport, cross-cut saws became more heavily used once loggers encountered the massive trees of the West as these saws were found to be more useful in falling operations (Cox, 2010, pp. 137 & 274). Existing old-growth stumps are often found with the remnant notch in them from where loggers used spring boards as sawing platforms. Spring boards, something unique to western United States logging operations, were essential to get loggers above the dense ground cover and 'butt swell' at the base of the tree (Cox, 2010, pp. 137 & 274).

Technologies of the time required loggers to spend long periods of time in a given area and, as stated previously, the cost of transporting workers to the site, in terms of production time lost, was more expensive than building a camp closer to the work site (CALTRANS, 2013). Technological improvements in logging such as the chain saw and the standard usage of trucks to deliver logs rather than trains did not become common practices until the 1940s, a time when logging in the Black Hills was winding down (Felt, 1975, p. 32). If these technologies had come into use sooner, fewer camps may have been needed throughout the forest because trucks could move more easily around the landscape, being less bound by road gradient than trains. The incorporation of logging trucks would also have sped up the transportation of workers to a site. Power saws allowed workers to cut trees more quickly, meaning more acreage could be cut in a shorter period of time. Moving faster through stands of timber would reduce the amount of time a camp was in existence, but likely would have eliminated the overall need for temporary logging camps. Setting up a logging camp when these technological advancements were available would have been fiscally irresponsible; however, removing existing rail infrastructure to provide access to log trucks may have been more expensive than the financial benefits log trucks could provide.

Logging Companies in Capitol Forest

A number of logging companies were involved in the early logging of the Capitol State Forest. These included the Vance Lumber Company, Mumby Lumber and Shingle Company, Union Timber Company, Lytle Logging and Mercantile Company, Mud Bay Lumber Company (partly owned by the Weyerhaeuser Timber Company) , and MCLC (Felt, 1975, pp. 29-35; Carlson, 2003, pp. 123 & 214). Each company removed the timber from their parceled land using their own railroad system. These companies also constructed their own work camps within the forest; the Mud Bay and Mason County Logging companies operated multiple satellite work camps, while the Union and Lytle companies had one apiece (Felt, 1975, pp. 29-35 & map insert; Blum, 2000).

The most prominent logging company in the Capitol Forest area, as discussed by Felt (1975, pp. 31-2), was the MCLC. In 1902, the Mumby Lumber and Shingle Company, initially a subsidiary of the MCLC, constructed a mill at what would become the town of Bordeaux on the east edge of the forest (Figure 7; OAHP, 1985). More than 200 workers were employed by the MCLC for their operations in the Capitol State Forest, most at the mill, but many others in the work camps along 85 miles of railroad through the forest (Felt, 1975, pp. 23 & 31). In 1924, MCLC purchased the Vance Lumber Company's operations near Malone adding another 10 miles of rail line to their operations on the west side of the forest (Felt, 1975, p. 32; Carlson, 2003, p. 214).

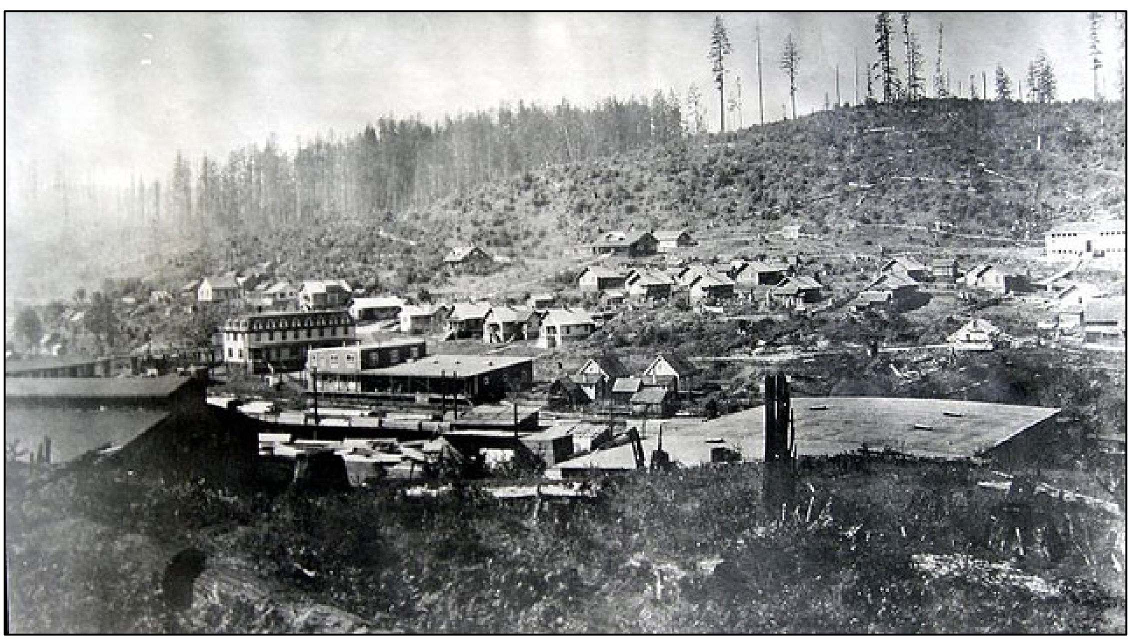

Figure 7. Picture of Bordeaux Washington circa 1910 looking northwest. The large building to the left is a hotel and the buildings to the north are living quarters for the workers. The mill included all the structures in the southern half of the image. Taken from the Thurston County webpage: http://www.co.thurston.wa.us/history/

For nearly 50 years, the seemingly endless supply of old-growth Douglas-fir (*Pseudotsuga menziesii*) and other species was removed at a staggering pace from the forest. Similar to many forested areas throughout America, the timber supply in the Black Hills was exhausted, causing the mill at Bordeaux to be shut down. With the closure of the mill in 1941, people who once worked in the hills and lived in the town left and Bordeaux fell into ruin (Felt, 1975, p. 32). What remains is a common sight in the industrial forests of the nineteenth and twentieth centuries, a ghost town representative of the great logging era in Washington. Also left in the forest are the scars of this bygone era, including the countless miles of railroad grades used to haul timber out of the woods. The tracks are no longer present because the iron was typically moved after an area had been harvested (Brashler, 1991) and because iron was salvaged for use in World War II. Many of the wooden trestles constructed throughout the forest have also been removed or destroyed, including some that were demolished by the United States Army during "explosive experiments" (Felt, 1975, p. 35).

Capitol Forest Logging Camps

Another remnant of the decades of logging in the Capitol State Forest is debris left by early loggers at sites where satellite work camps were located. Nearly all the camps scattered throughout the forest were temporary camps where structures could be loaded on train cars and moved to the next location. Much of what remains in these areas is trash consisting of bottles, ceramics, and cans left behind by the loggers. Trash can be the key to approximate camp occupation dates; for all of the camps discussed below, these dates are approximately between 1900 and 1950. Identifying logging camp sites in Capitol Forest was a key element of this research and involved combing through multiple historical resources, including books, historical maps from the United States Geological Survey (USGS), county timber cruise maps, and historical photographs from people who worked in the forest or from prominent photographers of the era such as Clark and Darius Kinsey. Researching logging companies and their associated camps in the Capitol State Forest identified 13 known and nine assumed camp sites; many of these camp sites are discussed in more detail below (Figure 8).

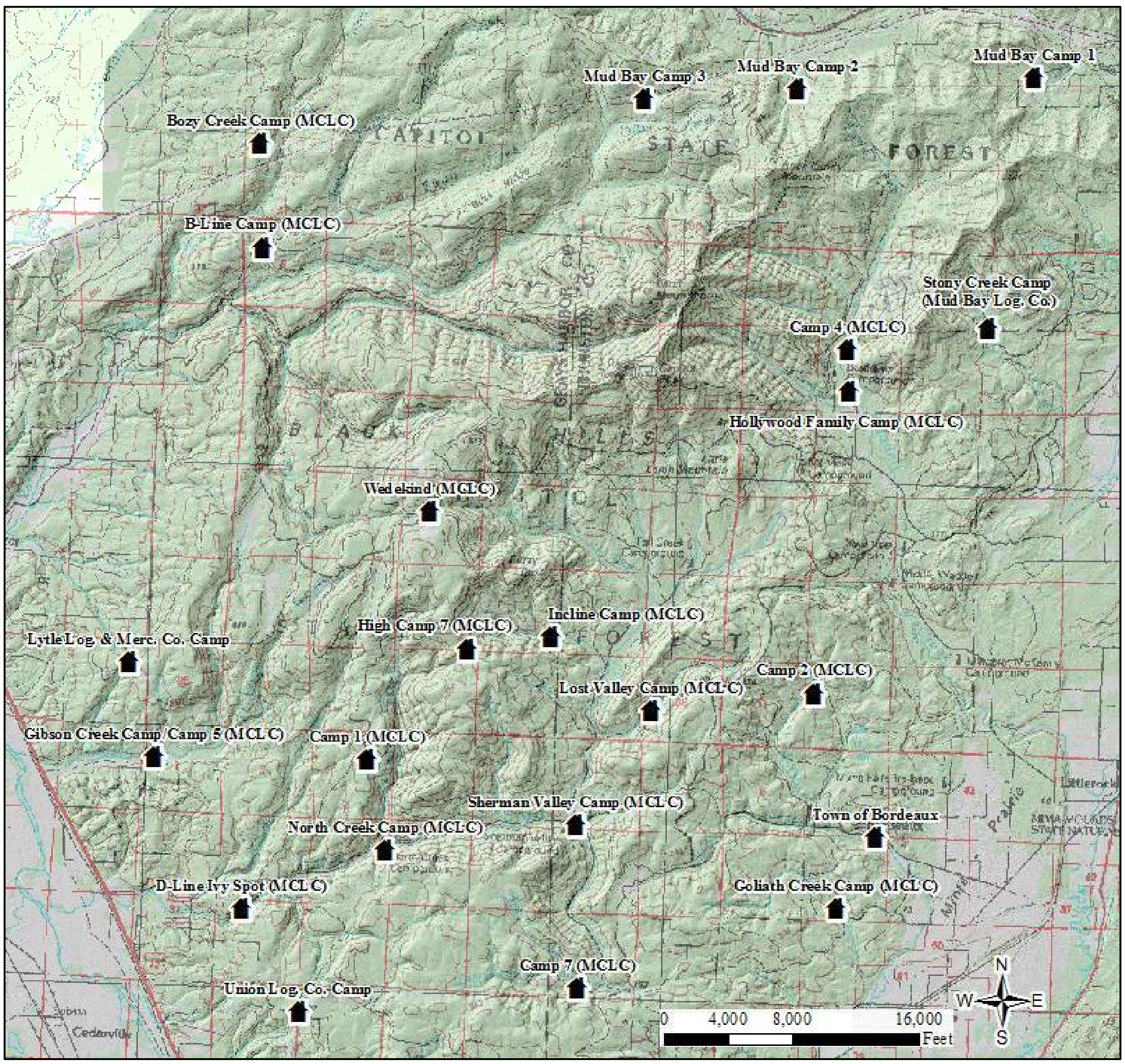

Figure 8. Map depicting all the known and assumed camp sites in the Capitol State Forest.

A map contained within Felt (1975, map insert) provided the location of some of the logging camps within Capitol Forest. All four camps associated with the Mud Bay

Logging Company, who operated in the northern portion of the forest, are noted as well as one logging camp site for MCLC, Camp 4.   MCLC Camp 4 is also depicted on a 1938 USGS topographic map, and represents the beginning of this research project (Figure 9).

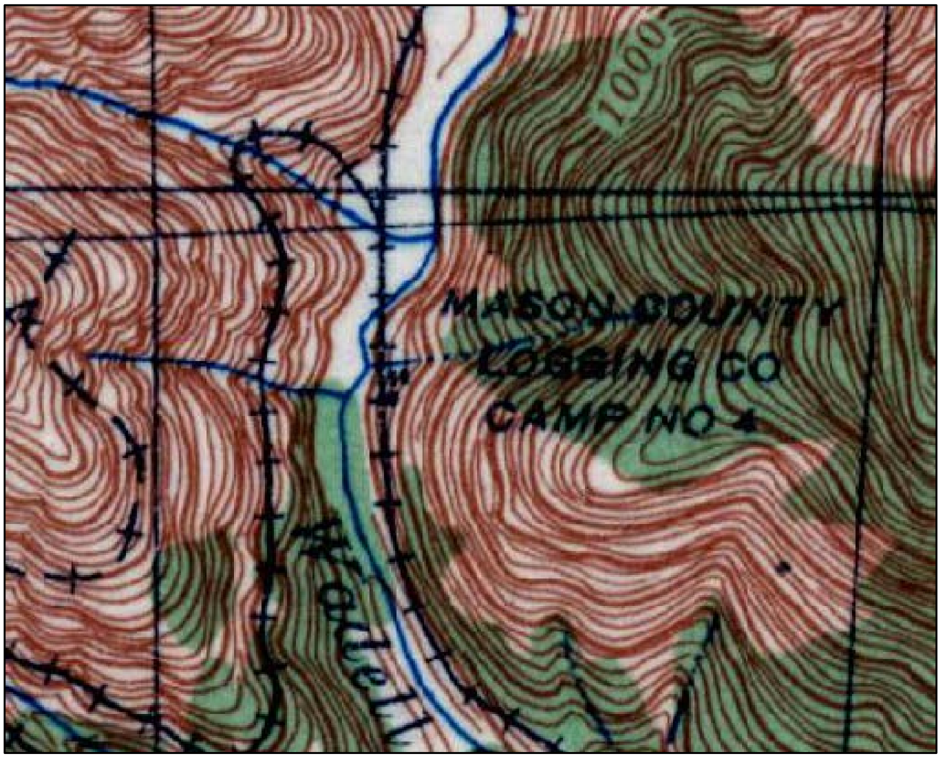

Figure 9. MCLC Camp 4 location shown on the 1938 USGS topographic map.

Camp 4 was located on Waddell Creek and was the only known permanent camp within the forest. Concrete foundation pieces, which were found on-site, would not have been associated with a temporary camp that could be transported by rail (Stilson, 2009). MCLC Camp 4 is adjacent to Camp Four Creek and it was this creek name which led to the discovery of MCLC Camp 7. Camp 7 was located along Camp Seven Creek, southwest of what is now the Cedar Creek Correction Center work camp (Stilson, 2009 & 2010D). The location of Camp 7 was also discussed in research completed by Blum (2000); this research was essential to the discovery of Lost Valley Camp and many of the camps discussed below (Stilson, 2010D).

Another site shown on the map in Felt (1975, map insert) was named Hollywood. Located just south of MCLC Camp 4, Hollywood was not a logging camp, rather it was a home to many of the families of the loggers working in the forest (Figure 10). For this reason, Hollywood was not used in distance measurements. Family camps could be a necessity for those loggers who traveled with their family for work, but whose families could not live in the satellite work camps or company town. In the 1950s, long after the logging had ended and families had left, Hollywood was converted into a campground (Ferguson, 2011A). The conversion of the Hollywood site to a campground along with research completed by Blum (2000) led to the discovery of another former logging camp in what is currently the North Creek campground (Figure 11; Ferguson, 2011B).

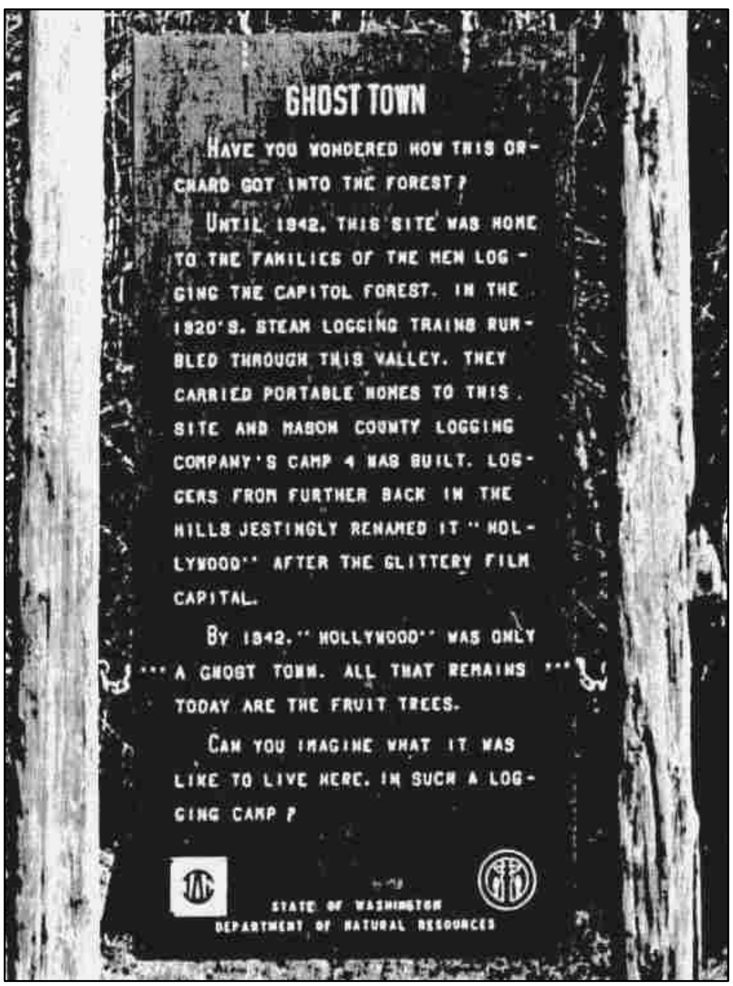

Figure 10. Photograph of informational sign that once stood in the Hollywood Campground discussing the use of the camp by workers' families (unknown photographer; Ferguson, 2011A).

Figure 11. Image of North Creek Campground, which was the location of MCLC North Creek Camp. Note the abundance of English ivy. Ivy is common among MCLC camps. Photograph by author (Ferguson, 2011B).

In completing research for site surveys of the camps mentioned above, the book written by Joseph Pierre in 1979 titled *When Timber Stood Tall* helped identify and locate additional MCLC camps. This book discusses some of the early logging of western Washington, including two areas within Capitol Forest. One area, Gibson Creek (Camp 5) along the western edge of the forest is located on private property, but the camp location can be inferred remotely from other sources (Pierre, 1979, pp. 79-80). Gibson Creek Camp was not used to measure distances between camps because it is not directly connected to other camps and there is not enough rail line beyond the Gibson Creek camp site to warrant another camp in that area.

The other site discussed in Pierre (1979, pp. 56-64) was High Camp 7, a camp located at the top of an incline. An incline is a stretch of railroad going directly uphill at a grade too steep for trains to climb under their own power (Labbe & Goe, 1961, p. 123). A steam donkey, which was used to pull trains up the grade and to slowly lower them back down, typically sat at the top of the incline. The incline discussed in Pierre (1979, pp. 58-9) and shown on the map in Felt (Figure 12; 1975, map insert) was located and surveyed in 2010. During the survey, remnants of camps were found at the base of the incline (MCLC Incline Camp) and at the top (High Camp 7). Remnants of the steam donkey, likely used to aid trains up and down the incline, were also found (Ferguson, 2010A & 2010B).

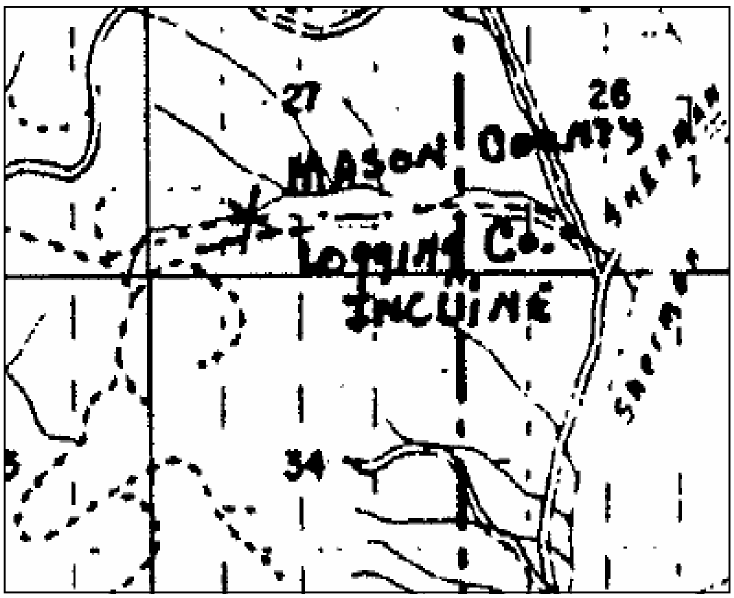

Figure 12. Portion of map from Felt (1975) depicting the location of a MCLC incline.

The last MCLC camp identified through research, MCLC Camp 2, was found after reading a transcript from an interview with a former MCLC train engineer discovered while researching previously surveyed camps in Capitol Forest. In the transcript, Harlan Smith referenced an old road, which has since been abandoned, when he mentioned “[t]his goes up to Camp 2” (Baldo & Coombs, 1991). Remotely following the old road grade, a site was identified as the best potential spot due to it being in close proximity to a large ponded area near the end of the railroad grade along a major stream. A field survey of the probable site location confirmed the location as a logging camp, likely Camp 2, uncovering numerous artifacts from the early twentieth century (Ferguson, 2011C).

It was the discovery of MCLC Camp 2 where a pattern in camp location was first encountered. A ring of four satellite logging camps appeared to be within a similar distance radially from the mill site at Bordeaux (Figure 13). This finding is similar to what Maniery et al. (1996, as cited by CALTRANS, 2013) found in a survey of historical sites in the Shasta-Trinity National Forest. Research by Maniery et al. (1996) notes that work camps were within a radius of approximately one to two miles of mill sites. MCLC camps were farther than one to two miles from the mill site at Bordeaux, but each visually appeared to be at roughly the same distance away. It is possible the theory provided by Maniery et al. (1996) that satellite camps were at a specific distance radially from a mill site is still applicable, but distances likely vary by logging company and topographic variability.

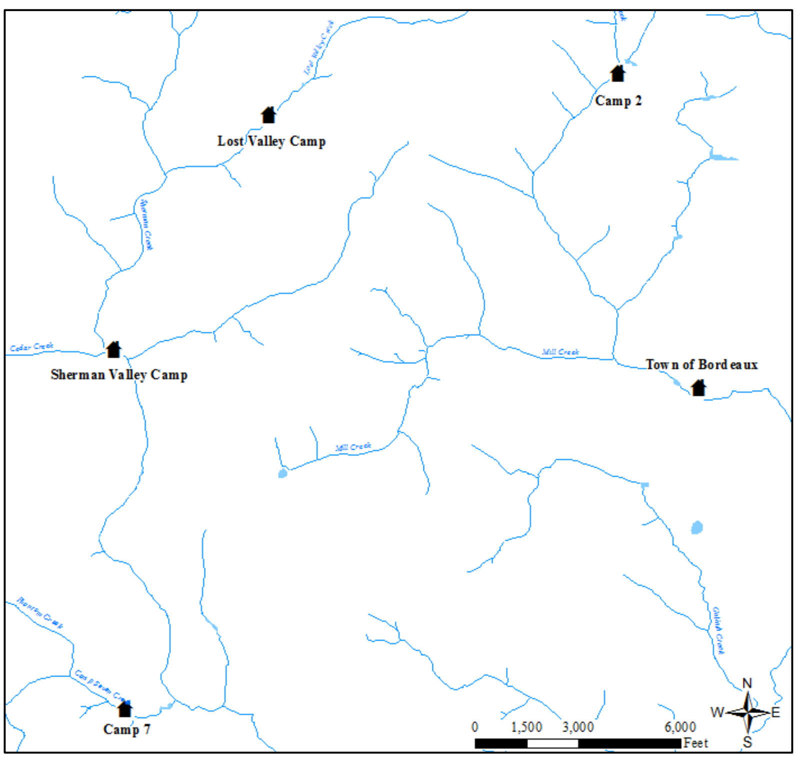

Figure 13. The ring of satellite camps appear to be at similar distances radially from the mill site of Bordeaux. These camps also appear to be located at similar distances from each other. Note locations of camps along major streams.

One camp location used in this research, Goliath Creek Camp, was found based on a theory similar to the findings of Maniery et al. (1996, as cited by CALTRANS, 2013). After observing the ring of satellite camps at similar distances radially from the mill site of Bordeaux, remote sensing analysis focused on an area to the south of Bordeaux where no camp locations were known. Two potential locations were identified, both within a similar distance to Bordeaux as the other camps in the ring and both having similar characteristics of other camp locations in the forest. One potential site was located at the junction of four railroad grades and the other was located just downstream of a large water impoundment in a wide floodplain along Goliath Creek. Field reconnaissance of the location at the grade junctions found no evidence of a camp, but reconnaissance of the Goliath Creek location found a small midden, water pipes, and English ivy (*Hedera helix*) (Ferguson, 2011E). Although the Goliath Creek location did not contain artifacts consistent with other camps, specifically an absence of kitchenware, the site shared multiple characteristics with other camp locations in the forest such as being located adjacent to a major stream and near impounded water (Stilson, 2009, 2010D, & 2010E; Ferguson, 2010A, 2011B, & 2011C). For this reason, Goliath Creek Camp and the distance between the camp and Bordeaux were used in this research.

There are two additional known MCLC camps where the sites have not been surveyed fully. One site, referred to as the D-Line Ivy Spot (Figure 14), was believed to have had a powder house where dynamite was kept and a “donkey sled operation” where the footings of steam donkeys were constructed (Blum, 2000, p. 6). A portion of this area was covered when the road through the forest was paved and thick English ivy now makes surveying the site difficult (Blum, 2000). The D-Line Ivy Spot was used to calculate the average distance between known camps because the site dimensions and distances to other camps can be determined.

Figure 14. The D-Line Ivy Spot location discussed as a MCLC camp by Blum (2000).

The second known camp, MCLC Camp 1, is believed to have been located somewhere north of both the North Creek Camp and the D-Line Ivy Spot locations. Although Blum (2000) provided specific details about the location of this camp, field reconnaissance failed to adequately pinpoint the location of MCLC Camp 1 and camp dimensions could not be ascertained. For this reason, distances between MCLC Camp 1 and other camps in close proximity were not included in calculations.

There are also two sites which have not been positively identified as logging camps, but for the purpose of this research will be assumed to have been logging camps based on the history of those sites and their relation to other positively identified camp sites. Wedekind, once the site of a Civilian Conservation Corps (CCC) camp used to house workers hired to replant Capitol Forest, was located at a very logical camp location. Wedekind was located at the junction of five rail lines in a topographical saddle and remnants of steam donkeys used to log Capitol Forest were found at the site (Figure 15; Ferguson, 2012A & 2012B). It is highly likely Wedekind was the site of a steam donkey construction operation (Ferguson, 2012A).

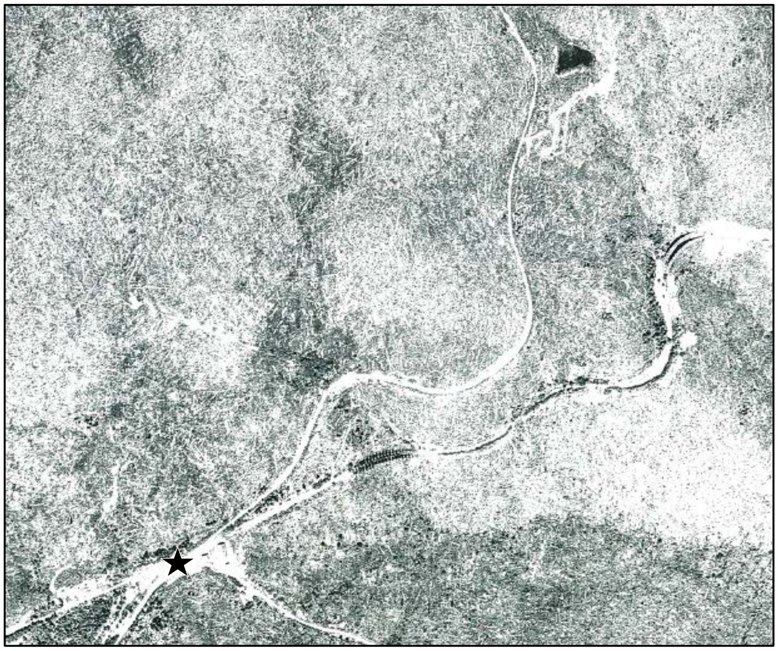

Figure 15. 1941 aerial photograph showing the Wedekind area. At least three (3) structures that were part of the CCC camp are visible in the photograph (designated by star). The water body to the northeast of the camp area is where Wedekind Dam was located (Ferguson, 2011D & 2012B).

A dam created by a large tree with planks set against it was found within close proximity to the Wedekind site and may have supplied water to the camp (Figures 15 & 16). Technology used to create the dam is consistent with early twentieth century logging. The dam is shown on a company map of the forest from 1924, a time when logging in the forest was at its peak and logging camps were common. The 1924 map does not cover the full Wedekind area; however, since the map does not indicate logging camp locations in an area where two camps are known to have existed, it is likely that a camp would not have been shown at Wedekind. Trees growing on top of the dam were cored and found to date near 1954, likely after the CCC planting camp was abandoned (Ferguson, 2011D & 2012B). This finding does not eliminate the notion of the dam being related to a logging camp at Wedekind because the dam was likely kept clear of vegetation while in use and it would have taken some time for trees to establish themselves on top of the dam once it was no longer needed.

As discussed in the previous section, camps were often located at major railroad junctions and as mentioned above, many campgrounds in Capitol Forest are located at former logging camp sites; Wedekind became a campground in 1967 and is still in limited use today (Ferguson, 2012B). Some artifacts consistent with other logging camps of the time were also discovered in the Wedekind area and these artifacts in conjunction with the steam donkey remnants and conclusions about the dam lead to the qualification of Wedekind as a logging camp site. It is extremely likely the subsequent uses of Wedekind as a CCC planting camp and recreation site led to the destruction of possible camp remnants.

Figure 16. Portion of the Wedekind Dam. The dam was constructed from one large log with planks placed against the log to impound water and sediment (Ferguson, 2011D).

The other assumed camp site used in this research is currently the Sherman Valley Campground. Five factors led to the inference of Sherman Valley Campground as a logging camp site. The first three factors are site characteristics common among other former camps in the forest; the site is now a campground, was located at a major railroad junction, and is situated in a wide floodplain next to Sherman Creek. Additionally, there is a structure shown at this location on the 1938 USGS topographic map during a time when MCLC was still operating in the forest (Figure 17). The final finding was the location of a powder house, a site where dynamite was stored for work involving blasting, depicted on the map included in Felt (Figure 18; 1975, map insert). The powder house location was at a safe distance, directly east of the site. The powder house can be seen on 1941 aerial photographs of the area as well (Figure 19). Also visible on the 1941 photograph is a large opening in the forest at the same location as the structure shown on the 1938 USGS map and the present-day campground. These findings provide the basis for inferring that a logging camp was located at this site.

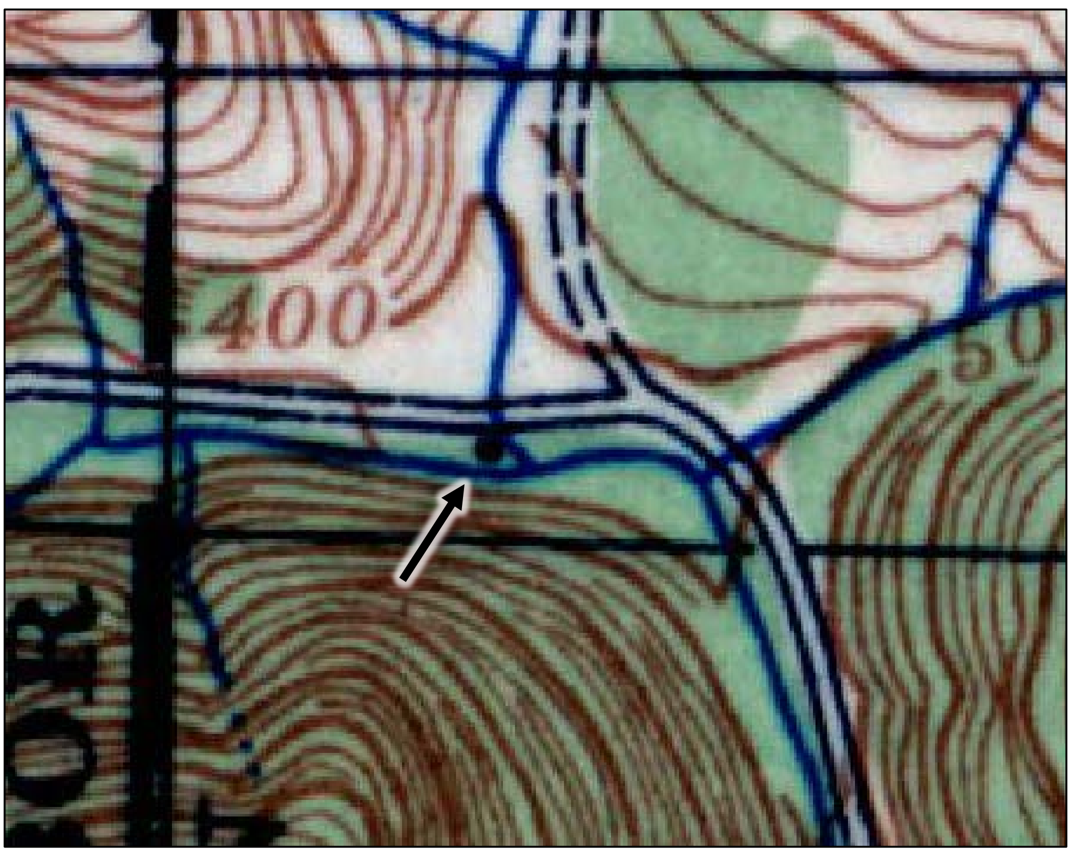

Figure 17. Sherman Valley Camp location shown on the 1938 USGS topographic map; the black dot (indicated with arrow) depicts location of a structure.

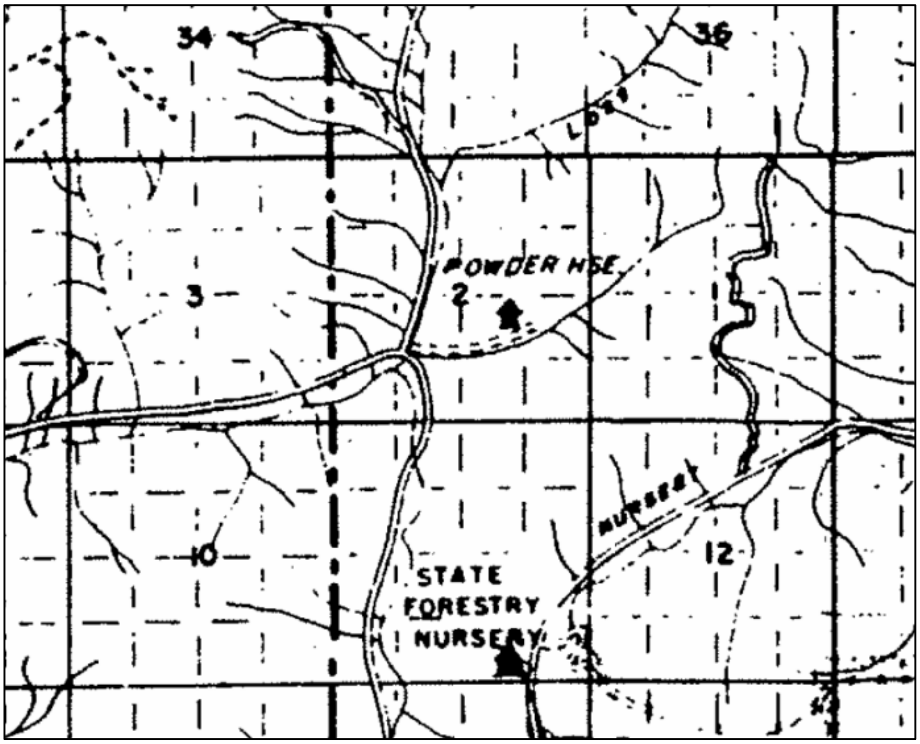

Figure 18. Portion of the map from Felt (1975, map insert) depicting the location of a powder house directly east of a four-way junction and the location of the current campground.

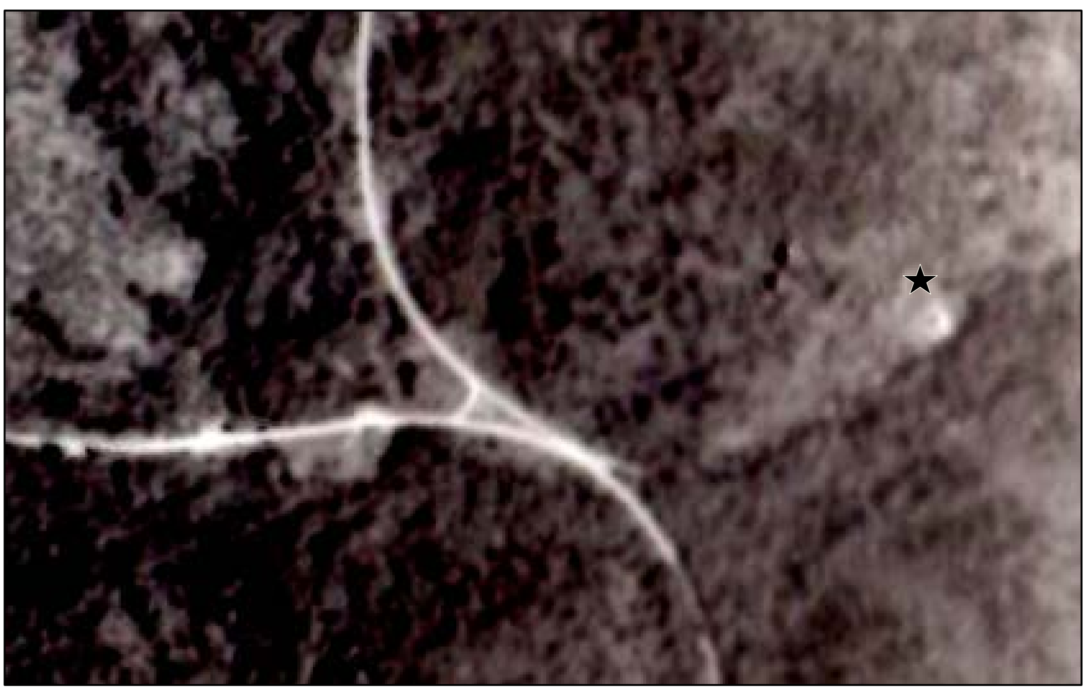
Figure 19. Portion of 1941 aerial photograph of Sherman Valley Campground area. Star at right indicates powder house location. Note rectangular opening in the forest along the grade just past the major rail junction. This opening is also the location of the dot depicting a structure on the 1938 USGS map (Figure 17).

Two other camps had been previously surveyed in Capitol Forest, both on the west side of the Capitol State Forest. Bozy Creek Camp and what will be referred to as B-Line Camp were quite a distance from the other MCLC camps located in the northwest portion of the forest. It is unclear which company operating in Capitol Forest was responsible for these two camps. The B-Line Camp may have been constructed by the Vance Lumber Company based on its proximity to the town of Malone where the Vance mill and headquarters were located, but artifacts found at the site date to after the purchase of the Vance Lumber Company by MCLC in 1924 (Christopherson, 2008; Stilson, 2011). Based on this finding, the B-Line Camp will be included as a MCLC camp and part of this research model. Bozy Creek Camp located north of the B-Line Camp was at a junction of three rail lines and a road labeled "Mox Chuck Truck Trail" on the 1938 USGS topographical map. The main route out of the forest from this camp was to the west where logs could have been delivered north to the town of Elma or south to Malone and the Vance Lumber Company mill.

Many of the known logging camps in the Black Hills share common features. As previously discussed, many camps were located close to major streams, but camps located high in the hills were not. Conversion of many former logging camps into campgrounds and camps being located at or near major rail junctions are other common factors already mentioned. Two other variables common at some camp locations are being located in areas with a wide floodplain and the existence of ponds or wetlands immediately adjacent to camp sites. The wide floodplain may be due to railroad grades being built along major streams, but the association of camps with bodies of water may be more than coincidental. This is because camps located near ponded water were also along streams that were not very wide and a greater source of water may have been needed. The pond near MCLC Camp 7 appears to have been man made, possibly to provide a water resource for the camp (Stilson, 2010D). MCLC Camp 2 and Goliath Creek Camp were also located near large ponds (Ferguson, 2011C & 2011E). These ponds are currently related to beaver activity, but may have initially been manmade impoundments.

Each of the factors discussed above should be taken into account when attempting to identify logging camp locations, but each variable may not apply to every location (Table 3) depending on topography and access to suitable water sources, as noted by CALTRANS (2013). Topography can be a key factor to specific site type locations (De Reu et al., 2011) and may be the most important factor related to logging camp site location. Railroads followed specific gradient requirements for efficient movement and were located in sites with similar topography. In the case of Capitol Forest, railroad grades were mainly located up the draws of major streams. Brashler (1991) notes a similar occurrence of logging camp sites in West Virginia, finding that sites were mainly located at the "headwaters of shorter tributaries" to main rivers and streams (p. 61). Likewise, the logging camps of the MCLC in Capitol Forest appear to be situated in similar topographical locations, a factor that should be taken into account when looking for potential sites. The Mud Bay Logging Company had to construct "impossible grades" and tall trestle crossings in order to access the steeper terrain of their ownership (Felt, 1975, p. 25). Two of Mud Bay Logging Company's four camps are located in the steep hills quite a distance from the main camp, demonstrating how topography impacted camp location.

		Camp Name														
		Bordeaux	B-Line Camp	Bozy Creek Camp	Camp 2	Camp 4	Camp 7	D-Line Ivy Spot	Goliath Creek Camp	High Camp 7	Hollywood[1]	Incline Camp	Lost Valley Camp	North Creek Camp	Sherman Valley Camp[2]	Wedekind[2]
Near Rail Junction		x	x	x		x	x	x		x	x	x		x	x	x
Near Stream/ Wide Floodplain		x	x		x	x	x	x	x		x	x	x	x	x	
Impounded Water Presence		x			x		x		x		x					
Current Campground											x			x	x	x
Near Major Landscape Manipulation[3]		x	x	x		x		x	x	x		x		x	x	x
Exotic Plants		x						x	x		x			x		
Artifacts	Consumables[4]	x	x	x	x	x	x		x	x	x	x	x	x	x	
	Metal Pieces[5]	x				x			x			x	x			
	Steam Donkey							x[7]		x						x
	Water Pipes	x				x			x			x				
	Structural Remnants[6]	x	x		x	x	x			x			x	x		

Table 3. Shared variables among known and assumed MCLC camps used in this research. [1]Hollywood was not a logging camp, but a family camp. [2]These are assumed camp locations [3]Major landscape manipulations include large (>10 feet) railroad grade cuts or fills and trestle crossings. [4]Consumables artifacts include bottles, earthenware, enamelware, tin cans, boot leather, etc. [5]Metal pieces are related to heavy machinery, trains, and pieces related to railroad operations. [6]Structural remnants include bricks, concrete foundations, stone footings, and pilings used for structures. [7]Site identified by Blum (2000) as having a steam donkey construction area.

Felt (1975, p. 32) concludes the discussion about the logging history of Capitol Forest by stating there are “some seven” logging camps located in Capitol Forest (p. 32). Not including the company town of Bordeaux and Hollywood family camp, research and surveys completed by Blum (2000) and those completed by Christopherson, Ferguson, and Stilson between 2009 and 2012 have documented 12 logging camps. The locations of another nine sites are known or assumed to be camps, but as yet, have not been adequately surveyed (Table 4). Of these 21 known and hypothesized camp sites, 15 are believed to have been used by MCLC and there remains potential for more MCLC camps to be found within the forest.

	Total	Company			
		Lytle Logging and Mercantile Company	Mason County Logging Company[3]	Mud Bay Logging Company	Union Logging Company
Total Number of Camps	*21*	*1*	*15*	*4*	*1*
Known to have existed[1]	19	1	13	4	1
Assumed to have existed[2]	2		2		
Documented	12		10	2	
Undocumented	9	1	5[4]	2	1
On Public Lands	17		14[4]	3	
On Private Lands	4	1	1	1	1

Table 4. Total number of known and assumed logging camps in the Capitol State Forest, not including the town of Bordeaux or Hollywood family camp. [1]Camps known to have existed were determined through research of historical documentation and field surveys. [2]Assumed camps are based on professional judgment of possible sites taking into account site variables shared with known sites. [3]Mason County Logging Company may include camps originally constructed by Vance Lumber Company. [4]Camp numbers include assumed camps.

Large gaps where no MCLC camps are known to have existed in Capitol Forest are evident when looking at the locations of the 15 known and assumed MCLC camps (Figure 20). Based on the knowledge that it was not cost effective to transport loggers long distances to where logging activities were taking place, it could be concluded that there are indeed more camp locations within the Capitol State Forest. The method proposed by this research uses the average distance between known and assumed camps based on three different measurements: from the edge of camp extents, from a central point within camps, and from the mill site in Bordeaux to the edge of satellite camp extents. The theory behind this average distance method is that camp locations were typically identified before railroad construction and logging activities began as part of a transportation plan to ensure a profit could be made from logging a given area (Andrews, 1954, p. 74). Logging company owners likely used a systematic method to identify camp locations, using an approximate distance a camp should be built from a company town or previous camp in order to maximize production and profits.

An average distance would have been derived from calculations related to a cost analysis based on one or more of the following three factors: how long it takes to transport workers to a work site; how long it takes to harvest an area based on topography, timber size (e.g. diameter and height), and logging technology; and how long it takes to deliver the timber back to the mill in order to keep the mill operating at capacity. Engineers traversing potential new rail lines through the forest would have used this approximate distance to identify the most feasible camp site nearest that distance. If this were the case, then calculating the average distance plus or minus one standard deviation between the known and assumed MCLC camps could pinpoint other MCLC camp sites. This research used the company town of Bordeaux along with 10 of the 15 known and assumed MCLC logging camps to calculate the average distance. Only 10 known and assumed camps were used to calculate distances because the remaining five camps were not directly connected to the other known or assumed camps. These calculations identified 36 areas where logging camps could potentially be located.

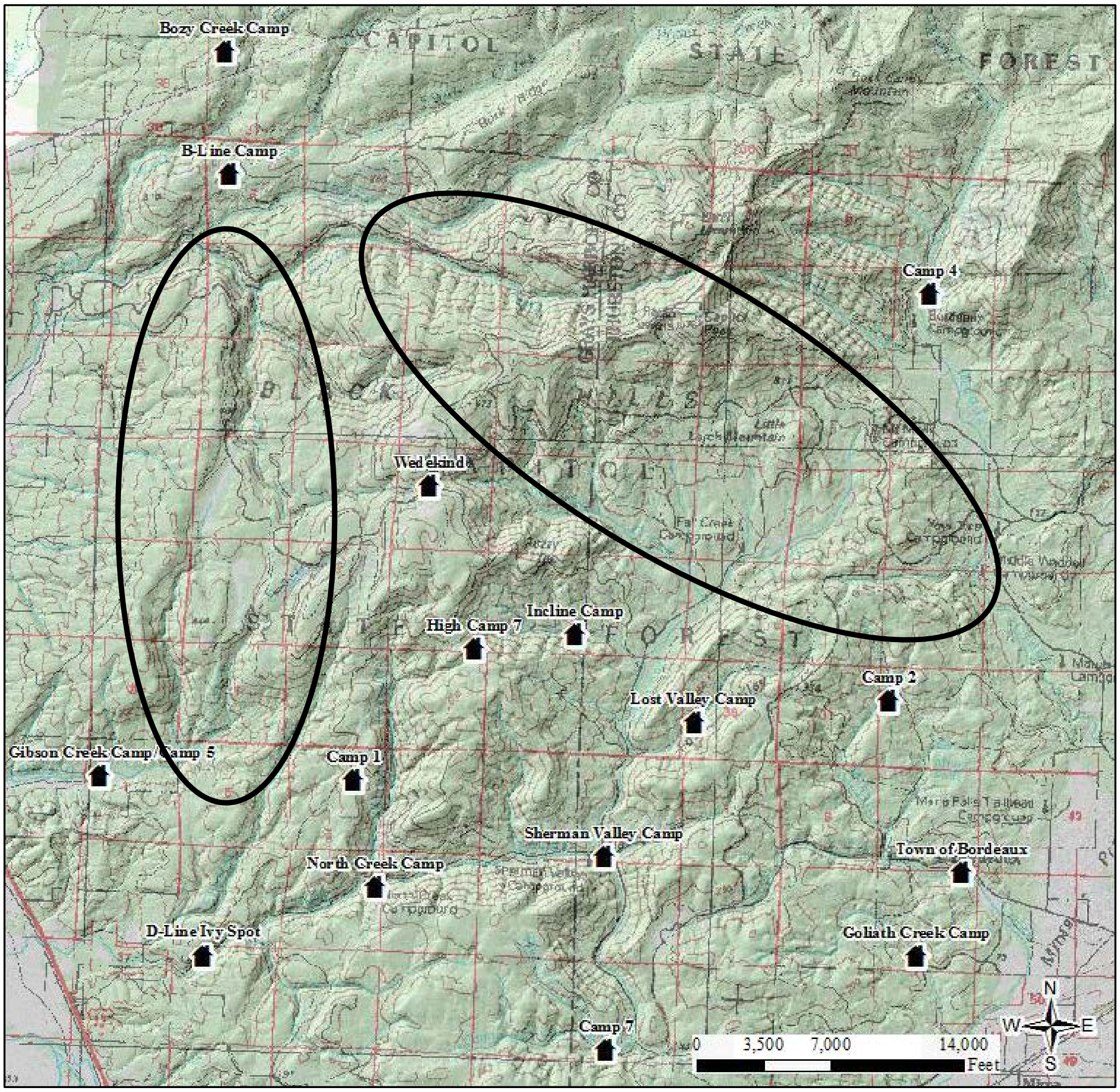

Figure 20. Known and assumed MCLC camps depicted on the current USGS topographic map (1994). Ovals signify gaps in Capitol Forest where no logging camps are known to have existed. House symbol indicates known and assumed MCLC logging camp locations.

Chapter 4 – Methods and Analysis

Creating Spatial Data

Field data from known and assumed Mason County Logging Company (MCLC) camps was collected between 2009 and 2012 using a Garmin 60CSx handheld GPS. Data collected included the locations of features such as railroad grades, structural remnants (if any), trash accumulations, landscape manipulations, and site extents. Points referencing site extent were used along with a 2-meter hillshade digital elevation model (DEM) based on LiDAR data from Washington State Department of Natural Resources (WADNR) to create a polygon feature in ArcMap 10 (versions 10.1 and 10.2) to distinguish an approximate camp size (Figure 21).

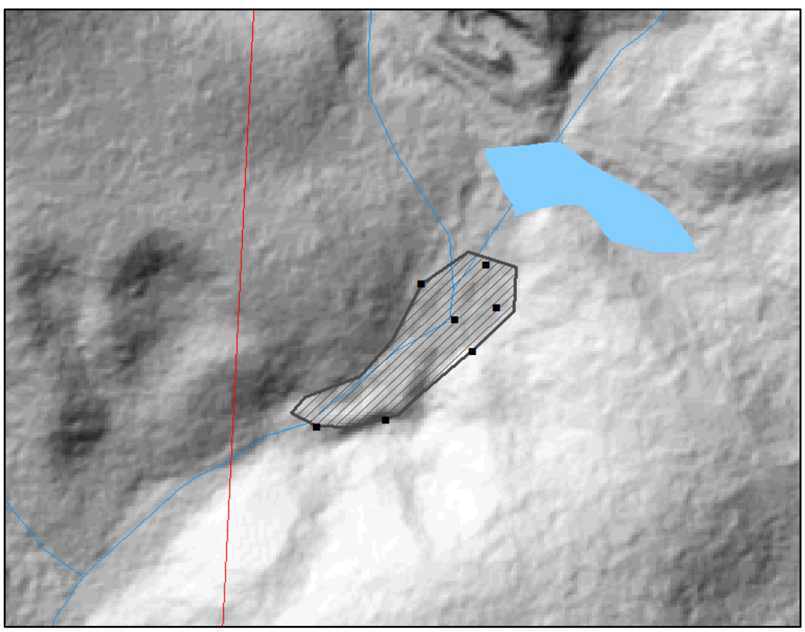

Figure 21. Example of polygon feature created to display camp extent (cross-hatched area) overlaid onto a 2-meter LiDAR hillshade DEM. Points represent landscape manipulations or artifact accumulations.

A layer of railroad grades known to have been used by the MCLC was created in ArcMap 10 using multiple sources for accuracy (Figure 22). A digitized historical United States Geologic Survey (USGS) map from 1938 provided by WADNR was compared to a MCLC map from 1940 depicting all company railroad grades. Both of these map sources were verified against the 2-meter hillshade DEM based on LiDAR data from WADNR. Additional layers for streams, bodies of water, roads, trails, townships, and sections were created in ArcMap 10 by clipping WADNR data for the research area.

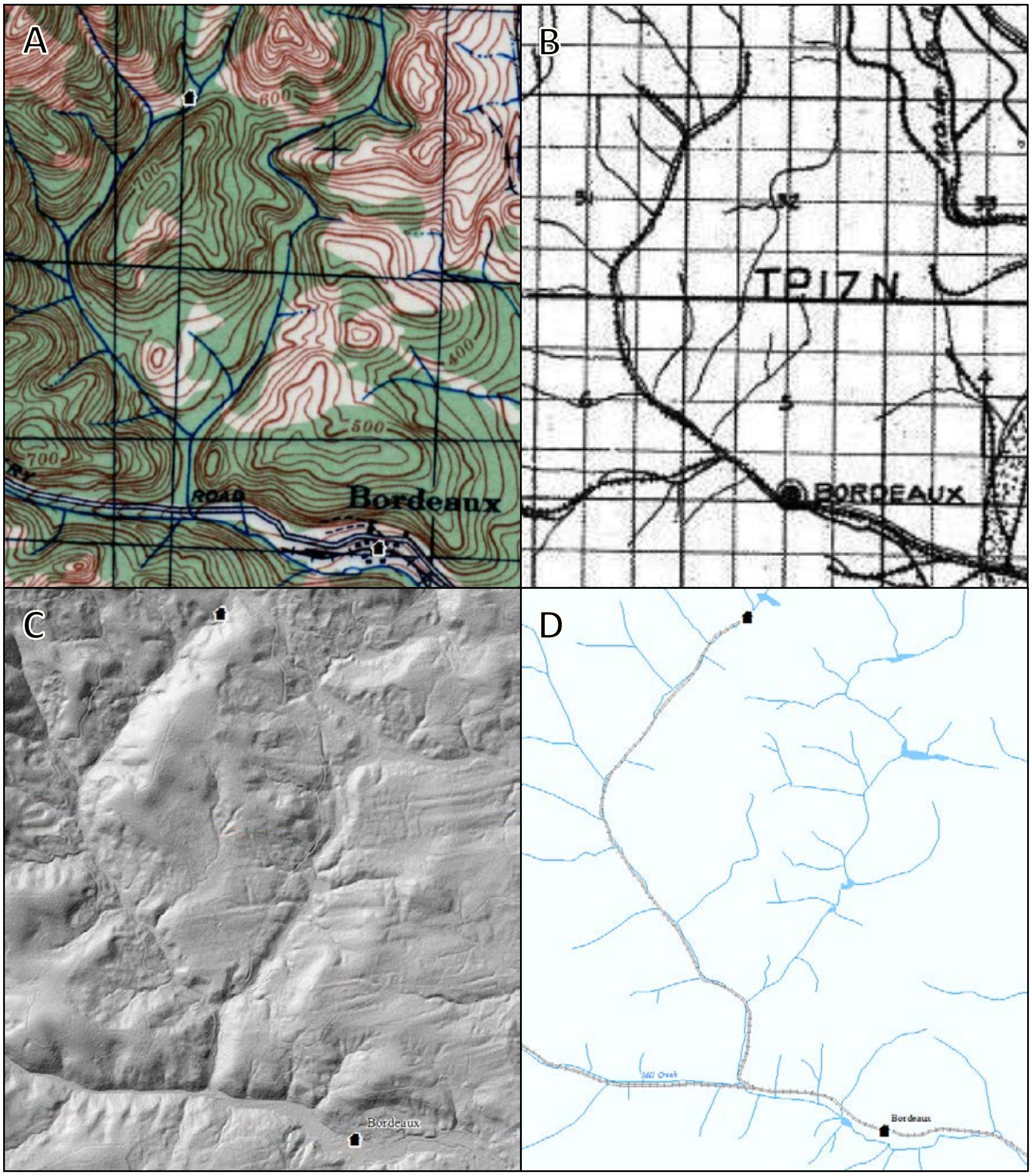

Figure 22. Sources used to create GIS layer of grades used by MCLC; 1938 USGS topographic map (A), MCLC railroad grade map compiled in 1940 (B), and 2-meter LiDAR hillshade DEM (C). Map (D) shows the final grade location based on the three sources. House symbol designates camp location.

Grade Measurements

Three methods were used to calculate average distance between camps; camp extent, camp central point, and Bordeaux central point to satellite camp extent. The edges of camp extent were easily distinguishable based on GPS data as discussed in the previous section. Basing distance between camps on camp extent may not be the best method because extent can grow or shrink over time; therefore, distances were also measured from a central point within each camp. Using camp central points is based on the notion that road mile markers are measured to or from a specific point location within a town such as a post office or city hall. Choosing central points may be an arbitrary exercise because, with the exception of Bordeaux where the mill could be used as a central point, no logical central location exists in each camp. Therefore, the third distance measurement method, Bordeaux central point to satellite camp extent, was completed to eliminate the subjectivity of distinguishing a central satellite camp point.

Railroad lines between camps were merged into a single line segment and the length of each segment between Bordeaux and 10 of the 15 known and assumed MCLC camps was calculated using the Calculate Length tool within the ArcMap XTools extension. Lengths were measured in feet based on the fact that American logging engineers, both past and present, measure distances in Imperial Units / United States Customary Units. Lengths of the segments between camps based on each of the three methods were exported into a Microsoft Excel (2010) spreadsheet where the mean distance between camps and the standard deviations were calculated (Table 5). One standard deviation was then added to and subtracted from the mean distance to determine a distance range to be field verified from each camp location.

CAMP EXTENT					
Camp Grades	Length (ft)	Difference	Dif^2		Standard Deviation
Bordeaux to Camp 2	11336.7132	-741.9364	550469.6052	4906235.5146	2215.0024
Bordeaux to Goliath Creek Camp	9817.765	-2260.8846	5111599.1243		
Camp 7 to Sherman Valley Campground	11974.0901	-104.5595	10932.6867		
Sherman Valley Campground to Lost Valley Camp	9302.8851	-2775.7645	7704868.4978		
Sherman Valley Campground to Incline Camp	14702.1787	2623.5291	6882904.9968		
Sherman Valley Campground to North Creek Camp	11843.3469	-235.3027	55367.3554		
North Creek Camp to D-Line Ivy Spot	10439.8725	-1638.7771	2685590.3471		
High Camp 7 to Wedekind	15884.5971	3805.9475	14485236.4573		
Lost Valley Camp to Incline Camp	13406.3977	1327.7481	1762915.0466		2215.0024
	-1 SD	Mean	+1 SD		
Probable Camp Distance Range (ft)	**9863.6472**	12078.6496	**14293.6520**		
Range		4430.0047			

CENTRAL POINT					
Camp Grades	Length (ft)	Difference	Dif^2		Standard Deviation
Bordeaux to Camp 2	13010.1594	68.4509	4685.5244	3909201.1053	1977.1700
Bordeaux to Goliath Creek Camp	12046.8332	-894.8753	800801.8226		
Camp 7 to Sherman Valley Campground	13286.8122	345.1037	119096.5519		
Sherman Valley Campground to Lost Valley Camp	9751.2972	-3190.4113	10178724.1561		
Sherman Valley Campground to Incline Camp	15072.0821	2130.3735	4538491.4232		
Sherman Valley Campground to North Creek Camp	12557.3776	-384.3309	147710.2555		
North Creek Camp to D-Line Ivy Spot	10866.0798	-2075.6287	4308234.5510		
High Camp 7 to Wedekind	16201.4528	3259.7443	10625932.8217		
Lost Valley Camp to Incline Camp	13683.2823	741.5738	549931.7361		1977.1700
	-1 SD	Mean	+1 SD		
Probable Camp Distance Range (ft)	**10964.5385**	12941.7085	**14918.8785**		
Range		3954.3399			

BORDEAUX CENTRAL POINT/CAMP EXTENT					
Camp Grades	Length (ft)	Difference	Dif^2		Standard Deviation
Bordeaux to Camp 2	12735.8146	258.7293	66940.8461	4074550.9067	2018.5517
Bordeaux to Goliath Creek Camp	12004.58546	-472.4999	223256.1554		
Camp 7 to Sherman Valley Campground	11974.0901	-502.9953	253004.2274		
Sherman Valley Campground to Lost Valley Camp	9302.8851	-3174.2003	10075547.2645		
Sherman Valley Campground to Incline Camp	14702.1787	2225.0933	4951040.3900		
Sherman Valley Campground to North Creek Camp	11843.3469	-633.7385	401624.4305		
North Creek Camp to D-Line Ivy Spot	10439.8725	-2037.2129	4150236.2202		
High Camp 7 to Wedekind	15884.5971	3407.5117	11611136.2863		
Lost Valley Camp to Incline Camp	13406.3977	929.3123	863621.4329		2018.5517
	-1 SD	Mean	+1 SD		
Probable Camp Distance Range (ft)	**10458.5337**	12477.0854	**14495.6370**		
Range		4037.1034			

Table 5. Distance between individual camps, mean distance, and standard deviation calculations using camp extents, central points within each camp, and Bordeaux mill site/satellite camp extent. The standard deviation in the lower right corner was calculated from the Microsoft Excel standard deviation function as a verification of the manual standard deviation calculations in the table.

Once the plus-1 and minus-1 standard deviation distances were determined, the measure tool in ArcMap was used to measure distances along the grades from known and assumed camps to plot potential sites. Measurements for the central point method were initiated from the designated central point of each camp, while extent measurements were made from the edge of determined camp extents. Measurements for the Bordeaux central point method were initiated from the mill location at Bordeaux and from the defined extents of each satellite camp. Due to the precision of measuring along a line in ArcMap, measurements were made to the nearest whole foot rather than the ten-thousandth of a foot as shown in the standard deviation calculations (Table 5). A point was placed at each location marking the beginning and end of the range for each of the three methods. Different colored symbols were used when there was overlap based on the direction of measurement; for instance, if measuring north along a grade from one camp overlapped locations measured moving south from another camp, the symbology would change to designate the overlap (Figure 23). There were a total of 41 measured segments based on extent measurements, 42 from central point measurements, and 44 from Bordeaux central point measurements (Appendix A). Some measured segments contain more than one beginning or end point due to segments spanning a railroad junction(s).

For ease of field verification, clumps of measured distance ranges were assigned an aggregate segment identifier (Appendix A). These 36 aggregate segments (Figure 23) were arranged into a Microsoft Excel (2010) spreadsheet where the location, access, site probability, and field verification information was entered. *Location* refers to the public land survey system or section, township, and range of each segment. *Access* provides details of whether or not a segment is along a road or trail. *Site Probability* documents a subjective opinion based on a remote site evaluation taking into consideration the factors that appear to be common among MCLC camps previously recorded, as discussed in Chapter 3 (Table 3). These factors include proximity to a railroad junction or stream, presence of impounded water, if a campground is located in part of the segment, and presence of a large landscape manipulation feature (i.e. grade cuts or fills over 10 feet). Discussed in more detail below, the probability also took into account topographic proximity to other MCLC camps and proximity to former MCLC property lines. Segments were assigned a low, medium, or high probability based on these factors; however, the probabilities were simply an educated opinion and had no impact on field verifications. *Field Verification* lists the date of each site visit, the type of artifact or feature found, and whether or not a camp site was identified.

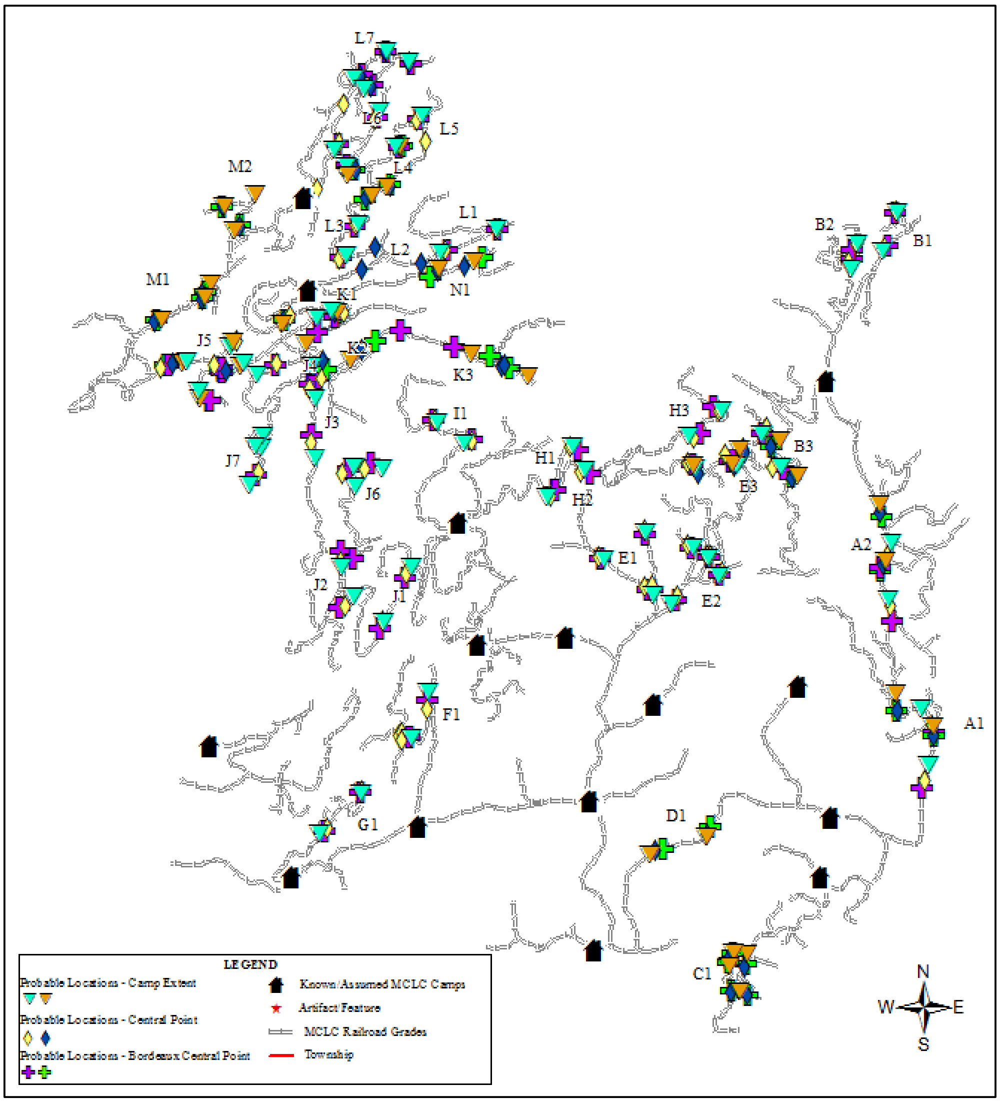

Figure 23. Map of all measured segments with aggregate segments identified.

Field Verification Process

Field verification methods involved traveling to locations within Capitol Forest by vehicle and hiking along old railroad grades to the locations indicated by distance measurements. Many old railroad grades have been converted to trails or roads within Capitol Forest, making travel along those grades easy. Less time was spent surveying grades that have since been converted to roads due to the level of disturbance in those areas. Trails were thoroughly surveyed because, as discussed below, trails can be helpful for locating artifacts. Walking railroad grades included weaving from one side of the grade to the other in order to survey the adjacent land because camps would not be built directly on the grade, but rather along it in wide areas or flats. Besides local topographic features, such as flats along grades, other areas receiving greater attention were draws (features in the terrain where water may flow or drain), stream crossings, and steep areas near flats along grades. Finding artifacts in these areas is common to both logging camps and homesteads of the late nineteenth and early twentieth centuries and could be considered typical topographic indicators of high site probability.

Major streams adjacent to grade segments were also surveyed in attempts to locate artifacts consistent with logging camps of the early twentieth century. As discussed previously, it was common for camps to be located near streams and inhabitants frequently threw broken or empty ceramics and glassware into adjacent streams (Figure 24; Stilson, 2009, 2010D, & 2010E; Ferguson, 2010A, 2011A, 2011C, & 2011E). Once in the stream, these artifacts were distributed over a larger area as pieces washed downstream. For this reason, verification of grade segments adjacent to major streams were completed by traveling upstream from below each segment.

Figure 24. Examples of trash deposited in streams and distributed by fluvial processes (designated by stars). Photographs by author from MCLC Camp 2 (left) and MCLC Camp 7 (Stilson, 2010D; Ferguson, 2011C).

Data collection consisted of digital photographs and written notes of artifacts and features of significance. GPS points were taken with a Garmin 60s handheld GPS where artifacts or landscape anomalies were found and the points transferred to ArcMap. Some segments were surveyed as part of WADNR timber harvest operations and not as a part of this research. Reports completed by Christopherson (2009A & 2009B), Ferguson (2012C), Nordstrom (2012 & 2014), and Vaughn (2013) were used to verify findings of the segments covered in each report.

Logging Camp Site Identification

Knowing what to look for in the field is important in order to identify whether or not a site was a logging camp. Common variables appear to be shared by multiple camps used by MCLC (Table 3). Sites characteristics such as proximity to rail junctions, floodplains of a major stream, or major landscape manipulations such as a large grade cut or fill (greater than 10 feet) are shared by almost every known and assumed MCLC camp. Consumables artifacts are a staple at every site except those that have not been fully surveyed; however, some of these types of artifacts or site features could be related to logging, railroad activity, or homesteads. There are a handful of homestead or cabin sites denoted on historical maps of Capitol Forest, but these areas have either been documented previously or the sites surveyed and nothing found. Determining whether artifacts or site features are related to a logging camp or other human activity can be difficult without an understanding of what those artifacts and features mean.

A single artifact found in the woods may mean very little by itself, but when other features around that artifact are taken into consideration, a full picture can begin to take shape. Likewise, comparing findings or recognizing features and patterns of those features from known sites can help archaeologists better identify site type. Artifacts can be the easiest pieces of evidence to identify site type. Logging camp artifacts can include consumable products such as earthenware or china, glass bottles, tin cans, enamelware, boot leather, gloves, tools, and more.

The difference between logging camp artifacts and artifacts found at a homestead are the types of bottles, china, cans, etc. Logging camps have an abundance of basic white china with little to no decorative properties because this type of china was cheaper and loggers did not typically have a need for such sophistication (Figure 25). While more common at homestead sites, decorative china has been found at logging camp sites, but not with great frequency. Decorative china at logging camp sites may also provide evidence for the presence of women or families. Dating china can be fairly accurate provided a maker's mark can be located and identified. Maker's marks can provide the location and date range a piece was manufactured. Finding a maker's mark can be difficult in the forest as ceramic fragments, also known as sherds, are all that remain.

Figure 25. Example of the plain white china often found at logging camps (left) and blue transfer print decorative china more commonly found at homestead sites. Photographs by author.

Figure 26. Example of bottle found at a historical camp site. This brown bottle was manufactured in 1933 based on the Owens-Illinois maker's mark shown. In the absence of a maker's mark, manufacturing variations can identify a possible production date. The oval-shaped seam on the bottom (indicated by arrow) is likely a cut-off scar where the bottle was cut from a suction machine; this type of scar dates the bottle between 1904 and 1950. Photograph by author (Ferguson, 2011A).

The types of glass bottles found at a site can also be indicative of a logging camp site. The most common bottles found at MCLC camp sites are ketchup and liquor bottles. These types of bottles can also be found at homesteads, but not in the numbers found at logging camps. Bottles can provide the best methods for obtaining a date of usage. Like china, bottles often have maker's marks from which an exact manufacturing date can be ascertained from bottle identification sources (Figure 26).

Other bottle features can help pinpoint an approximate manufacturing date. Features such as seams, which can identify the type of mold used, how a lip or finish was applied to the bottle, closure type (e.g. cork), letter embossing, and glass color can all be used to identify a manufacturing date range. Dating a bottle cannot determine site type unless a specific site type only existed during a given time period, which can be the case for MCLC. Although whole bottles make identification much easier, they are not required because glass fragments, also known as shards, can provide enough clues based on the various dateable bottle characteristics listed above.

Artifacts made from metal were common items left in the forest following the major logging era. Metal artifacts include cans, enamelware dishes, pans, saws, files, barrels, stove parts, bed frames, and more. These artifacts can be indicative of any habitation site type, but some can be more commonly found specifically at logging camp sites. Certain tin cans are found on a regular basis in logging camps including condensed milk cans and tobacco tins. Similar to bottles, can features such as closure type, seam type, and dimensions can help date that can. Various tobacco brands existed in cans from 1907 to the 1960s; however, Prince Albert was the most common brand found in logging camps. Unfortunately for many historical sites such as logging camps, tin cans end up deteriorated beyond recognition due to time and climate. Metal artifacts such as enamelware are not exclusive to logging camps, but can be if found with other artifact types and features. Metal bed frames are a definitive indication of habitation and have been found at multiple camps in Capitol Forest, but could also be related to a homestead (Stilson, 2009; Ferguson, 2010B & 2011A). Cross-cut saws can be more common to logging camps, but homesteads of the same era also used cross-cut saws to clear land.

Structural artifacts found at sites that were, at one time, home to forest workers include bricks and foundational pieces. Bricks can be indications of a structure and are very common at logging camp sites in Capitol Forest, including MCLC's Camp 2, Camp 4, Camp 7, High Camp 7, and Lost Valley Creek Camp (Stilson, 2009, 2010D, & 2010E; Ferguson 2010B & 2011C). Bricks can help ascertain approximate dates of production based on manufacturing method or if a name was part of the brick mold; however, many bricks were mass-produced and were often moved from site to site. For this reason, bricks are not trustworthy artifacts by themselves for dating a site. Foundational pieces such as concrete or stone footings also indicate former habitation. Concrete foundation pieces demonstrate a more permanent structure location while stone footings may be more representative of temporary residents (Stilson, 2009, 2010C, & 2011).

Similar to structural remnants, leather artifacts such as shoe parts may not provide a time of usage for a site, but the style of shoe can be used to identify site type and determine the presence of women and children (Ferguson, 2011A). Leather boots similar to work boots worn by foresters and loggers today are common at logging camp sites. Shoes with more decorative qualities and colors signify a woman's presence in a camp while smaller shoes can indicate the presence of a child (Figure 27; Ferguson, 2011A).

Shoe remnants can be found at various site types, but are indicative to some form of habitation rather than a simple logging activity.

Figure 27. Leather shoe examples found at Capitol Forest logging camp sites. Plain boots (left) were commonly worn by loggers while the decorative shoe likely belonged to a woman. Photographs by author (Ferguson, 2011A).

All artifacts discussed above can help assign an approximate date range a site may have been used as well as determine the type of historical site (e.g. logging camp versus homestead). Artifacts, along with research into the history or ownership of a specific area, can also provide site type determination. For instance, if numerous artifacts were discovered in the middle of the forest near a railroad grade and there was no land grant patent listed for that geographic location, the site is more likely to be a logging camp than a homestead. An absence of the types of artifacts listed above, however, can make it difficult to distinguish between a habitation site and a site where only logging or railroad activity took place.

In the absence of consumables artifacts, other site features such as equipment pieces can help identify a site as a potential logging camp. Equipment left behind may signify a site where only logging operations took place rather than a camp site. For instance, wire rope, hereafter referred to as logging cable, in varying diameter can be found in abundance throughout the forest. Single strands of cable are likely related to logging activities; however, large piles comprised of various diameters of logging cable have been found associated with logging camp sites throughout Washington State, including those used by the MCLC (Figure 28; Ferguson 2010A & 2010B).

Figure 28. Mound of logging cable found at MCLC Incline Camp. Photograph by author (Ferguson, 2010A).

Steam donkey remnants can also be common for both logging camp sites and logging activity only. A few steam donkey remnants appear to have been left in random locations within Capitol Forest, but others seem to be connected to logging camp locations. Discussed previously, three of the known and assumed camps contained or were known to have had steam donkeys associated with them. High Camp 7 and Wedekind both had remnants on-site while the D-Line Ivy Spot was known to have had a steam donkey construction operation (Blum, 2000; Ferguson 2010B & 2012A). Steam donkey remnants typically include the log skids with large iron pieces within each skid and sometimes connecting skids. Corrugated metal from roofing elements, metal waterlines, and logging cable are also common artifacts to find in conjunction with steam donkey remnants.

Landscape manipulations, in the case of logging activities, include any modification or addition to the landscape. Large amounts of earth were commonly removed from or added to areas to keep the rail grade at allowable slopes for train movement; these are called cuts and fills with through cuts being when earth is removed from both sides of the grade (Figure 29). These features can range from one foot to greater than 30 feet in depth or height. Cuts deeper than 10 feet required heavy excavation work to move the vast amounts of material to reach grade and, prior to bulldozers, this work was completed with tools such as a Fresno scraper (Labbe & Goe, 1961, pp. 62-3). Camps needed to house the workers constructing these large landscape modifications have been found near large cuts in Capitol Forest (Christopherson, 2008; Stilson, 2010A & 2011). Smaller cuts and fills could be completed more quickly and likely did not require lodgings nearby. Even small cuts and fills are visible using LiDAR and that data can be used to map grades as completed in the methods above. Some smaller modifications such as flattened areas near grades and small rail spurs (short lengths of grade) can indicate a possible camp site; however, without artifacts to definitively identify past habitation, these features are likely logging related.

Figure 29. An extreme example for Capitol Forest, this through cut near Mud Bay Logging Company's Camp 2 is greater than 40 feet deep through solid rock. Photograph by Lee Stilson (Stilson, 2010A).

Another landscape modification common to late nineteenth and early twentieth century logging was the wooden trestle. Bridges made from stacked logs or pilings and cut lumber were constructed when there was no other route around a stream or gully (Figure 30; Labbe & Goe, 1961, pp. 33-4). Logging camps in Capitol Forest have been located near significant trestles (Stilson, 2009; Ferguson, 2010C); however, trestles are not an adequate indication of a logging camp site. Due to the disposal patterns of humans as discussed by Schiffer (1983 & 1986), areas where trestles once stood are good locations to survey for artifacts that may have been thrown from passing trains. Artifacts discarded in these locations can lead to a camp locations.

Figure 30. Trestle remnants found near MCLC Camp 4. These remnants are approximately 20 feet tall. Although many standing trestle remnants were removed or demolished in the decades following the end of the major logging era in Capitol Forest, a number of examples remain. Photograph by author (Ferguson, 2010C).

Exotic plants, which are non-native species either planted or spread by other means in the forest, can also help identify a logging camp site. Fruit trees, typically apple or cherry, and ornamental flowers often leave no question as to whether or not a site was inhabited (Felt, 1975, p. 35; Stilson, 2010A; Ferguson, 2011A). English ivy (*Hedera helix*) was found associated with the D-Line Ivy Spot, Hollywood family camp, North Creek Camp, and Goliath Creek Camp sites and can be a good indicator of past occupation (Ferguson, 2011A, 2011B, & 2011E). Another exotic plant species that can help lead to a positive logging camp site determination is holly (*Ilex aquifolium*). Exotic plants can also be related to homesteads as settlers commonly planted ornamental species. Non-native plants can also appear in random locations from natural mechanisms such as birds spreading seeds or berries to different locations. These plants can also be spread when an apple core or cherry pit is tossed from a train as its moving through the forest. For these reasons, exotic plants should not be used to define a site as a logging camp site without the presence of other site variables.

Potential Complications and Limiting Factors

There are multiple factors that could complicate and limit the success of this research. Factors unrelated to research methods such as landscape changes, timber harvest, road construction, recreation, looting, local topography, and property boundaries can all potentially lead to negative findings. Factors related to the measurement methods used in this research or basing known camp identifications solely on artifact accumulations rather than known habitation sites could also lead to unintended errors.

A large number of railroad grades in the Capitol State Forest have been converted to forest roads since MCLC left the forest. In some places, former railroad grades have been widened, paved with asphalt, or covered with gravel. Disturbance along these converted grades covered, if not completely obliterated, any trace of artifacts or past inhabitants as was the case with the D-Line Ivy Spot where road paving is said to have covered artifacts (Blum, 2000). Many other grades have been converted into recreation trails. This can be seen as a positive outcome, one which allows the public an opportunity to enjoy these historical features; however, some trails located near known logging camps can disturb artifacts found on-site (Figure 31). Numerous segments to be verified are now either roads or trails, likely limiting success of locating artifacts.

Figure 31. Example of a recreation trail disturbing a known logging camp site. Turned up by all-terrain vehicles, glass shards and earthenware sherds can be seen in the footprint of the trail (designated by stars). Photograph by author.

How recently timber harvest occurred in potential locations can improve or reduce the ability to locate or identify possible camp locations. As noted earlier, artifacts can be easier to find following timber harvest as the understory brush is almost completely removed and ground disturbance from equipment can uncover artifacts with little damage (Christopherson, 2008; Stilson, 2011). Heavily stocked stands of 15-year-old or older reproduction timber with fully closed canopies and little ground cover also improve the ability to find artifacts and potential camp sites (Stilson 2009 & 2010A). This is because ground visibility is higher and the most recent harvest activity likely turned up artifacts that were partially or fully buried. The period after recently harvested areas have been planted, but prior to the canopy closing, can be a difficult stand successional stage to survey for potential sites because the ground is nearly impossible to see with the amount of vegetation, both trees and shrubs, covering the forest floor. Likewise, mature stands, those greater than 60-years-old that are developing an intermediate canopy, can be difficult to survey due to the amount of ground cover. As discussed, railroads were constructed along major streams due to the gradients required for train movement. This fact along with current timber harvest restrictions requiring areas immediately adjacent to streams to be left for riparian protection, means that many surveyed areas were within mature stands.

Local topography caused segments to be close in geodesic distance, which is the straight line distance between two points ignoring topography, to existing camps. Many segments were well below the average distance from known camps due to the topography of the landscape (Figure 32). In these cases, loggers of the era could have simply walked across the landscape to these potential sites in the time it would take them to be transported by rail, making a camp in those locations unnecessary. Short geodesic distances were one of the variables used in determining site probability (Appendix A) and likely limited success of locating undocumented logging camps.

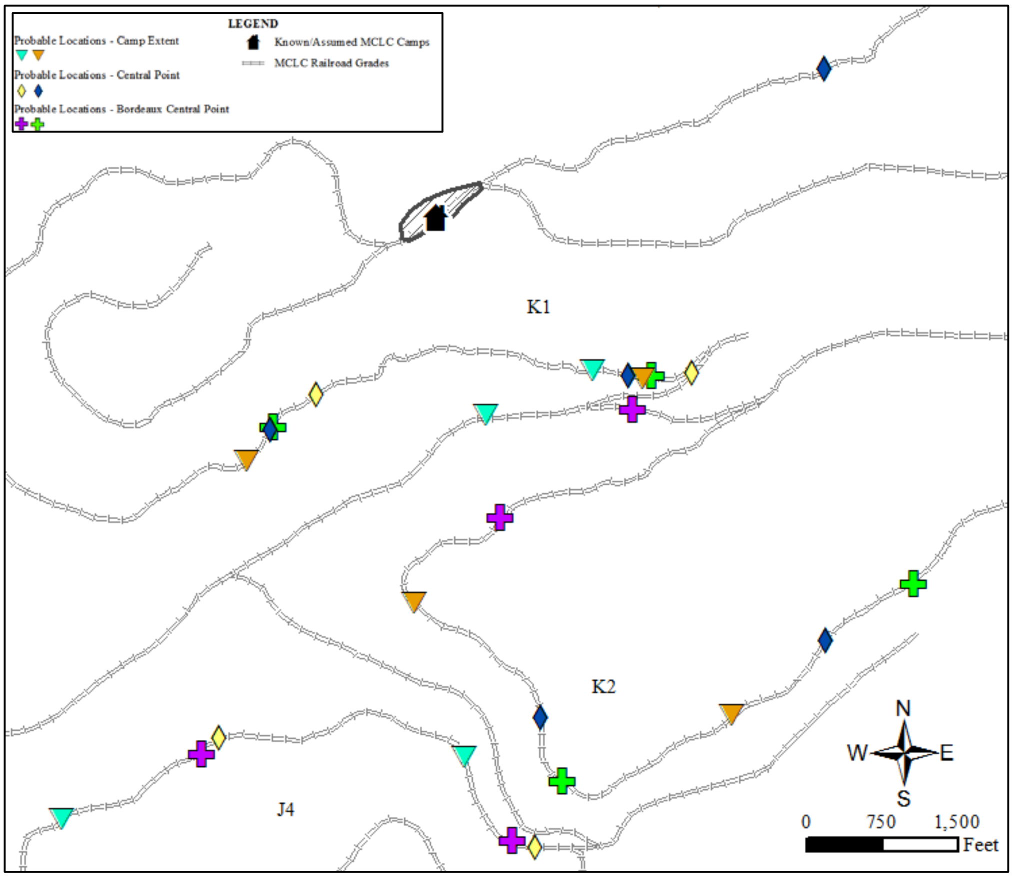

Figure 32. Example of grade segments that, due to topography, are too close to existing camps in geodesic distance to make a logical camp location. In this example, aggregate segments J4, K1, and K2 are all less than 6,000 feet from the existing camp, which is well below the calculated average distance between known and assumed camps.

A number of segments were at the end of known rail lines and up against ownership lines between MCLC and the Mud Bay Logging Company. This is an important factor because it does not seem plausible that a company would undertake the time and cost of establishing a satellite logging camp when that company's property only extends a limited distance past where a camp would have been logical (Figure 33).

Segments close to known property boundaries are a limiting factor to success and also contributed to lower probability predictions (Appendix A).

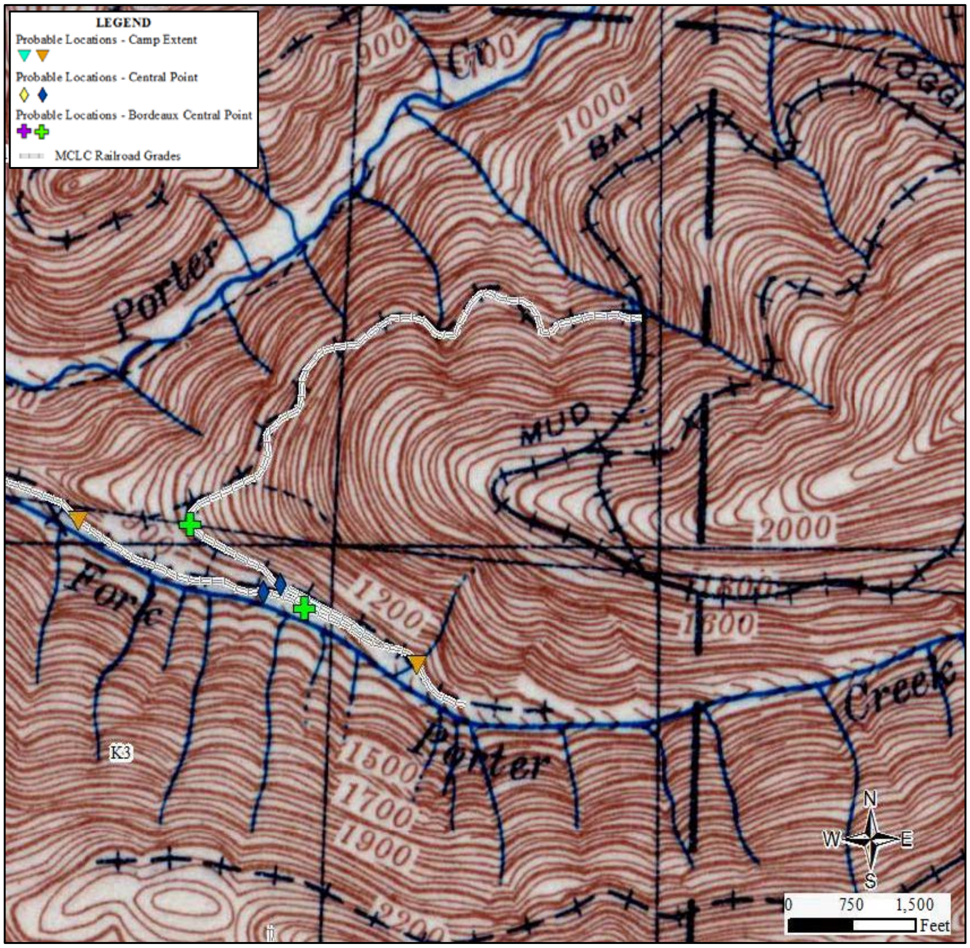

Figure 33. 1938 USGS topographic map showing measured distance segments in close proximity to land managed by the Mud Bay Logging Company.

Looting may also make it more difficult to find artifacts. It is common for people to go to historical sites such as logging camps to gather bottles and other artifacts with the intention of selling those artifacts for profit. This has clearly happened at MCLC Camp 4; however, the identification of Camp 4 was easy given the sheer volume of artifacts found on-site as well as the documentation of the camp on historical maps (Stilson, 2009). Much of the information collected by Blum (2000) was from a local resident who knew the locations of many camps within the forest; it can be assumed that camp locations are common knowledge among longtime residents of the Capitol Forest area. Finding and recording historical camps may not deter looting; however, documenting and revisiting sites could determine if looting has occurred. Knowingly removing artifacts from historical sites is considered a misdemeanor crime in Washington State.

A potential complication specifically related to methods used in this research is that of compounding measurement errors. Segments measured from the end of previous measured segments can create potential location errors depending on where a camp may have been located. For instance, if a camp is discovered within one measured segment, segments beyond the newly discovered camp site should be adjusted based on that finding and would result in a different set of potential locations. If no adjustments are made after discoveries, this error would compound itself given the long stretches of railroad grades between some camps (e.g. Wedekind to B-Line Camp).

A final potential complication related to the specific methods used in this research is the misidentification of camp sites. Using camps that are either unproven to be camps, such as Sherman Valley Campground and Wedekind, or, like the D-Line Ivy Spot, that have not been sufficiently surveyed, can affect the average distance measurements. Also, understanding the human disposal patterns discussed by Schiffer (1983 & 1986) could lead to changes in camp locations. A site recorded based on the location of a midden may not be an actual camp site, but rather a dump site. This could be the case with Goliath Creek Camp since common logging camp artifacts such as dishware and other consumables were not discovered. Misidentification of camp sites would affect calculated average distances and cause shifts in the distance segments identified as potential logging camp sites.

Chapter 5 – Results and Discussion

Results

Field verifications of distance segments were inconclusive, failing to definitively identify any historical logging camp locations. Artifacts dating from the early twentieth century and consistent with logging camps of that era were found within some of the 36 aggregate distance segments and within close proximity to others (Table 6; Appendix A). Aggregate segments are clumps of measured distance ranges located in the same general area.

Variable		Within Segments	Outside Segments[1]
Total		*36*	
Near Rail Junction		20	
Near Stream/ Wide Floodplain		21	
Impounded Water Presence		4	
Current Campground		4	
Near Major Landscape Manipulation		7	
Exotic Plants		4	
Artifacts	Consumables	5	3
	Metal Pieces	5	
	Steam Donkey	1	1
	Water Pipes	2	2
	Structural Remnants	1	
Limiting Factors[2]	Near Property Line	17	
	Close in Geodesic Distance	10	
Nothing found[3]		29	

Table 6. Field verification findings in aggregate segments. [1]Cells without a value do not apply. [2]Four aggregate segments were both near property lines and close in geodesic distance. [3]Includes segments where artifacts were found outside, but close to that segment.

As previously mentioned, artifacts such as bottles, earthenware or china, and enamelware can be the best indicators of site type. These types of artifacts were found within five aggregate segments (A1, E1, E2, J5, and L3); however, artifacts found in one segment (L3) were determined to be from after Mason County Logging Company (MCLC) had shut down operations in Capitol Forest. Other findings discovered within aggregate segments, which were similar to those artifacts and features discussed in previous chapters, lead to more potential logging camp sites. In total, artifacts consistent with historical logging camps in Capitol Forest were found within seven separate aggregate segments (A1, E1, E2, E3, J5, J6, and L7) and within close proximity to five additional aggregate segments (B1, D1, F1, J2, and M1). Specific findings, both within and just beyond aggregate segments, are covered in more detail below.

Results in relation to the three different methods used for measuring average distance were very close, likely due to the small differences among averages (Table 7; Appendix A). Artifacts and features found within aggregate segments were often found within segments of all three measurement methods; however, more artifacts and features were found within extent segments. These findings are discussed in more detail below.

Variable		Extent	Central Point	Bordeaux Central Point / Extent	Outside Segments[1]
Total		*41*	*42*	*44*	
Exotic Plants		4	1	1	
Artifacts	Consumables	6	4	5	3
	Metal Pieces	4	2	3	
	Steam Donkey	1	1	1	1
	Water Pipes	1	1	1	2
	Structural Remnants	2	2	2	
Limiting Factors[2]	Near Property Line	19	21	21	
	Close in Geodesic Distance	12	10	11	
Nothing found[3]		32	35	37	

Table 7. Field verification findings among three measurement methods. [1]Cells without a value do not apply. [2]Four segments of each type were both near property lines and close in geodesic distance. [3]Includes segments where artifacts were found outside, but close to segments.

Aggregate Segment Findings

Aggregate Segment A1 Findings

An enamelware pitcher was found within all three types of measured segments within aggregate segment A1 (Figures 34 & 35; Ferguson, 2011F). The pitcher was found along the edge of a beaver pond adjacent to the original railroad grade. The beaver dam failed in 2011, releasing the impounded water. It remains possible more artifacts could be uncovered as the sediment of the former pond is scoured. This pitcher is unlikely to be an isolate because it is not an item typically discarded at a random location like a broken dish or bottle.

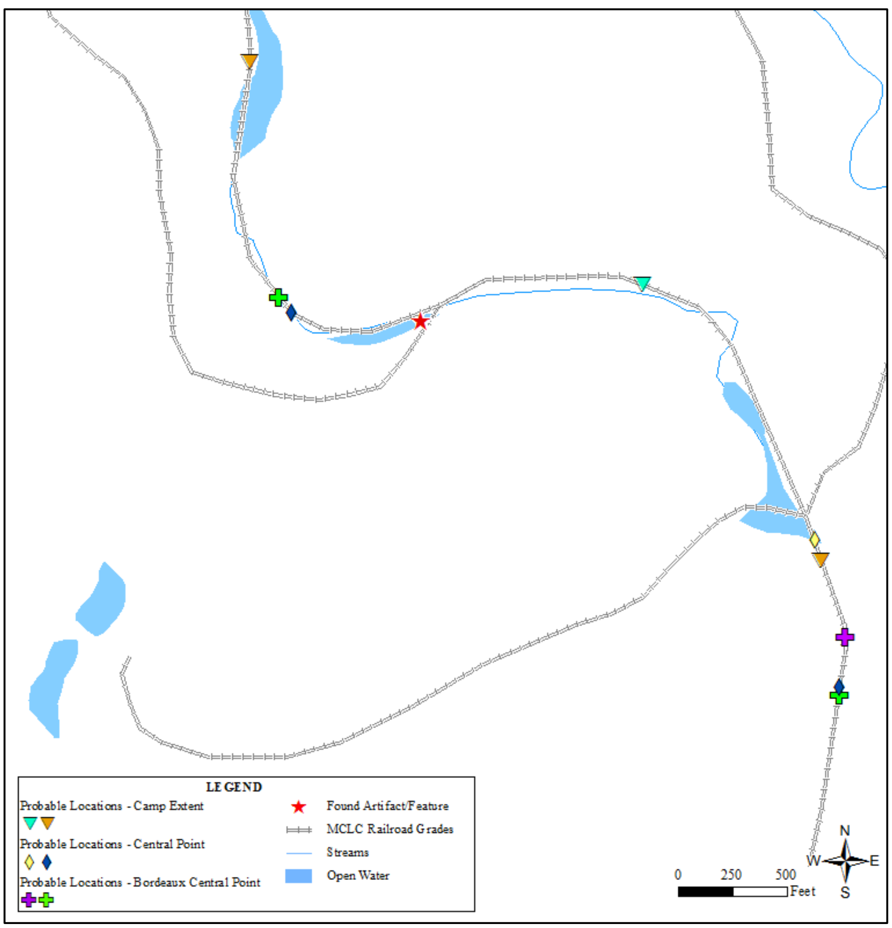

Figure 34. Area of aggregate segment A1 where artifact was found. Note location near junction and impounded water.

Figure 35. Enamelware pitcher found within segment A1. Photograph by author (Ferguson, 2011F).

Some logging cable was also discovered near another junction and large impounded body of water at the southern portion of segment A1, but could be related to logging activity only. It remains a possibility that artifacts also exist within this southern body of water as it may not have been full of water during the time the forest was initially harvested. This is because the adjacent stream has been altered downstream of the site, likely causing changes in flow patterns. If the pond did exist at the time of original harvest, the southern pond may have been used as a dump site similar to what was found at the Hollywood family camp site (Ferguson, 2011A).

Aggregate Segment B1 Findings

A portion of a 1.5-inch iron water pipe was found during a survey by Vaughn (2013) approximately 1,800 feet from the ends of extent and Bordeaux central point measured segments (Figure 36). By itself, this water pipe does not indicate a logging camp site. Given the location of this pipe at the end of a rail line, it may be more likely this pipe was related to logging or railroad activity only.

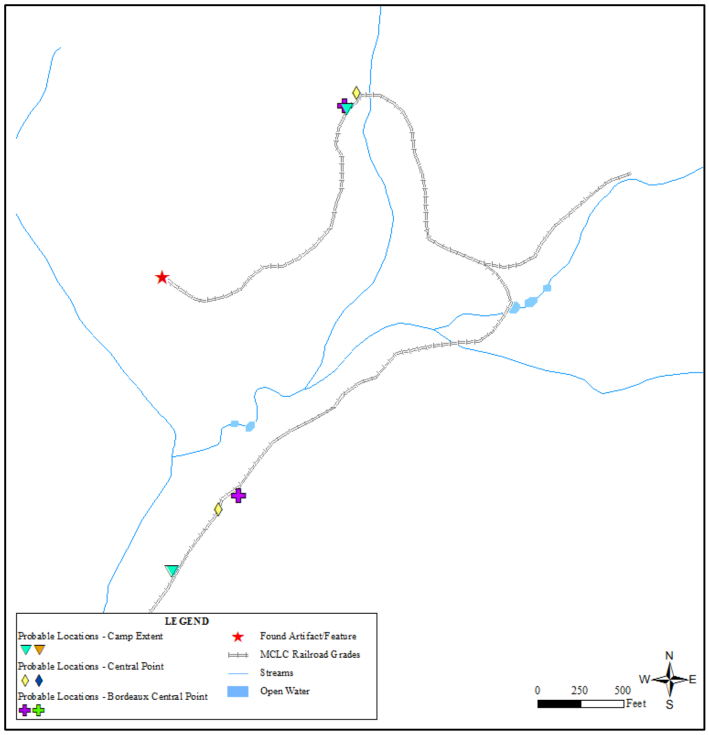

Figure 36. Findings near aggregate segment B1.

Aggregate Segment D1 Findings

A cultural resource survey completed prior to a culvert removal uncovered a trash accumulation consisting of ceramic, glass, and metal fragments during shovel tests, where holes are dug to see if artifacts exist in the earth. Located just over 2,000 feet from the northern edge of segment D1 in a wide floodplain of a major creek (Mill Creek), this trash midden was from the early twentieth century and consistent with logging camps of that era (Figures 37 & 38). The nearest distance range within segment D1 was based on Bordeaux central point measurements. Surveys of the areas between the midden site and the end of segment D1 failed to find any signs of habitation. This location is now a major road junction, and it is possible the road work destroyed any signs of a former camp. This trash site is likely too far from the town of Bordeaux or the Art Karlen homestead (site of the current Cedar Creek Correctional Camp) to have been related to either.

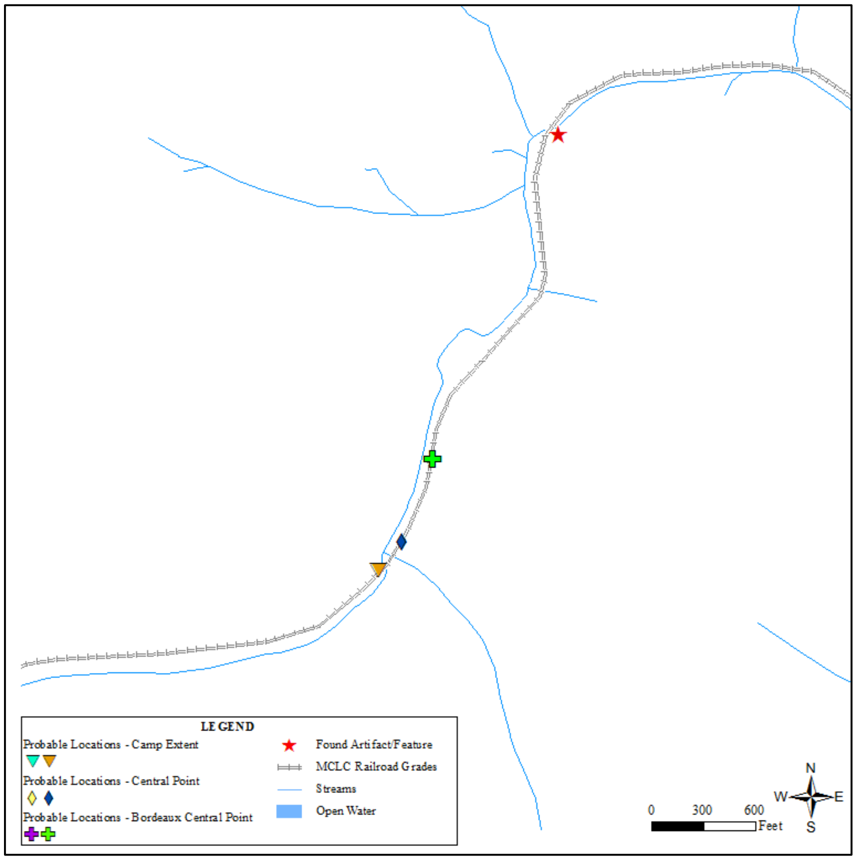

Figure 37. Location of midden in relation to aggregate segment D1.

Figure 38. Ceramic sherds discovered during shovel tests north of aggregate segment D1. Photograph by Maurice Major.

Aggregate Segment E1 Findings

In the initial survey used to record the railroad grades, a whiskey bottle dating from between 1910 and 1920 was found near a bridge crossing within each of the three measured segment types (Figure 39; Christopherson, 2009A). Christopherson (2009A) also found the skids from a steam donkey outside this aggregate segment, approximately 1,000 feet west of a central point segment. Other surveys found a small china fragment, also known as a sherd, and some metal pieces, likely related to logging or railroad equipment, near a major junction within extent and Bordeaux central point measured segments and roughly 400 feet from a central point measured segment. It is possible the sherd and bottle are isolate artifacts; however, aggregate segment E1 is located in what was deemed a high probability location because it is located in or near the floodplain of a major stream, Monroe Creek, and near impounded water and a major rail junction.

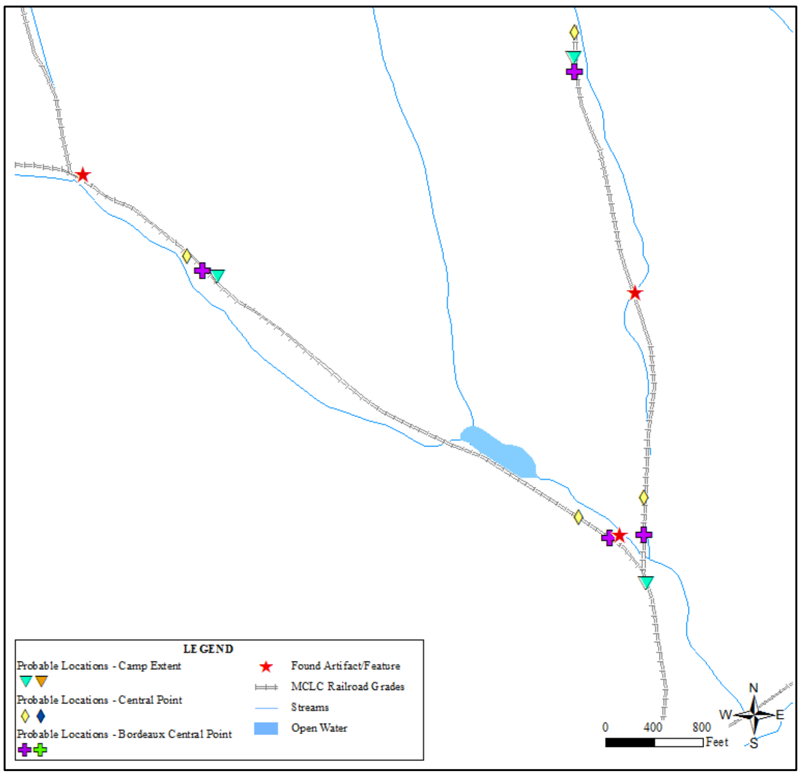

Figure 39. Findings in aggregate segment E1 with donkey skids to the west, china and metal at south, and bottle in the northeast.

Aggregate Segment E2 Findings

A ceramic insulator, a china sherd, iron pieces related to railroads, and an apple tree were all found within all three measurement variations in aggregate segment E2 (Figures 40 & 41). Collective segment E2 was initially noted as having a high probability for a logging camp location because it is located in or near the floodplain of two major creeks, Falls Creek and Sherman Creek. A portion of this segment is also located in the present-day Falls Creek Campground. As discussed at length, multiple current and former campgrounds in Capitol Forest were at one time logging camp locations (Ferguson, 2011A, 2011B, & 2012B). It is possible the insulator and fruit tree are related to an attempted homestead or recreational activity, but the iron pieces and china sherd add more weight to the site having been a logging camp.

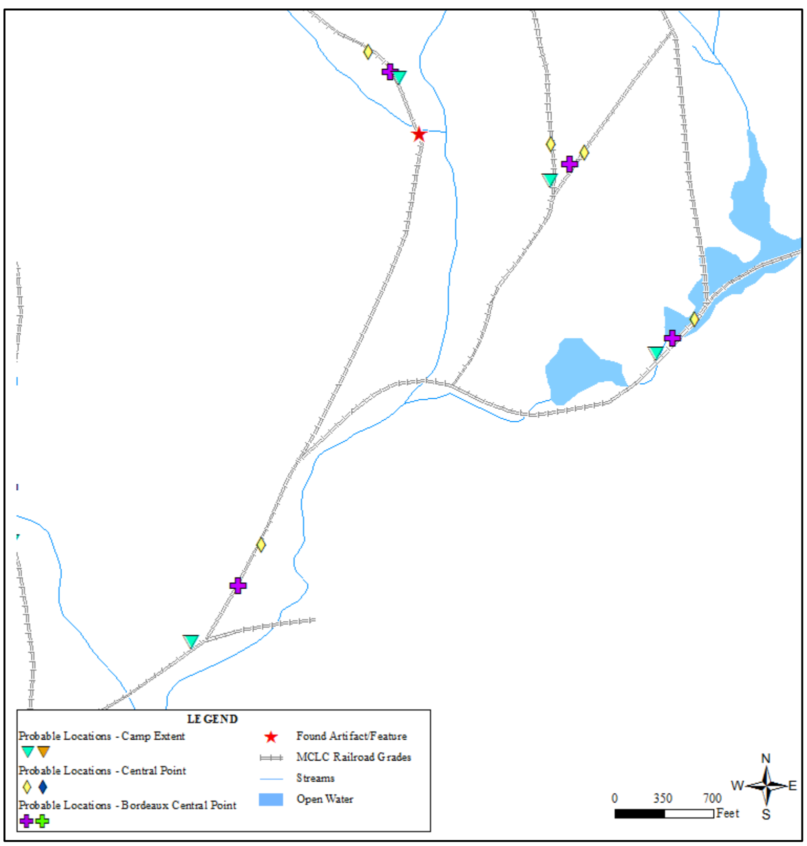

Figure 40. Findings within aggregate segment E2. Findings are within Falls Creek Campground.

Figure 41. Findings within collective segment E2. Ceramic insulator (A), china sherd (B) found slightly downstream of other findings, and fruit tree (C), likely an apple. Photographs by author

Aggregate Segment E3 Findings

Two features within a portion of aggregate segment E3 are important characteristics when compared to known logging camp sites. A standing portion of a railroad trestle, approximately 12 to 15 feet in height, and fallen remnants of the same trestle were found at a large stream crossing within extent and central point distance segments (Figures 42 & 43). Just past the southern end of the former trestle is an approximate one-twentieth acre patch of English ivy (*Hedera helix*) growing on at least seven trees (Figure 44). As noted, former camps have been located near large trestles and the areas where trestles crossed can be valuable locations for finding artifacts; however, no artifacts other than those related to the former trestle were discovered. Likewise, English ivy can be a sign of past habitation, but no other artifacts or features were found to identify the site as a logging camp. The grade where the trestle was located was not originally known prior to field verifications as it was not shown on the MCLC map of grades and was not clearly visible on LiDAR imagery.

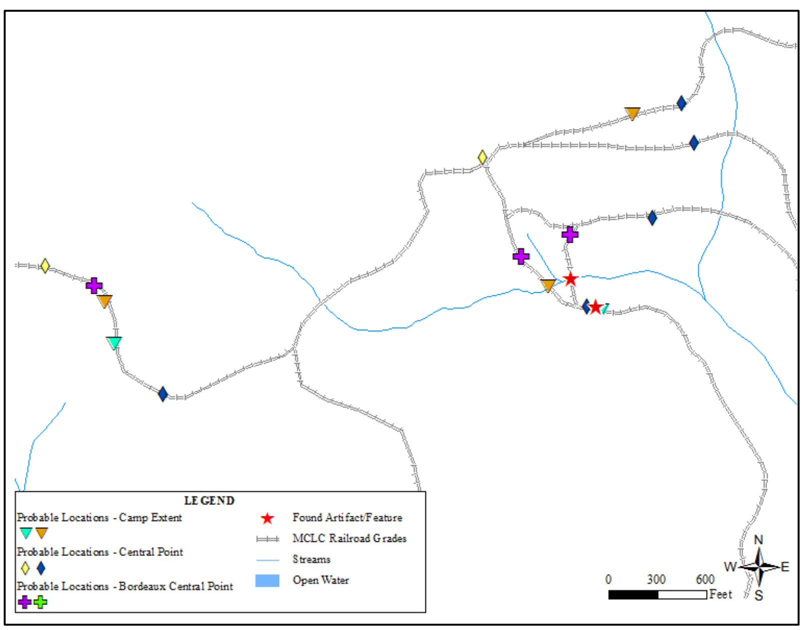

Figure 42. Map of findings in aggregate segment E3. Star to the north is the trestle location.

Figure 43. Looking south from end of grade at the standing portion of trestle remnants found in aggregate segment E3. Photograph by author.

Figure 44. English ivy found along grade within segment E3. Photographs by author.

Aggregate Segment F1 Findings

Numerous glass shards, including manganese glass, which was manufactured from the early 1800s to 1916, were found approximately 400 feet past the end of a central point measured segment within aggregate segment F1 (Figures 45 & 46). The location of artifacts found near aggregate segment F1 are likely from MCLC Camp 1, which was detailed by Blum (2000). Even after multiple field visits, the exact location of MCLC Camp 1 has yet to be determined and may be hidden in the dense brush. The fact that a known camp is located relatively close to, if not within, a distance segment may be evidence that camps were indeed constructed at or near a specific distance from other camps.

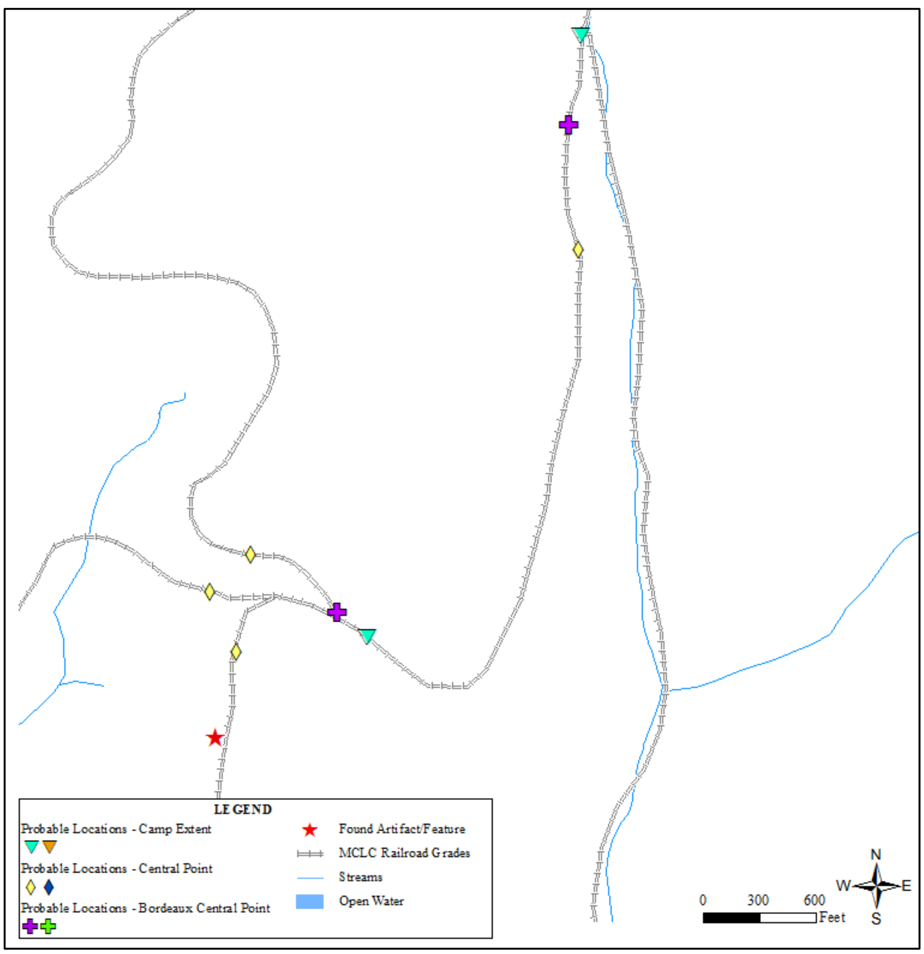

Figure 45. Findings near collective segment F1.

Figure 46. Example glass fragments found near aggregate segment F1. At left is a manganese glass shard from the Western Paint & Glue Company; manganese glass was manufactured from early 1800s to 1916. At right is a bottle manufactured by the Whitall Tatum Company likely between 1870 and 1901 (BLM & SHA, 2014). Photographs by author.

Aggregate Segment J2 Findings

A 2-inch iron water pipe was found coming out of the ground along a short rail grade above an approximate 32-foot deep through cut. The pipe is located roughly 1,300 feet outside an extent measured segment of collective segment J2 (Figures 47 & 48; Ferguson, 2012C). Similar pipes were found in the Lower Incline Camp and MCLC Camp 7 (Stilson 2010D; Ferguson, 2010A). A cherry tree was also found approximately 50 feet south of the water pipe location. Although cherry trees occur naturally throughout the forest, the location of this particular tree is suspicious in relation to the grades and pipe. This location is also near a large flat in a topographic saddle; however thick understory brush hindered a more thorough investigation of the saddle.

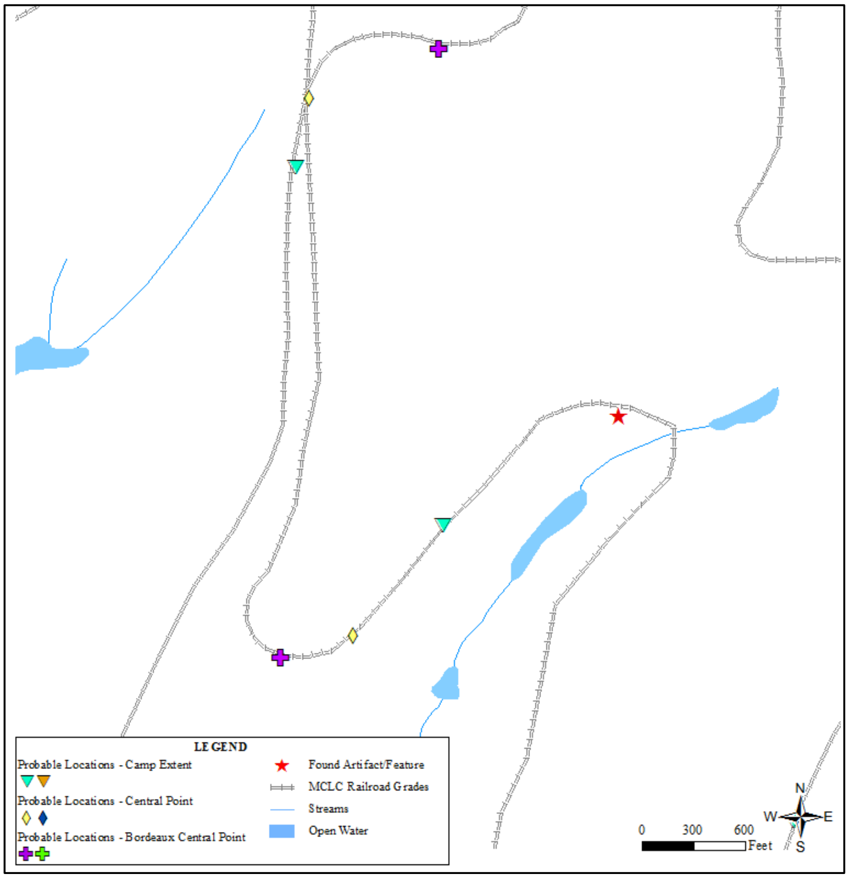

Figure 47. Findings near aggregate segment J2.

Figure 48. The 2-inch water pipe found in situ on a side grade above a deep through cut near segment J2. Photograph by author (Ferguson, 2012C).

Aggregate Segment J5 Findings

Surveys of the segments in combined segment J5 found a few artifacts leading to an inference that a camp may have been present. A piece of brick was found on the grade within all distance measurement variations in the western portion of the aggregate segment (Figure 49; Ferguson, 2010D). This brick piece is likely an isolate or unrelated to historical activity. Surveys in the eastern portion of segment J5 found a small china sherd and a small patch of English ivy within the current Porter Creek Campground (Figure 50). Both the ivy and the broken china could, again, be related to recreational activities, but when the history of campgrounds within the forest is considered, it seems logical to infer that Porter Creek Campground may have been a logging camp. The campground is only located within extent measured segments.

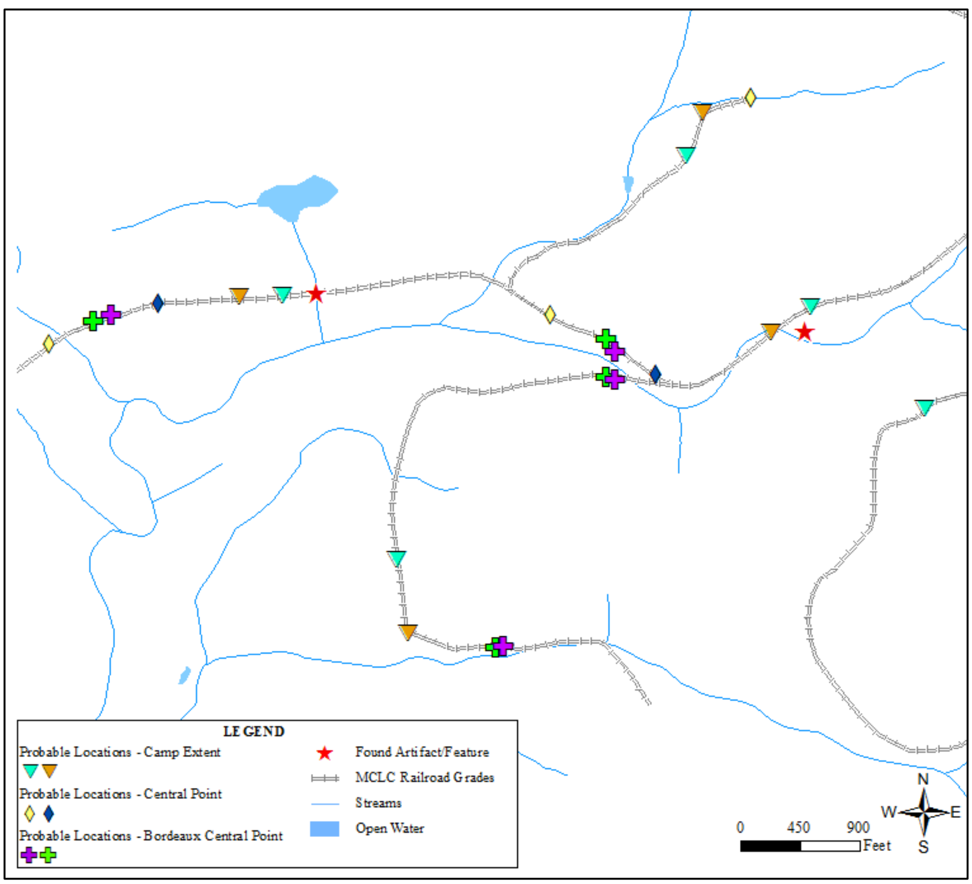

Figure 49. Map of findings within aggregate segment J5.

Figure 50. View of English ivy as seen looking south within present-day Porter Creek Campground. China fragment was found to the east of this location in Porter Creek.

Aggregate Segment J6 Findings

Multiple features were discovered within all three measurement types in aggregate segment J6 (Figure 51). Parallel to the grade near a large beaver pond are the remnants of two sets of steam donkey skids. These two sets of skids are less than 50 feet apart and both sets consist of logs roughly 35 to 40 feet in length and 36 to 40 inches in diameter. Multiple 1-inch threaded iron posts spaced approximately three feet apart were found protruding from each skid (Figures 52 & 53). Also found attached to each set of donkey skids was a large iron washer or wheel (Figure 53) that was nine inches in diameter for the northern skid set and seven inches for the southern set. Deteriorated metal remnants, possibly roofing material, were found between the northern set of skid remnants. The northern set of skid remnants also had a shorter log connecting the two skids at one end; this was a common feature of steam donkeys. Strands of 1.5 and 2-inch logging cable were also found with both sets of skids.

Other artifacts found within collective segment J6 include an abundant amount of 1, 1.5, and 2-inch logging cable adjacent to the large beaver pond. A 1-inch pipe was found crossing the grade just to the south of the donkey skids (Figure 54). The alignment of the pipe appeared to be coming directly from the large pond. Pieces of corrugated metal, often used for roofing on both steam donkeys and structures, were discovered along the edges of the beaver pond as well. A piece of corrugated metal was also found approximately 1,200 feet from the skids and water pipe. This particular piece of metal may be unrelated to historical logging or the similar pieces found near the skid remnants; however, given its proximity to artifacts found near the pond, there is a high likelihood the isolate piece of corrugated metal is related to historical logging operations.

Although no consumable type artifacts were found within segment J6, it remains possible that a logging camp may have existed in this area. The two sets of donkey skids aligned parallel to the railroad grade could lead to an inference that this site was used as a steam donkey construction site similar to other camps in the forest; the D-Line Ivy Spot and Wedekind are both believed to have had steam donkey construction operations associated with a camp (Blum, 2000; Ferguson, 2012A). The skids are aligned as such to allow them to be loaded onto rail cars and shipped to other locations; however, this could also mean the two sets of skids were dumped at this location after breaking down.

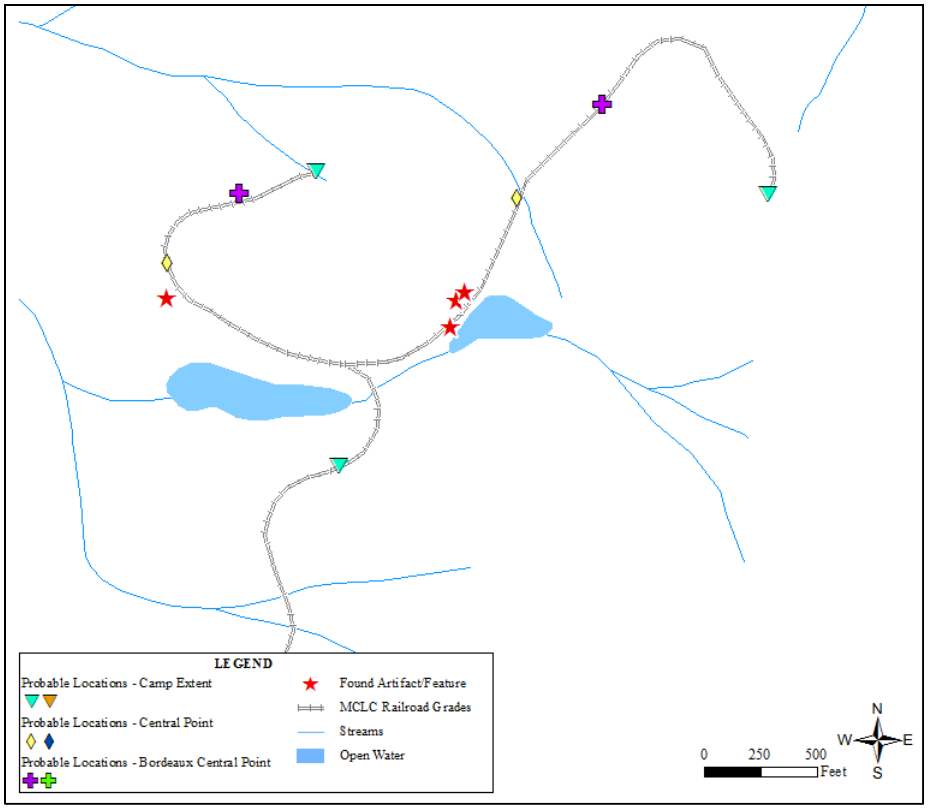

Figure 51. Findings within collective segment J6. The two stars to the west of the grade and beaver pond are the two donkey skids with the 1-inch pipe located just to the south of them. Far west star is isolate corrugated metal.

Figure 52. The southern donkey skid as seen looking east towards the beaver pond. Arrow designates a 1-inch diameter iron rod and strands of 1 to 1.5-inch logging cable to the left of young tree. Photograph by author.

Figure 53. Photographs of northern donkey skids. Looking north along skid (top left) with stars indicating locations of some of the numerous 1-inch diameter iron posts (top right) protruding from skid. Southern end of northern skids (bottom left) with 9-inch diameter iron disc (also bottom right) visible with perpendicular log across skids. Portion of 2-inch diameter logging cable near machete is visible in bottom left. Photographs by author.

Figure 54. Image of the 1-inch water pipe found on grade and now under water (left). The arrow (right) designates the location and orientation of the 1-inch water pipe, which may be coming from the existing pond. Photographs by author.

After reviewing 1941 aerial photographs of the area, a third reason for artifacts found within aggregate segment J6 became clear (Figure 55). MCLC harvested and milled their last remaining timber in 1941; in the aerial photograph, small stands of mature timber are located immediately adjacent to the steam donkey locations. These stands of timber likely represent those final trees harvested by MCLC. Scars on the surrounding landscape show both very recent logging activity to the south as well as areas that were harvested much earlier to the north. This is likely because areas to the north were more easily accessible with Porter Creek, a major stream system, providing topography more suitable for train movement while the area of segment J6 is located higher in the hills of the forest which took longer for MCLC to gain access to. Another interesting finding is that the skid roads, which are the trails created by logs being pulled from where they were cut to the locations they were to be loaded onto train cars, appear to be converging precisely at the location of the steam donkey remnants. From this evidence, it seems clear that this location was not a logging camp, but was indeed the last area logged by MCLC and these steam donkeys were left where they were last used after parts of value were removed, leaving only the skids, metal, and logging cable.

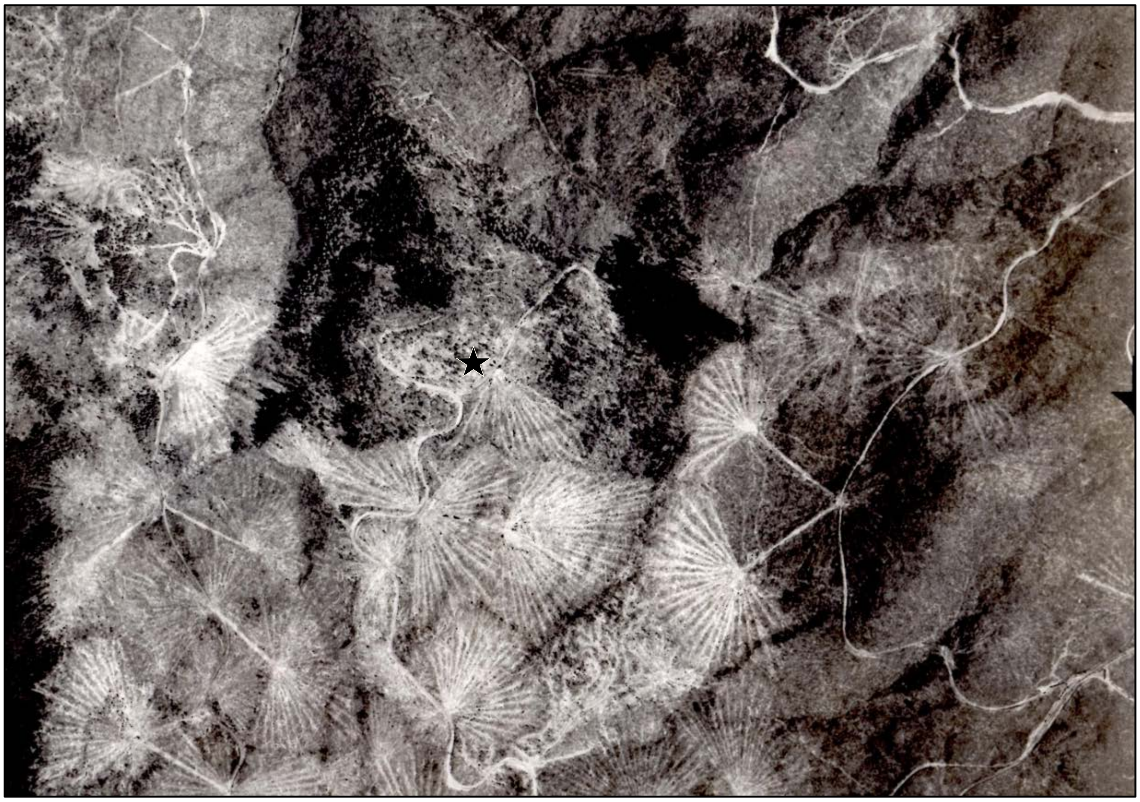

Figure 55. Portion of a 1941 aerial photograph showing aggregate segment J6. Note mature timber in the immediate vicinity as well as the skid roads (white lines appearing to create fan shapes) converging at the location of the steam donkey remnants (indicated by star). Wedekind is also shown at the bottom right of photograph.

Aggregate Segment L7 Findings

Segment L7 is located at the northwestern extent of MCLC ownership and seemed unlikely to be a potential camp site; however, the segment is located near a major rail junction and in close proximity to a large pond (Figure 56). Only one potential artifact was discovered during field verifications; what appeared to be a metal stove pipe or chimney piece was found partially buried in a dug out area immediately adjacent to the grade within an extent measured segment (Figure 57). This area was likely excavated to provide fill material for the grade. The metal artifact is approximately 8 inches in diameter and extends roughly another foot into the ground.

Found throughout the immediate vicinity of the metal artifact was an abundance of holly (*Ilex aquifolium*). This non-native species can be spread easily by birds and may not be indicative of habitation; however, the sheer number of plants and one large specimen found near the main junction of grades to the southwest of the metal artifact could prove otherwise (Figure 58). The metal artifact may prove to be unrelated to historical logging activity in the forest as some recent trash was also found in the excavated trench. A large flattened area was discovered directly east of the metal artifact. This flat was not immediately adjacent to any grades or roads and trees growing on the flat were much younger than the adjacent stand. More investigation in the area of the trench and flat should be completed.

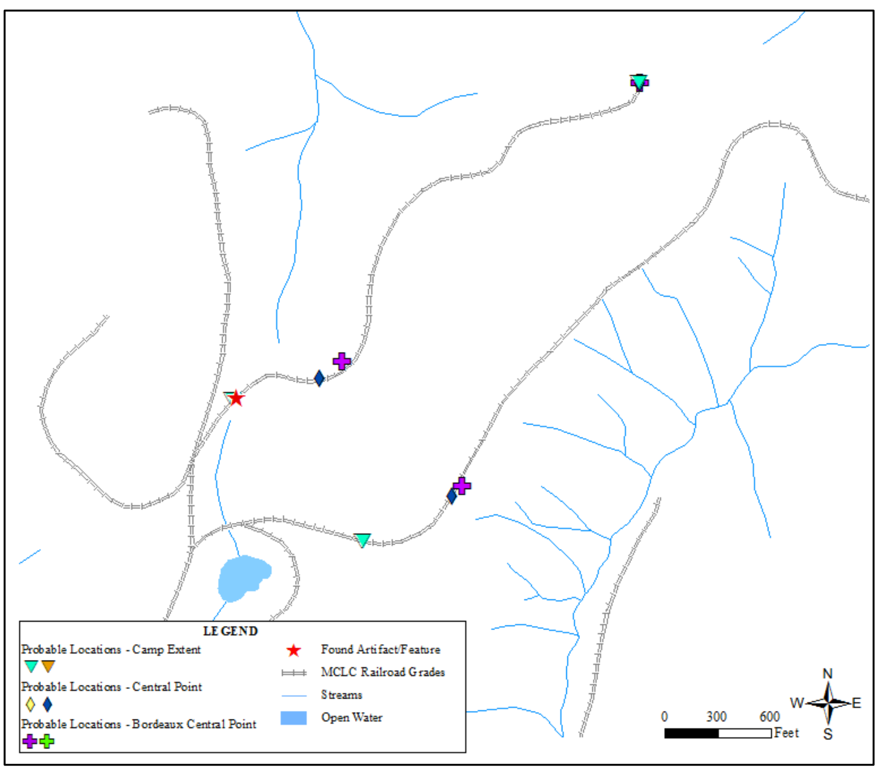

Figure 56. Aggregate segment L7. Star represents location of the metal artifact found in a trench adjacent to the grade.

Figure 57. Metal artifact found adjacent to the grade in segment L7. Photograph by author.

Figure 58. Large holly discovered on grade in segment L7. Photograph by author.

Aggregate Segment M1 Findings

A fragment from a ceramic coffee cup was found approximately 1,550 feet north of an extent measured segment in aggregate segment M1 (Figure 59). The area where the sherd was found has flat topography near a rail junction; however, no other artifacts were discovered in a field survey, leading to the inference of this artifact being an isolate. Small dug out holes approximately three feet in diameter and roughly a foot deep were found next to the grade as well. This artifact was found approximately 7,000 feet from Bozy Creek Camp, putting it close in geodesic distance or straight line distance from that camp, providing further evidence of this artifact being an isolate.

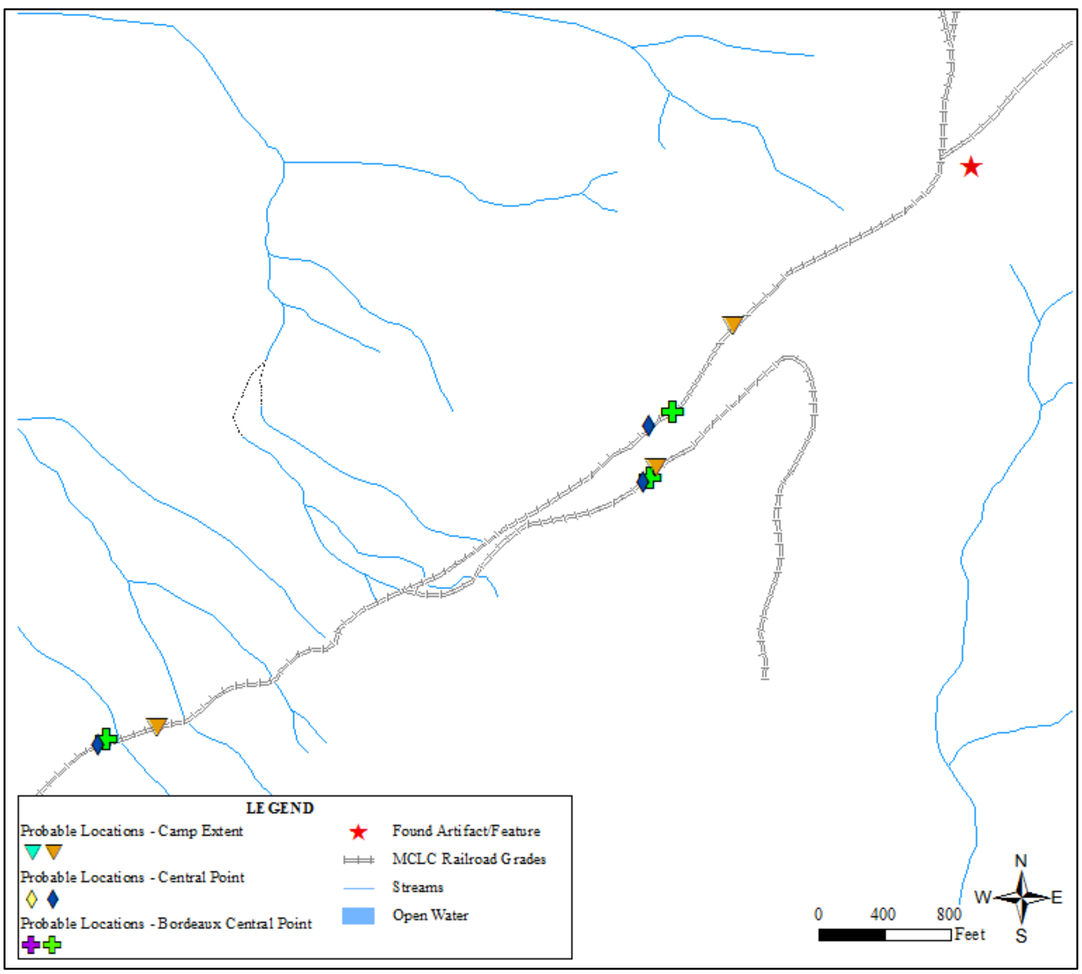

Figure 59. Coffee cup fragment finding in relation to aggregate segment M1.

Discussion

It was assumed from the beginning of this research that not all identified segments would contain a logging camp site because it is unrealistic for the given area. A lack of any definitive camp location identification was, however, unexpected. More investigations should be done in the areas where artifacts and features consistent with historical logging camps were discovered. Some of these areas are located in mature timber stands which are available to be harvested; if harvest occurs in these areas, field surveys should be completed following harvest activities. Future surveys could also include a metal detector for those areas where brush was too thick to complete an adequate survey at the time of this research.

It remains possible that camps existed within the segments where artifacts were found in close proximity because it was common for trash to be dumped outside the central living area. As discussed in the literature review, Schiffer (1983 & 1986) points out accumulations of artifacts are subject to various formation processes in regard to their positioning. Artifact collections may not pinpoint a habitation site, but rather a dump site based on human disposal practices (Schiffer, 1983 & 1986; Paullin, 2007). For instance, middens were found approximately 500 feet from MCLC Camp 4 and 700 feet from the Lower Incline Camp (Stilson, 2009; Ferguson, 2010A). With an artifact accumulation as close as 400 feet, measured segments inside collective segment F1 could potentially have contained a logging camp. Measured segments within J2, M1, and D1 aggregate segments, at more than 1,300, 1,500 and 2,000 feet respectively from artifact accumulations, are unlikely to have contained logging camps that could have generated the discovered artifacts. The water pipe found roughly 1,800 feet from the edge of aggregate segment B1 is more likely to be related to logging or railroad operations than a camp. More thorough investigations in each aggregate segment where artifacts, features, or both were found within or near will deliver more insight into whether a logging camp existed within those segments.

Potential complications discussed in Chapter 4 may have led to the overall low success rate and could be accounted for in future testing of this theory. Twenty-nine, or 75 percent, of combined segments contained no artifacts (Table 6; Appendix A). Approximately 47 percent of the aggregate segments are within close proximity to past MCLC property lines and nearly 28 percent are close to known or assumed camps in geodesic distance. It should be noted that three aggregate segments originally considered to be close in geodesic distance or near former property lines contained artifacts or features that may be related to historical logging activities or camps. Because no logging camp sites were definitively identified, segments were not adjusted and compound measurement errors could not be identified.

Using assumed camp locations was another complication related to the research methods. Using the assumed camp locations of Sherman Valley Campground and Wedekind did not appear to cause an error, but would have produced different results. Completing average distance calculations based only from measurements between known logging camp sites produced similar average distances for each measurement method; however, the distance ranges based on adding or subtracting one standard deviation were smaller (Table 8). Shorter distance ranges would create a different set of segments to verify as well as different results. Roughly plotting segments based on the average distances between only known camps did not improve results. Sherman Valley

Campground fell within all three measurement methods based on calculating distances between known camps only; however, Wedekind was not located within any distance segment calculated using only known camps. Removing distances calculated using assumed camps reduced the amount of calculations from nine to four, possibly limiting accuracy of predicting an average distance for MCLC. Although the use of assumed camp locations did not affect the outcome of this research, using as many locations as possible to provide more distances for determining a company specific average would be preferred and should produce more accurate predictions for potential logging camp sites.

Measurement Method	With Assumed		Without Assumed	
	Average	Range	Average	Range
Camp Extent	12078.65	4430.00	11250.19	3133.72
Central Point	12941.71	3954.34	12401.59	2448.60
Bordeaux Central Point	12477.09	4037.10	12146.67	2547.51

Table 8. Average distances and standard deviation ranges for each measurement method calculated with and without using the assumed logging camp locations of Sherman Valley Campground and Wedekind.

The potential limiting factors discussed in Chapter 4 also hindered more thorough site surveying. As mentioned earlier, many old railroad grades have been converted into roads or trails. Conversion of grades to roads can result in minor impacts to the integrity of those railroad grades; however, widening, placing rock, or paving grades can lead to a loss of historical artifacts or features. This was known to have happened near the D-Line Ivy Spot (Blum, 2000). Creating trails on railroad grades also has minimal impacts to the integrity of the grade, but can open sites up to looting and light damage from all-terrain vehicles. Also, while many railroad grades go up drainages, roads and trails often cut across drainages; misidentification of roads and trails as railroad grades while interpreting LiDAR data could lead to errors in distance calculations.

Much of Capitol Forest is managed by the Washington State Department of Natural Resources (WADNR) for timber production with few areas unavailable for harvest. A number of segments surveyed were located in forest stands with abundant understory brush, making surveying the ground difficult. Most field verification was completed during the winter in an attempt to visit sites when the foliage of shrub species was at a minimum, but species such as salal (*Gaultheria shallon*) and sword fern (*Polystichum munitum*), with foliage persisting through the winter, were common among all segments. A large number of segments were also along major streams where foliage can be especially dense. As discussed in Chapter 2, timber harvest can have minimal impacts on sites and can be beneficial to archaeologists by uncovering new artifacts. Areas where artifacts and features were found as part of this research should be surveyed following any future harvest to look for signs of past habitation or additional artifacts.

Total findings based on the three measurement methods were within five percent of each other and there appears to be no significant difference among those methods. Segments based on calculating average distance from the edges of logging camp extents did produce more results than the other two methods. This could be because the calculated range of extent segments was greater and a larger search area should yield greater results. From these results, identifying and measuring from the edge of camp extent may provide the best results due to longer segments; however, this may vary depending on site location and logging company.

The probabilities assigned to each aggregate segment prior to field verifications may have been successful (Table 9; Appendix A). As noted in the methods section (Chapter 4), probabilities were assigned based on remote site evaluations taking into account the factors common among known logging camp sites. Although originally considered arbitrary, site probability assignments appear to have been a good indication of potential camp locations.

Probability	Total	Findings[1]	No Findings
High	4	3	1
Medium	14	8	6
Low	18	1	17

Table 9. Success of probabilities assigned to aggregate segments. [1]Findings include artifacts and features consistent with historical logging camps discovered within and outside all aggregate segments except L3 where artifacts found dated to after MCLC operations had ended in the forest.

Comparing site characteristics shared among known camp sites in conjunction with improved methods for calculating the average distance between camps could prove valuable in future attempts to locate historical logging camps. Success based on comparing the shared site characteristics could lead to the conclusion that spatial modeling based on those common characteristics is the most promising method for locating camps.

Chapter 6 – Conclusion

In the case of the Mason County Logging Company (MCLC), distance from other camps along rail lines may not have been a determining factor for logging camp locations. In regards to this research, average distance in relation to camp spacing of the known and assumed MCLC camps appears to be coincidental and logging camp location may be related to other factors such as topography, proximity to water resources, and possibly land ownership. Although no logging camp locations were definitively identified, artifacts and features found within some segments and within close proximity to others may be evidence of how distance between camps was an important factor for camp placement. More thorough investigation of areas where artifacts were discovered, including shovel testing or metal detecting, could determine if there were logging camps in those locations or if the artifacts discovered were isolates. Also, there was no obvious difference among the three measurement methods used. This is likely due to the three methods having relatively small differences in their calculated average distances and standard deviation ranges.

This research did show that there are numerous site characteristics common among historical logging camp sites; this finding could be useful for archaeologists attempting to locate these sites in the future. Variables identified during this research appearing to be common among logging camp sites include being located near rail junctions, major streams, impounded water, and landscape manipulations (e.g. large cuts, fills, or trestles), as well as sites that continue to have forms of habitation such as campgrounds. Each of the known and assumed logging camp sites used in this research were located near two to four of these variables, demonstrating the significant role these characteristics may have in predicting sites.

Other factors beyond those variables discussed above likely influenced camp locations in different geographic areas based on how long it took to harvest a given area. Stand species composition, tree size, and harvest technology could all affect the duration a camp was in use. If a logging company was primarily interested in harvesting the most valuable timber species out of a mixed stand, or high-grading, that company may move through a given area more quickly than if they were to harvest the entire area. Similarly, if trees in an area are much larger in diameter than another area (e.g. western Washington Douglas-fir (*Pseudotsuga menziesii*) and western redcedar (*Thuja plicata*) versus eastern Washington pine species), it would take longer to fall, cut-to-length, and remove the larger trees from the forest. Finally, as harvest technology improved from axes to cross-cut saws and then to chainsaws, the amount of time spent falling timber would be greatly reduced. This technology change would also reduce the amount of time spent logging in a given area and the need for additional logging camps. The same point could be made about techniques to yard or remove logs from a site; as methods progressed from horse and oxen, to steam donkeys and trains, to log loaders and trucks, the need for logging camps would be reduced. All of these factors should be accounted for when attempting to predict where logging camps may have been located in different geographic areas.

The methods used for this research could be improved to possibly provide more accurate predictions. Improving techniques in regards to calculating distance and plotting the resulting distance segments may increase accuracy. Utilizing the network analyst tool in ArcMap could potentially accomplish this predictive analysis as well as account for other factors such as time of travel and direction. Even though using assumed camp locations to calculate average distance measurements did not appear to impact the results of this research, using only known camp locations would likely provide the most accurate predictions. As far as improvements to field verifications, winter appears to be the best time to survey potential sites due to low foliage levels. Where applicable, surveys following timber harvest provide greater results due to removal of the ground cover species and the low impacts on artifacts from harvest activity (Christopherson, 2008; Stilson, 2010C & 2011).

There remains more opportunities to test this average distance theory due to the number of large logging operations that took place throughout the United States during the railroad logging era. One specific area where the methods used in this research could be attempted are the areas formerly managed by the Cascade Lumber Company north of Cle Elum, Washington, as discussed in *The Pine Tree Express* (Henderson, 1990). In this book, Henderson (1990) notes the locations of a significant number of logging camps on hand drawn maps (pp. 100-05); nearly all of these camps remain unverified and unrecorded. These camps can be roughly digitized based on the hand drawn maps and the railroad grades verified with the use of LiDAR once it becomes available for the area. Once an adequate number of camp locations have been verified, average distance calculations could be completed and compared to the remaining unverified camp locations to see if those camps align with that average distance prior to additional field verifications.

Locating historical sites such as logging camps could become easier to do as mapping and spatial analysis technology improves. As noted in the literature review, Hare et al. (2014) achieved success using high resolution LiDAR data, similar to archaeologists who have used LiDAR to locate sites concealed by dense jungles in Central and South America. These recent successes demonstrate how improvements to LiDAR quality and resolution will further the abilities of archaeologists to map and locate undocumented sites. Altering the methods used in this thesis to determine distance between camps along with improved LiDAR data may provide more definitive results; however, spatial modeling based on common logging camp site characteristics, which can also account for issues such as geodesic distances, may prove to be more successful in determining potential historical logging camp sites.

During the major exploitation era of logging in America, thousands of men, women, and children lived in various logging towns and satellite camps associated with those towns. Locating and documenting historical logging camps is essential for understanding the lives of the people who called these towns and logging camps their home. The best method for identifying historical logging camp locations is to research historical maps and documents; however, due to their ephemeral nature, logging camps often went undocumented. In this situation, it can be advantageous to locate a person with direct knowledge of where camp sites may have been. Unfortunately, losses of the people with first- or second-hand knowledge of camp locations will occur with more frequency in the future. In the absence of historical documentation and local knowledge, it is imperative a method be established to locate historical logging camps for the purpose of collecting and preserving the data from these sites and to further our understanding about the lives of early-American loggers and their families.

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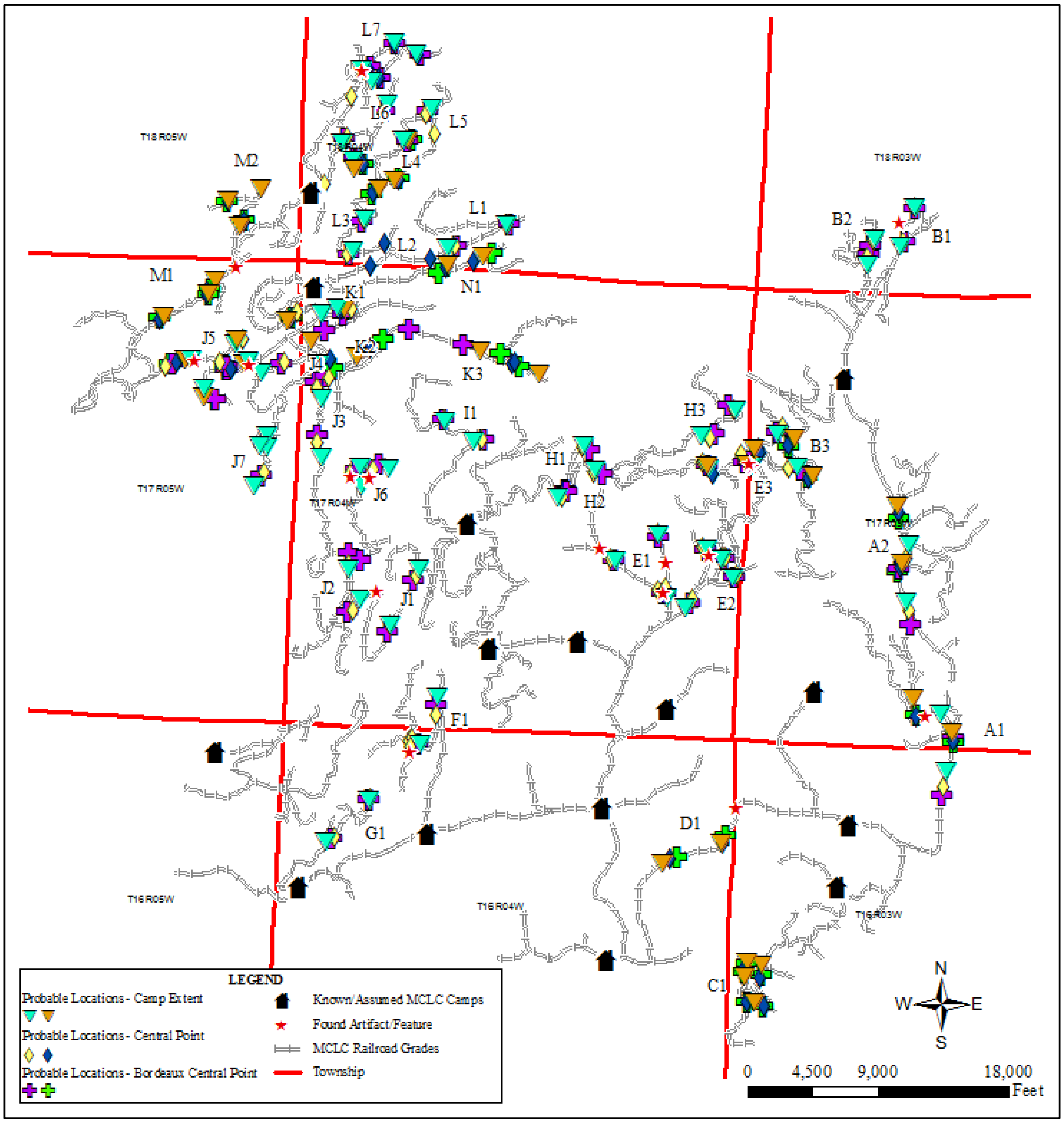
Appendix A – Aggregate Segment Information and Findings

Segment Identification Map



Aggregate Segment Location Information

Distance Segment Information							
		Location			Access		
Aggregate Segment	Measured Segments	Section(s)	Township(s)	Range(s)	On Road?	Road Name or Number	Notes
A1	B01, B02, C01, C02, E01, E02	3, 4 33	16 17	03W 03W	No	NA	Along trail. The portion in Section 4 is privately owned
A2	B03, B04, C03, C04, E03, E04	16,21,28	17	03W	Yes	Waddell CK/Sherman Valley	Also Middle Waddell Campground
B1	B05, C05, E05	28,32,33	18	03W	No	NA	Along trail
B2	B06, C06, E06	32	18	03W	Yes	C-8000	
B3	B07, E07	18	17	03W	No	NA	Along trail
C1	B16, C15, E11	18,19	16	03W	Yes	E-5000	End of E-5000 at big opening
D1	B15, C14, E12	12	16	04W	Yes	E-7000	Road to Cedar Creek CC
E1	B13, B14, C12, C13, E14	23, 25, 26	17	04W	No	NA	Monroe Creek grade
E2	B12, C11, E13	24, 25	17	04W	Yes	C-6000	Falls Creek Campground area
E3	B08, C08, C09, E08, E09	7, 18 13	17 17	03W 04W	Yes	C-Line/C-7000	
F1	B17, C20, E17	5 33	16 17	04W 04W	No No	NA	Partially on the D-1070
G1	B18, C21, E18	5, 7, 8	16	04W	Yes	D-1000	
H1	B11, C16, E15	15	17	04W	No	NA	
H2	B10, C16, E15	15	17	04W	Yes	C-Line	
H3	B09, C10, E10	12, 13	17	04W	Yes	C-7200	
I1	B19, C17, E16	8, 16, 17	17	04W	Yes	C-3000	
J1	B20, C18, E19	20, 29	17	04W	No	NA	Partially along trail
J2	B21, C19, E20	19, 30	17	04W	Yes	C-Line/C-2020	
J3	B23, C23, E22	7, 18	17	04W	No	NA	
J4	B24, C24, E25	7 12	17 17	04W 05W	No	NA	
J5	B26, B27, B31, B32, C26, C27, E26, E27	11, 12	17	05W	No	NA	Near Porter Falls partially along trail from Porter Creek Campground
J6	B22, C22, E21	17, 18	17	04W	Yes	C-3100/C-3110	
J7	B25, E23, C42	13	17	05W	Yes	B-0100	
K1	B33, B34, C28, C29, E29, E30	6 1	17 17	04W 05W	No	NA	
K2	B28, C25, E28	7	17	04W	Yes	B-1000	Along trail also
K3	B29, B30, C30, E31	9, 10	17	04W	No	NA	Along trail just off B-1000

Aggregate Segment Location Information

Distance Segment Information							
Aggregate Segment	Measured Segments	Location			Access		
		Section(s)	Township(s)	Range(s)	On Road?	Road Name or Number	Notes
L1	B36, C33, E33	33	18	04W	No	NA	Along Swan Creek
L2	C32	32	18	04W	No	NA	Along trail
L3	B37, C34, E34	31	18	04W	No	NA	Along trail
L4	B38, C35, E35	29-32	18	04W	Yes	A-4000/A-5000	Some off road
L5	B38, B39, C36, E37	20, 29	18	04W	No	NA	
L6	B40, C37, E36	19, 30	18	04W	Yes	A-Line/A-4000	Some off road
L7	B43, B44, C40, C41, E40, E41	19, 20	18	04W	Yes	A-Line	
M1	B42, C38, E38	2	17	05W	Yes	A-Line	
M2	B41, C39, E39	36	18	05W	Yes	A-2050	Some off road
N1	B35, C31, E32	4,5 33	17 18	04W 04W	Yes	B-Line/B-2030	Some off road

Aggregate Segment Site Probability & Characteristics

Distance Segment Information								
	Site Probability							
Aggregate Segment	Probability	Near Junction	Near Stream	Water Impoundment	In or Near Campground	Landscape Modification	Near Property Line	Close in Geodesic Distance
A1	High	X	X	X			X	
A2	Medium	X	X		X			
B1	Low	X	X				X	
B2	Low	X					X	
B3	Low	X			X			X
C1	Medium	X					X	
D1	Medium		X					
E1	High	X	X	X				
E2	High	X	X		X			
E3	Medium	X	X			X		
F1	Medium	X						
G1	Low							X
H1	Low						X	
H2	Low							
H3	Low						X	
I1	Medium		X			X	X	
J1	Medium		X					
J2	Medium	X	X			X		
J3	Low							
J4	Low							
J5	Medium	X	X		X	X		
J6	Medium	X	X	X		X		
J7	Medium	X	X				X	
K1	Low		X			X		X
K2	Low		X					X
K3	High	X	X				X	

Aggregate Segment Site Probability & Characteristics

Distance Segment Information								
	Site Probability							
Aggregate Segment	Probability	Near Junction	Near Stream	Water Impoundment	In or Near Campground	Landscape Modification	Near Property Line	Close in Geodesic Distance
L1	Medium		X	X			X	X
L2	Low	X	X					X
L3	Low							X
L4	Low	X	X				X	X
L5	Low						X	
L6	Low	X	X				X	X
L7	Medium	X				X	X	
M1	Medium	X					X	
M2	Low		X				X	X
N1	Low						X	

Aggregate Segment Field Verification Findings

Distance Segment Information									
Aggregate Segment	Field Verification								
	Date(s)	Consumables	Metal Pieces	Steam Donkey	Water Pipe	Structural Remnants	Exotic Plants	Notes	Camp Present?
A1	8/9/2010	X	X					Enamelware pitcher, logging cable	Possible
A2	12/9/2009 1/14/2015							Nothing found - heavily disturbed	No
B1	12/9/2013				X			Steel pipe found (J. Vaughn) outside segments, but nothing else.	No
B2	6/10/2010							Nothing found	No
B3	1/13/2015							Nothing found	No
C1	9/30/2010 1/13/2015							Nothing found	No
D1	9/18/2014	X						Trash pile found north of this segment by Mo	Possible
E1	4/29/2009 4/25/2011 1/22/2015	X	X					Original survey of grade with Rolin Christopherson found a whiskey bottle from 1910-1920 near stream crossing structure and donkey outside segment; grade was recorded. Second survey found small china fragment. Third survey found nothing new.	Possible
E2	10/20/2010	X	X				X	Insulator, china fragment, rail piece, and fruit tree found	Possible
E3	1/13/2015						X	Found trestle remnants and suspicious ivy spot, but no artifacts	Possible
F1	6/9/2010 9/18/2014	X						Found glass outside segment that can date from 1870s to 1938; second search revealed nothing new. Camp likely, but unable to determine precise location.	Possible
G1	9/18/2014							Nothing found	No
H1	1/13/2015							Nothing found	No
H2	1/13/2015							Nothing found	No
H3	6/23/2010							Nothing found	No
I1	1/14/2015							Nothing found	No
J1	1/31/2014							Nothing found (N. Nordstrom)	No
J2	10/20/2010 1/31/2014				X			Pipe in ground just east of saddle, but outside range segment. Nothing found in segment survey (N. Nordstrom).	Possible
J3	1/14/2015							Nothing found	No
J4	5/18/2009							Surveyed by Rolin Christopherson. No artifacts found.	No
J5	6/2/2010 1/16/2015	X				X	X	Surveyed and recorded railroad grade West of Porter Falls - only trestle remnants and one brick found. Found small piece of china (undetermined age) and a large spot of English ivy in Porter Creek Campground	Possible
J6	1/14/2015		X	X	X			Located 2 sets of steam donkey skids 20 feet apart along with an abundance of logging cable; no glass or porcelain artifacts	Possible
J7	1/14/2015							Nothing found	No
K1	5/10/2010							No artifacts - recorded railroad grades (6/22/10), major stream crossing	No
K2	9/18/2014							Nothing found	No
K3	9/18/2014							Nothing found	No

Aggregate Segment Field Verification Findings

Distance Segment Information									
	Field Verification								
Aggregate Segment	Date	Consumables	Metal Pieces	Steam Donkey	Water Pipe	Structural Remnants	Exotic Plants	Notes	Camp Present?
L1	1/16/2015							Nothing found other than stream crossing pylons	No
L2	1/16/2015							Nothing found	No
L3	7/12/2012	X						Artifacts found near the north end of segment. Artifacts date to later than logging operations would have been in the forest (post-1960); most likely a hunting cabin. Grade was previously recorded.	No
L4	1/22/2015							Nothing found other than stream crossing pylons	No
L5	1/22/2015							Nothing found	No
L6	1/22/2015							Nothing found	No
L7	1/22/2015		X				X	Suspicious stove pipe found partially buried in dug out area along grade; abundance of holly, also large flat directly east of flat	Possible
M1	3/22/2012	X						Nothing found (N. Nordstrom). However, isolate coffee cup found 1550 feet north of segment	Possible
M2	1/14/2015							Nothing found	No
N1	1/16/2015							Nothing found	No