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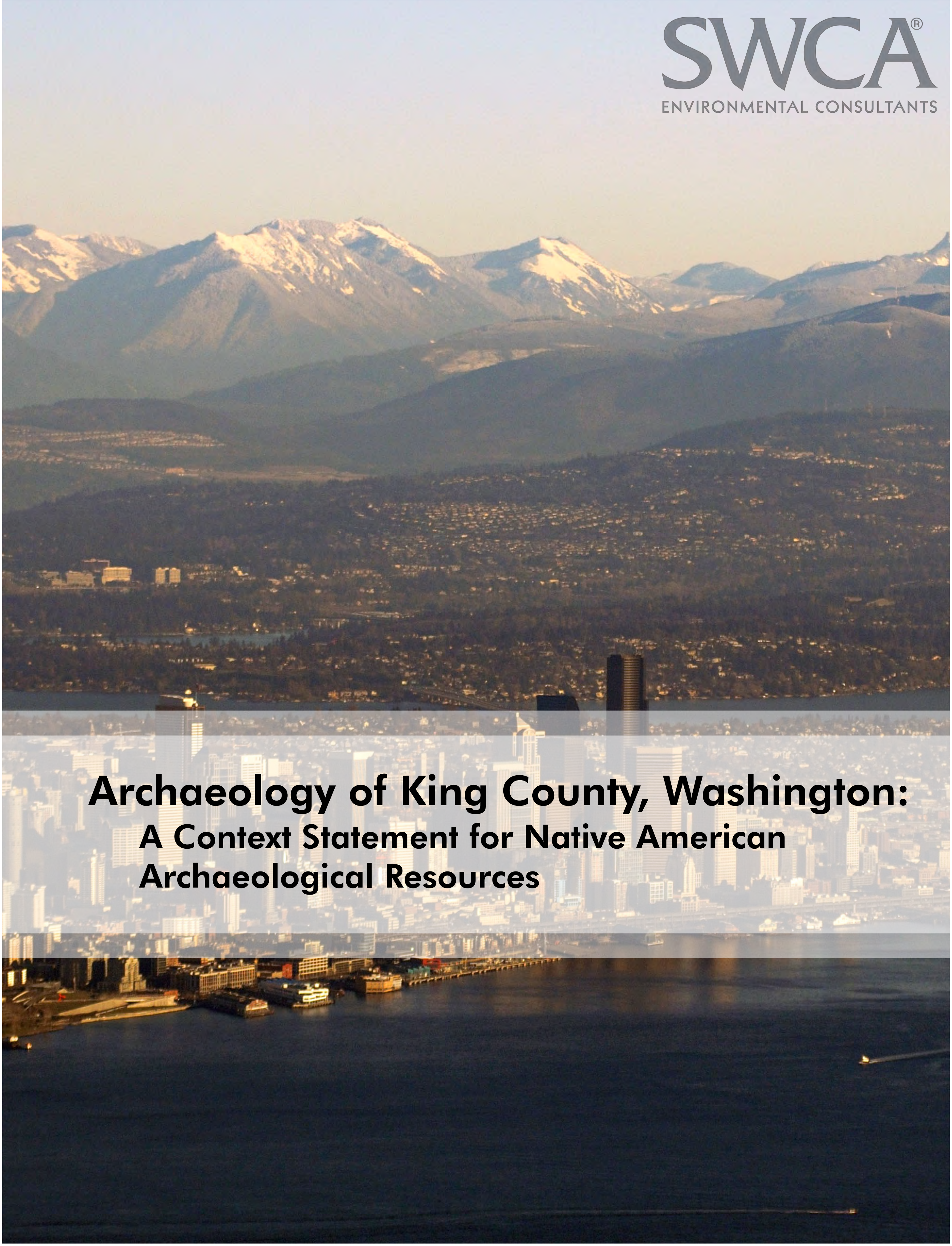

Archaeology of King County, Washington:
A Context Statement for Native American Archaeological Resources

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Robert Kopperl, Charles Hodges, Christian Miss, Johonna Shea, and Alecia Spooner

SWCA Environmental Consultants
221 1st Avenue W, Suite 205
Seattle, WA 98119

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Robert Kopperl
Previously with SWCA Environmental Consultants
Willamette Cultural Resources Associates, Ltd.

Charles Hodges
Pacific Geoarchaeological Services

Christian Miss
SWCA Environmental Consultants
Northwest Archaeological Associates, Inc.

Johonna Shea
SWCA Environmental Consultants

Alecia Spooner
Seattle Central College

EXECUTIVE SUMMARY

This context statement for Native American archaeological resources in King County provides the following elements:

- Environmental background
- Information on ethnographic-period Native American communities inhabiting the vicinity near the time of Euroamerican contact and settlement
- A summary of culture historical sequences developed for the region
- A classification of pre-contact archaeological resources
- A review of previous archaeological investigations and known resources in King County
- An explanatory model of pre-contact Native American settlement and subsistence in King County
- Rationale for and descriptions of spatial variables used in the companion geographic information system– (GIS-) based archaeological site sensitivity model
- Recommendations for future research so that King County data gaps can be addressed
- Discussions of assessment of site significance and integrity in King County

Following the Chapter 1 introduction, Chapter 2 describes the environmental setting of the Puget Sound region, with most specific discussions focusing on processes and phenomena as they have occurred in King County since the end of the Pleistocene epoch. An accompanying appendix briefly summarizes absolute dating methods and provides a discussion of radiocarbon calibration, marine reservoir effects, and other issues involved in creating absolute chronologies from radiocarbon dating and other dating techniques. Modern-day vegetation communities are discussed, as are recent studies on the changing paleobotanical record and its relationship with late Pleistocene and early Holocene climatic change. The living environment of Puget Sound and King County is also described in terms of the general biogeography of important kinds of animal resources used by Native Americans, including shellfish, marine and freshwater fish, anadromous salmonids, terrestrial and marine mammals, and birds.

Chapter 3 summarizes ethnographic and ethnohistoric data that inform us of many aspects of the lifeways of Native Americans who occupied the vicinity of present-day King County for millennia. Following a brief summary of local ethnographic and traditional cultural place studies, certain aspects of the data they have generated are summarized, focusing on settlement, subsistence, and other economic activities that are modeled in later chapters as integral to explaining the archaeological record and estimating site sensitivity throughout King County. Also summarized are ethnographic-period resources that have been observed and recorded in one form or another in King County, such as village and camp sites, resource acquisition areas, trails, and other places that have pre-contact analogues and archaeological signatures.

Chapter 4 reviews pre-contact chronologies archaeologists have developed for the region that subsume King County and its vicinity. Both culture historically oriented temporal sequences and ones developed as part of selectionist and evolutionary ecological theoretical frameworks are discussed. A five-period culture historical sequence is then defined that is used throughout the remainder of the document. The sequence was derived from comparison of the established chronologies and schematic outlines, identifying both parallel and divergent trajectories in hypothesized economic organization, social organization, and subsistence-settlement patterns. The schematic outlines of archaeological data were compared with outlines of environmental regimes through time in Western Washington, and the five Analytic Periods were created: Analytic Period 1 (14,000 cal BP–12,000 cal BP), 2 (12,000 cal BP–8000 cal

BP), 3 (8000 cal BP–5000 cal BP), 4 (5000 cal BP–2500 cal BP), and 5 (2500 cal BP – Euroamerican Contact).

Chapter 5 develops a classification of Native American archaeological resources for King County. This chapter begins with a brief discussion of methodological issues that persistently shape the way we view the archaeological record in King County, as well as much of the rest of the Northwest Coast, which has important implications for the ways in which we categorize archaeological materials found during fieldwork. The site typology conceived in this document includes eleven basic categories, grouped first by their association with residential activities (villages and camps), non-residential activities (resource procurement and processing areas), or lack of association with particular ongoing activities by a group during their annual settlement round. Residential sites are divided into specialized-task and multiple-task occupation sites. The former are encampments associated with the acquisition of one particular resource, while the latter encompasses centralized villages, residential base camps, and field camps—all three of which hosted multiple economic pursuits. Non-residential activity sites are places where a particular resource was obtained and/or processed away from a residential camp or village, and are as varied as the kinds of subsistence and non-subsistence resources available in King County. This typology highlights the mobility patterns of the site occupants, whether or not the site represents residential activity in addition to economic pursuits, and the variability in the number of tasks undertaken at the site itself. Inventoried resources, their classification within this framework, and their distributions across various landforms in the Puget Sound region are then discussed.

Chapter 6 focuses specifically on the archaeological record of King County, using the background information summarized in Chapters 2 and 3, the culture-historical sequence developed in Chapter 4, and the site typology developed in Chapter 5. Following discussions about the kinds of data generated by archaeological investigations in King County, ranging from overview reports, surveys, and monitoring to test excavations and data recovery projects, specific site types identified in King County are discussed as well as their associations with certain environmental variables.

Chapter 7 develops the explanatory model of pre-contact Native American settlement and subsistence. Theoretical frameworks derived from selectionist and evolutionary ecological theory are reviewed and evaluated, resulting in a set of general assumptions derived from aspects of both theoretical frameworks. The assumptions about human population, subsistence, and community formation and settlement are discussed in turn, and facilitate estimation of particular archaeological resource types and distributions during each Analytic Period. For each of these periods, specific aspects of Native American lifeways are modeled, including population, subsistence systems, settlement types, and mobility patterns. Also hypothesized are the site types associated with each period and areas on the landscape of that time period that would attract human activity and possibly retain archaeological material.

Chapter 8 provides a bridge between the background information and explanatory model of this context statement and the GIS-based sensitivity model that will be a primary cultural resources management tool of the King County Historic Preservation Program. The chapter begins with a brief review of the goals of the GIS model and the broader academic debate regarding inductive versus deductive predictive modeling, followed by a summary of the Washington state-wide archaeology predictive model. The methodology used to compile digital layers representing site sensitivity variables and derive sensitivity maps on the GIS platform is then described. Each variable is then discussed in turn; its rationale and role in the explanatory model is briefly reviewed, the conversions required to transform the data into polygons for the GIS model and how values were assigned to those polygons are described, and diachronic adjustments to variables and values to calculate site sensitivity during earlier Analytic Periods are described. Another axis of the GIS model discussed here is preservation, which uses geophysical data to calculate ages of landforms in King County and the likelihood that archaeological deposits would be preserved, and potentially buried, in the modern-day landscape. The chapter concludes with a review of the model and recommendations for testing and future refinement.

Chapter 9 concludes the document with discussions of data gaps in the King County record and considerations of site significance and integrity in light of our current archaeological knowledge based on King County data. The data gaps are embedded in a series of research questions that can be used to evaluate site significance during future archaeological investigations in King County.

ACKNOWLEDGEMENTS

The staff of the King County Historic Preservation Program (HPP) and the King County Department of Transportation Road Services Division (KCRSD) were the driving force behind completion of this effort. Phil LeTourneau diligently tracked our progress, facilitated meetings and presentations, and provided essential data and useful suggestions. Charlie Sundberg was a valuable participant in those meetings and discussions as well, offering a perspective from HPP informed by the previous experience of developing an archaeological resources context statement for King County. Julie Koler was supportive of this context from its inception, and Jennifer Meisner has been supportive in its completion. We thank the HPP for giving us the opportunity to contribute to King County archaeology and historic preservation in this manner. The KCRSD provided essential funding and facilitated contracting for completion of this project, and KCRSD archaeologist Tom Minichillo also gave valuable feedback as a member of the project Advisory Committee.

Dennis Lewarch deserves special mention as a member of the Advisory Committee. He set the bar very high with the initial version of this document. In many ways, the document in front of you is built on the foundation he and Lynn Larson laid 13 years ago. Dennis must also be acknowledged for his selfless encouragement of our progress towards finishing this context statement.

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SWCA Environmental Consultants staff and management provided support and contributed to completion of this document, including Rhiannon Held, Brandy Rinck, Cyrena Undem, and Lorelea Hudson. Several other people provided specific assistance, advice, or data that substantively improved this document. Paul Solimano answered some questions the lead author had regarding Portland Basin prehistory and supplied copies of a few hard-to-find reports. Kevin Aitkin, U.S. Fish and Wildlife Service, provided some very elusive King County survey data for freshwater shellfish. Earlier work by Ross Smith regarding marine reservoir corrections for radiocarbon dates provided the basis for that appendix.

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CHAPTER 1. Introduction

The King County Road Services Division (KCRSD) and the Historic Preservation Program (HPP) received a federal grant in 2000 to develop the Cultural Resource Protection Project (CRPP), a county-wide initiative to improve the management and protection of cultural resources through advanced planning. The CRPP has three major elements: 1) development of a repository for all available information about cultural resources in King County; 2) creation of a geographic information system (GIS) based sensitivity model of cultural resources to assist in the identification of preservation options and planning alternatives; and 3) development of a body of policies and procedures to guide the use and access to King County's cultural resources information (King County Office of Cultural Resources and KCRSD 2000a:1). A key element of the CRPP is preparation of a context statement for evaluation of Native American archaeological resources that predate AD 1860. The context statement provides the rationale, theoretical background, and description of environmental and cultural resource data that are used to develop the sensitivity model for archaeological resources in King County.

Archaeological remains and other cultural resources are important to all the citizens of King County, including Native Americans (King County Office of Cultural Resources and KCRSD 2000a, 2000b). In light of this importance, the HPP proposed development of a planning tool that would increase King County's ability to effectively manage cultural resources. Details of the CRPP are summarized in two project planning documents (King County Office of Cultural Resources and KCRSD 2000a, 2000b). King County contracted with Larson Anthropological Archaeological Services Limited (LAAS) in January 2001 to gather information regarding hunter-gatherer archaeological sites and environments in King County as part of the CRPP. LAAS produced a draft context statement in 2003 in Phase 1 of the CRPP. Northwest Archaeological Associates, Inc. (NWAA), now SWCA Environmental Consultants (SWCA) revised the document to its current form as part of Phase 2 of the CRPP to more suitably complement the GIS sensitivity model. A third phase of the CRPP is also currently underway that provides a context for the historical archaeological resources of King County.

DEFINITION AND PURPOSE OF THE HISTORIC CONTEXT STATEMENT

Historic contexts have been developed over the past several decades to serve as an analytical framework in which archaeological sites are better understood. Such frameworks establish themes, geographic limits, and chronological periods of importance and identify data gaps that newly discovered sites may have the potential to address (Little et al. 2000). This historic context statement discusses the current state of knowledge regarding the pre–European contact environment, pre-contact cultural chronologies, and attributes of the archaeological record for King County and Western Washington. In addition, the historic context statement defines archaeological variables such as site types, and evaluates analytical summaries that have been used to describe the archaeology of Western Washington. The historic context provides the rationale for using ethnographic, archaeological, and environmental data to develop the archaeological sensitivity model for King County. Research domains that may be used to evaluate the significance of particular archaeological resources are derived from our current state of knowledge, and are briefly explored at the end of this document.

The context uses multiple time periods to explore changes in hunter-gatherer subsistence-settlement patterns. The time periods allow comparison of estimates of the kinds, ages, and locations of hunter-gatherer archaeological resources in different environmental settings throughout King County. The term hunter-gatherer refers to the people who lived in Western Washington prior to European contact. While some contemporary Tribes in Western Washington prefer other conventions, the term hunter-gatherer is retained throughout this document because it is used more commonly in contemporary anthropology and archaeology and denotes the full range of hunting, fishing, and gathering subsistence activities pursued by non-agrarian societies.

The primary purpose of the historic context is to provide an explanatory framework for the archaeological sensitivity model for King County. This model generates estimates of archaeological sensitivity across the present-day landscape of King County that are derived from anthropological and archaeological theory rather than statistical analyses of extant archaeological data in Western Washington. It therefore may be considered “deductive” in its approach. Known archaeological site distributions may be used to test the accuracy of the model, but in that framework, do not generate estimates of site distribution. The inductive-deductive dichotomy in predictive model construction is not a particularly useful distinction, however, because in reality model-building tends to be an iterative process that relies on both empirical data and theoretically justified selection of variables to create a product useful as both research and management tool (cf. van Leusen 2002:5.1–5.6). The advantages of the approach taken here are two-fold. First, separating analyses of existing data from probability estimates for a sensitivity model helps avoid circular reasoning that may occur when a model is tested against the same data used to develop it. Second, the archaeological record for King County, like many areas defined by modern political boundaries, is biased and not quantitatively sufficient for complex statistical analyses. Survey coverage varies widely across the county as well, with substantially more archaeological surveys in marine littoral and alluvial floodplain environments where most the intensive construction and development have occurred over the past 50 years.

SCOPE AND SCALE OF THE HISTORIC CONTEXT

This historic context statement considers hunter-gatherer occupations in Western Washington between 14,000 years ago and approximately 150 years ago. The best available evidence from archaeological investigations in Washington State suggests that small groups of hunter-gatherers entered Western Washington around 14,000 years ago, approximately 1,000 to 2,000 years after the retreat of the Puget Lobe of the Cordilleran Ice Sheet (Burtchard 1998; Schalk 1988). Fluted spear points have been discovered as isolated finds in the greater Puget Sound region (Burtchard 1998; Croes et al. 2008:108; Meltzer and Dunnell 1987), similar to Clovis points that date to approximately 11,000 to 14,000 years ago in Eastern Washington and elsewhere in the Intermountain West. This earliest period in the pre-contact sequence is represented in King County, as of 2009, by just one archaeological site in which artifacts have been found in a buried, intact deposit dating to the terminal Pleistocene epoch (Kopperl et al. 2010, Kopperl et al. 2015).

The roughly 10,000 to 12,000 intervening years between the earliest human settlement on the landscape and initial Euroamerican contact is manifested in King County by an archaeological record that increases in representation through subsequent chronological periods. As described in more detail in Chapter 4 of this document, archaeologists have created culture historical sequences for the area that document a record of temporal and spatial variability, from a handful of poorly-dated sites from the early and mid-Holocene to much more abundant later Holocene sites situated in a greater variety of environments throughout the county.

The ethnographic period is defined as the period between AD 1792 and 1860, when historic documentation supplements archaeological data for our knowledge of past Native American land use in King County. Initial European contact began in the 1790s. By 1860, Euroamerican settlement had expanded to such a large extent, and regional Native American population had decreased so dramatically, that Native American economic and settlement systems had significantly changed from the pre-contact period. Despite this change, brought about to a large extent by disease epidemics (Boyd

1999), data from the ethnographic period is still valuable in formulation of archaeological site types and other aspects of the sensitivity model.

Geographic Areas

King County is a political subdivision of Washington State encompassing approximately 2,126 square miles of land within the Southern Puget Sound basin of the Puget Trough Physiographic Province (Figures 1-1 and 1-2) (Franklin and Dyrness 1973:Figure 2). Archaeologists conventionally define the Southern Puget Sound basin based on river and stream systems (e.g., Campbell 1981:3–5). The south end of the basin is demarcated by the Deschutes River and Nisqually River drainages, the east side by the crest of the Cascade Range, the north end by the Pilchuck River drainage, and the west side by the crest of the Olympic Mountains.

Regional Contributions

Archaeological data from the greater Western Washington region are also important in the development of this context statement. Archaeological chronologies, site data, and distribution patterns from relevant studies in Western Washington provide a broader regional framework for the context statement, and, ultimately, the sensitivity model. Archaeological studies outside the political boundaries of King County provide examples of site types that have not been identified in King County, or that have not been studied as intensively in King County. Excavated sites in Western Washington with detailed archaeological information allow project researchers to make inferences about kinds and ages of archaeological resources on similar landforms or in comparable habitats in King County.

BACKGROUND FOR SELECTION OF DATA AND THEORETICAL FRAMEWORKS

Review of some theoretical frameworks used by anthropologist and archaeologists in the region shows how data have previously been selected and interpreted to explain the archaeological record of the region. These schools of thought have changed substantially over the past several decades, reflecting evolution of theoretical orientations and the analytical and methodological capacities of archaeologists to formulate and address new research questions.

This context document includes a review of contemporary anthropological theories that have been used to study the archaeology of Western Washington, with the goal of identifying and incorporating their most useful elements. Most regional archaeological studies are descriptive summaries of site features and artifact attributes, including discussions of chronology and comparison of artifact assemblages and traits among sites (Blukis Onat 1987; Blukis Onat et al. 2001; Morgan 1999; Nelson 1990). Such studies are based on the culture history approach and identify basic patterns in the archaeological record. Several contemporary anthropological theories regarding hunter-gatherer systems have been used by some archaeologists to move beyond a descriptive focus and towards explanatory goals of a broader anthropological nature. Evolutionary ecological schools of thought derived from optimal foraging theory (e.g., Broughton and O'Connell 1999; Smith and Winterhalder 1992) have been embraced by Pacific Northwest archaeologists (e.g., Burtchard 1998; Butler and Campbell 2004). Other anthropological approaches focus on social inequality and exchange from a variety of explanatory theoretical orientations, ranging from Marxism to various interpretations of Darwinian evolutionary and social complexity theory (e.g., Ames 1996; Ames and Maschner 1999; Coupland 1988; Earle 1997; Maschner and Bentley 2003). These investigations seek to identify mechanisms for the development of social complexity and status differences among hunter- gatherers. A particular Darwinian selectionist framework, with roots in the anthropology department of the University of Washington, has been used by other archaeologists to explain changes in functional and stylistic traits of different classes of

Figure 1-1. Location of King County.

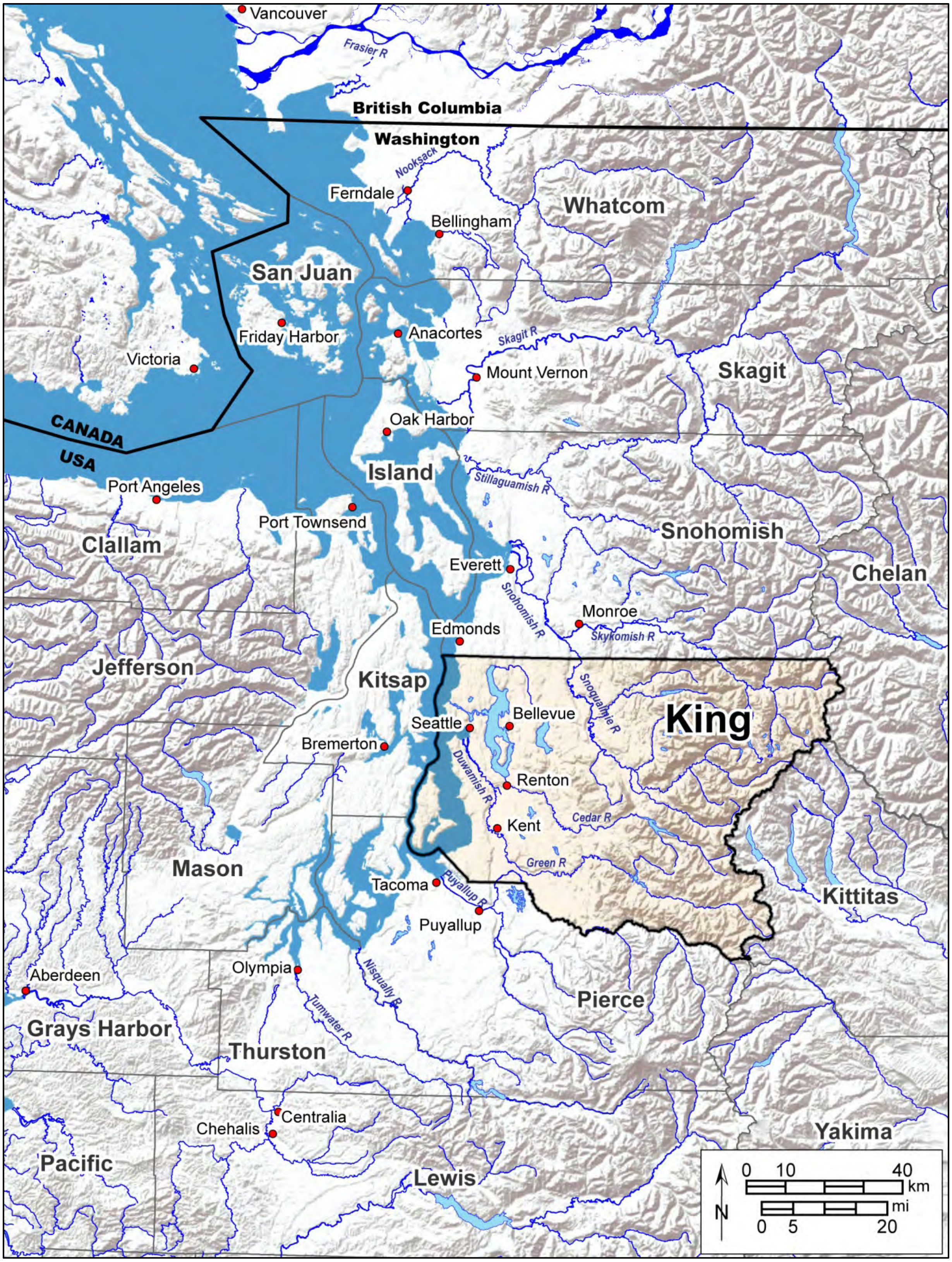


Figure 1-2. Physiographic map of the Puget Sound region.

archaeological data in terms of natural selection (e.g., Dunnell 1989; Lewarch et al. 1995; Thompson 1978).

ROLE OF THE HISTORIC CONTEXT STATEMENT IN THE KING COUNTY CULTURAL RESOURCE PROTECTION PROJECT

The historic context describes and categorizes the variables that will be used to develop the archaeological sensitivity model, and documents the rationale and theoretical framework for the project. The document follows the general steps outlined by Little et al. (2000), including a review and synthesis of archaeological, environmental, and ethnographic data. King County describes the CRPP historic context statement as a key aspect of its effort to "integrate cultural resource data with existing environmental data to produce an archaeological sensitivity model identifying the probable locations of archaeological resources" (King County Office of Cultural Resources and KCRSD 2000b:1). Review of environmental, ethnographic, and archaeological data identifies landforms and habitats that are strongly associated with archaeological resources. Integration of these data facilitates estimation of probable ages of ground surfaces, and identification of probable archaeological and ethnographic period resources by time period, resource type, and landform and habitat type.

DEVELOPMENT OF ARCHAEOLOGICAL RESEARCH DESIGNS

As a conclusion following the review of available archaeological data for Western Washington and King County, this context document summarizes themes or topics that have been identified as important for research by archaeologists working in the region. A notable recent change in regional research goals has been a gradual shift from compiling chronologies using the culture historical approach to studying and attempting to quantify variation in the archaeological record in such a way that answers the "how" and "why" questions as well as the "what, where, and when" questions. Although an explicit set of research questions has not been developed for King County, the information synthesized in this document highlights potential research domains and data gaps in the King County archaeological record, and it may therefore be used as an aid in assessing the significance of future discoveries of Native American archaeological resources. Recommendations are made that address current data gaps in the King County archaeological record and a general set of research domains and specific research questions that can be answered in a variety of ways using King County archaeological data.

CHAPTER 2. Late Pleistocene and Holocene Environments in Puget Sound

Chapter 2 provides an overview of contemporary and past natural environments in King County and Western Washington, and identifies attributes of the environment relevant to understanding hunter-gatherer land use through time. Understanding aspects of the natural environment that may correlate with human land use is a key component in selecting relevant environmental data for development of the archaeological sensitivity model. A more detailed discussion of the articulation between the processes and products of the natural environment and their treatment in the archaeological sensitivity model is given in Chapter 8.

The physical environment of Western Washington and the Puget Sound basin changed dramatically at the end of the Pleistocene epoch (e.g., Booth, Troost, et al. 2004; Borden and Troost 2001; Leopold et al. 1982; Whitlock 1992). Around 17,000 years ago (in calibrated years before present), the Puget Lobe of the Cordilleran Ice Sheet reached its maximum southern extent near the present-day town of Tenino, Washington. At its maximum, the ice sheet blocked the marine connection of Puget Sound via the Northern Puget Sound and the Strait of Juan de Fuca. During retreat, the ice sheet impounded glacial meltwater and runoff from rivers and streams in large proglacial lakes that filled ice-carved troughs created at the base of the glacial ice. By about 16,000 years ago, the ice sheet retreated to the northern portion of the Southern Puget Sound basin and the landscape to the south, including present-day King County, was available for colonization by plants and animals.

Against the backdrop of major shifts in climate over the next 16,000 years, aspects of the physical environment of Western Washington also changed. Relative sea levels have locally fluctuated due to the combination of postglacial rise in global sea level, uplift of land due to regional isostatic rebound following retreat of the Puget Lobe, and localized tectonic events that uplifted or lowered portions of King County basins. Stream and river floodplains have responded to base level changes related to both global and relative sea-level change over the course of the Holocene. Notably, the topography of the lowlands northwest of Mount Rainier was dramatically reworked about 5,600 years ago by a large mudflow from the volcano’s flanks. These events and the general physical processes that control them are discussed first, followed by discussions of the biotic environment, including vegetation and animal communities that have been economically important to Native Americans for millennia.

A Note Regarding Radiocarbon Dating Conventions

In this chapter and subsequent ones that describe the natural and cultural environment of the region, radiocarbon dates and age ranges based on those dates are given in calibrated calendrical years. Conventional radiocarbon age estimates have been recalibrated using the CALIB rev 7.0.4 program available on the internet, which utilizes the IntCal09 calibration curve (Reimer et al. 2009). Use of calibrated ages wherever possible allows some consistency in discussion of cultural chronologies, dated events in the natural environment such as volcanic and tectonic activity and shifts in the climatic regime, and the relationship between these processes. Appendix A includes a discussion of the procedures used for calibrating age estimates based on radiocarbon data, as well as some other pertinent issues that arise when absolute dates are obtained and inferences drawn from them. For either uncalibrated radiocarbon ages or those calibrated to calendar years that are given in years before present (cal BP), commas are not used when the age is less than 10,000 years.

THE PHYSICAL ENVIRONMENT OF KING COUNTY

The modern landscape of King County is characterized by landforms and sediments produced across multiple spatio-temporal scales in glacial, deglacial, and nonglacial environments. Some of the physical features associated with earlier glacial and deglacial conditions are still readily visible around the county; other landscape features are the products of much more recent Holocene geomorphic processes.

Geomorphology, surficial geology, and bedrock geology supply information on the physical conditions supporting the biotic component of a landscape, and influence the formation of soils (Forman 1995; Forman and Godron 1986; Huggett 1995; Malanson 1993). The properties of these physical substrates impose broad constraints on soil development and the operation of ecosystem processes throughout the county. In some places residues generated by processes connected to the operation of the local ecosystem have been preserved within sedimentary bodies. These residues include archaeological materials subject to the same natural processes of burial, weathering, and erosion that affect the preservation and distribution of noncultural deposits (Bettis 1992; Fedele 1976; Schiffer 1987). In turn, soil and geomorphic data derived from the depositional contexts of archaeological sites can indicate features of past landscapes that are no longer visible on the surface (Holliday 1990).

This section of Chapter 2 describes characteristics of the various and changing depositional environments of King County with emphasis on the processes responsible for the configuration of landforms comprising the county landscapes at different times over the last 16,000 years.

Setting

King County is bounded on the west by the marine waters of Central Puget Sound and extends eastward to the crest of the Cascade Range. Approximately the western two-thirds of the county is occupied by the Puget Lowland, a broad rolling glacial drift plain flanking the eastern shoreline of Central Puget Sound. Structurally, the Puget Lowland is part of a larger trough system that extends south from British Columbia to the Willamette Valley in west-central Oregon. For the most part there are few bedrock exposures in the Puget Lowland, particularly in King County, due to the thick glacial deposits that cover the underlying structural geology (Booth, Cox, et al. 2004; Livingston 1971; Mullineaux 1970; Shimel et al. 2003; Troost et al. 2003; Walsh et al. 1987; Yount et al. 1993).

The Cascade Range takes up the eastern third of the county, and are composed of complexes of igneous, metamorphic, and sedimentary rock (Livingston 1971) that have been subdivided into the North Cascades region to the north and the Cascades region to the south (Figure 2-1). The Cascades region consists of several large stratovolcanos and mountains of more moderate elevation extending south from the vicinity of Snoqualmie Pass, where Interstate 90 crosses the mountains east of downtown Seattle, through Oregon to Mount Shasta and Lassen Peak in northern California. The North Cascades region north of Snoqualmie Pass and extending into southern British Columbia is predominantly composed of metamorphic and granitic rocks, with some extrusive volcanic rock (Tabor and Haugerud 1999). The North Cascades are some of the most rugged mountains in the continental United States, including two stratovolcanoes (Mount Baker and Glacier Peak), and they exhibit extremely high relative relief (Mierendorf 1986). These mountain ranges have experienced more intensive alpine glaciation than the Cascades region to the south (Livingston 1971:25), and host the largest number of active glaciers in North America (Tabor and Haugerud 1999). The highest peak in King County is Mount Daniel (2,434 m above sea level, or 7,986 feet) in the North Cascades province in the northeastern corner of the county (Livingston 1971).

Western Washington is a tectonically active region because of offshore movement and subduction of crustal plates. As the oceanic Juan de Fuca Plate moves east from the Juan de Fuca Ridge it plunges beneath the lighter continental North American Plate. As the denser oceanic crust is forced deep into the Earth's interior beneath the continental plate in a process known as subduction, the plate

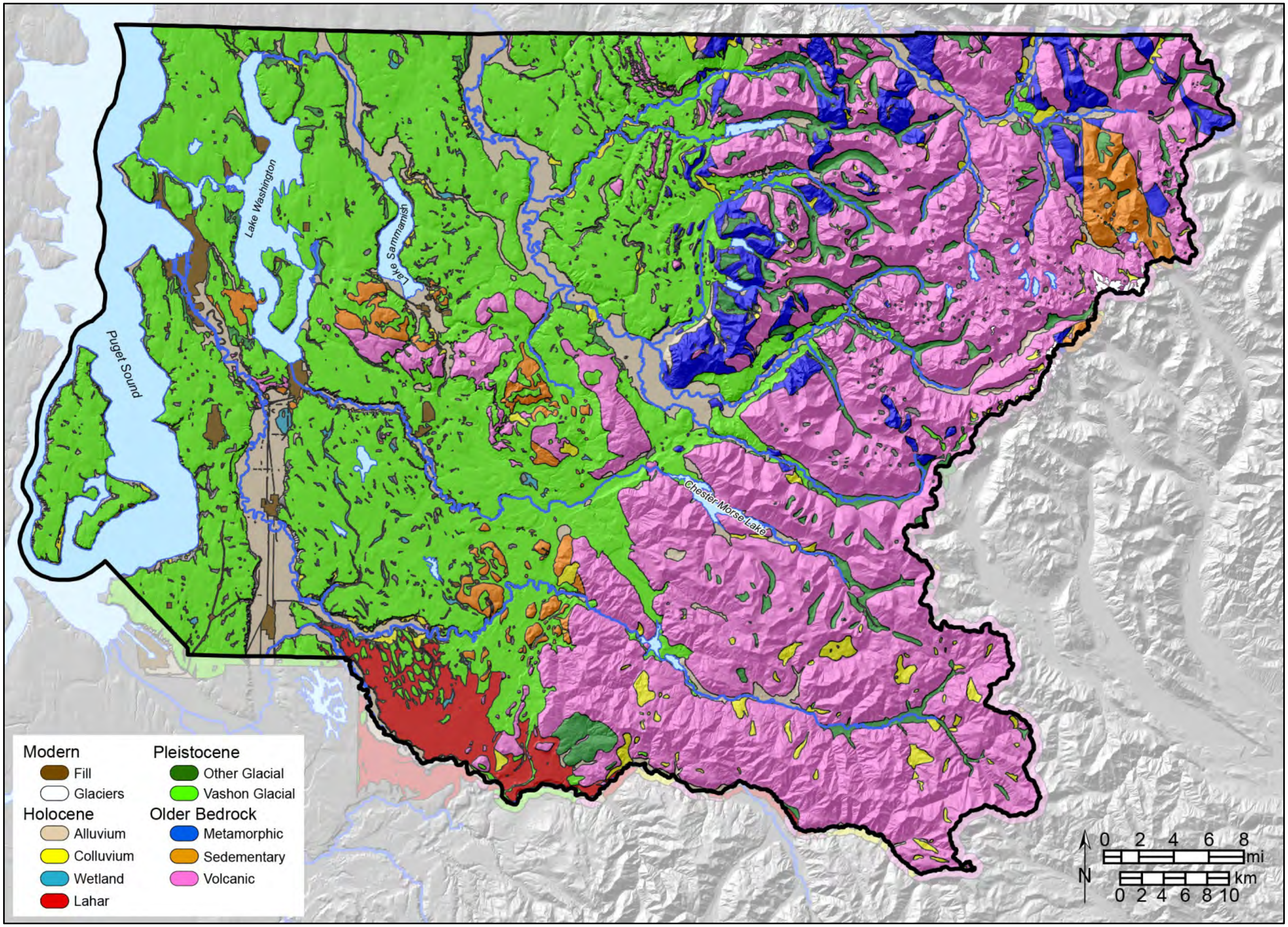


Figure 2-1. Surface geology map of King County.

encounters high temperatures and pressures that partially melt solid rock. Some of this newly formed magma rises toward the Earth's surface and erupts to form a chain of volcanoes above the subduction zone.

In Western Washington ongoing subduction has been expressed as episodes of mountain building. The western foothills of the Cascade Range are an older uplifted sequence of extrusive volcanics and volcanoclastic rocks, interspersed with intrusive volcanic rock, and form low mountains at elevations ranging between 425 and 850 m (1,400 and 2,800 feet) above sea level. Active volcanoes dominate the Cascade Range east of the foothills. Most of the Cascades range between 610 and 2,000 m (2,000 and 7,000 feet) in elevation with Mount Rainier exceeding 4,300 m (14,000 feet). Local relief is more than 300 m (1,000 feet) in most of the region. Rock types in the Cascade Range range from Miocene- and Pliocene-aged extrusive rocks dominated by basalt and some dacite to intrusive granites and diorites. These are intercalated with numerous pyroclastic tuffs and breccias. In the North Cascades portion of the county, crystalline rock types including gneisses, schists, metasediments, and metavolvanics dominate.

A prominent bedrock outlier called the Newport Hills Promontory or Newcastle-Grand Ridge Hills extends west into the Puget Lowland from the foothills to the south end of Lake Sammamish, and includes Cougar Mountain, Squak Mountain, and Tiger Mountain (Livingston 1971:24). The ridge system comprising the Newcastle-Grand Ridge Hills is a large anticline composed of marine and non-marine sedimentary rocks dating to the Eocene, Oligocene, and Miocene ages (Yount and Gower 1991:7–8). Elsewhere along the eastern margin of the Puget Lowland are small bedrock outcrops of similar material in the Duwamish River Valley south of downtown Seattle near the town of Tukwila, and in areas south of Renton. Both of these areas of outcrops play prominent roles in local Native American mythology (Miller and Blukis Onat 2004).

In addition to mountain building resulting from plate tectonic movements, the county’s landscape has been affected by global changes in climate during the Pleistocene (beginning about 2.8 million years ago and ending about 10,000 years ago). Variation in global atmospheric circulation patterns associated with changes in the tilt and rotation of the earth’s axis resulted in alternating long-term climate cooling and warming trends in British Columbia and the Pacific Northwest that have left a strong topographic signature on the Cascade Range and the Puget Lowland (Barnosky et al. 1987; Bryson and Goodman 1986; Kutzbach and Webb III 1993; Whitlock and Brunelle 2006; Whitlock 1992). During cool climate cycles lowland King County was overrun by ice sheets originating in southwestern British Columbia; during the same periods, though not always synchronously, alpine glaciers advanced down mountain valleys in the Cascade Range. Advance and retreat of the alpine glaciers left a legacy of classic alpine landforms including cirque basins, arêtes and horns, terminal and lateral moraines, hanging valleys, and steep drift-mantled slopes. Recent research suggests alpine ice accumulation and glacial erosion has exerted control on the maximum altitude reached by peaks in the Cascade Range (Mitchell and Montgomery 2006). In the lowlands the advance and retreat of the last ice sheet left behind a landscape dominated by extensive glacial drift uplands composed of broad, gently undulating advance outwash and till plains; intervening large, deep, north-south-oriented subglacially carved troughs; and recessional outwash plains accompanied by a host of features related to the formation and variable persistence of deglacial recessional lake and meltwater drainage systems.

The large glacial troughs partitioning the drift uplands are now occupied by marine waters and large freshwater lakes and rivers. In King County, the largest of these troughs is now occupied by Puget Sound, and other large troughs are occupied by the county’s major lakes and rivers including the

Snoqualmie River, the Duwamish River–Green River Valley, and Lakes Washington and Sammamish (Galster and Laprade 1991; Liesch et al. 1963; Shimel et al. 2003; Yount et al. 1993).

Landscape sculpting continued during the Holocene (the last 10,000 years), albeit on vastly smaller spatio-temporal scales. The larger-scale modifications are limited for the most part to coastal bluff retreat along Puget Sound (Downing 1983; Shipman 2004), minor fluvial erosion in the form of short, steep-sided ravines along the margins of the drift uplands (Buffington et al. 2002), and low-frequency, high-magnitude events such as earthquakes and lahar inundation (Atwater and Moore 1992; Dragovich et al. 1994; Karlin et al. 2004; Vallance and Scott 1997). In general, the effectiveness of Holocene geomorphic processes in shaping the county's postglacial landscape is best understood and measured in terms of high-frequency, low-magnitude events such as rain-on-snow events, river flooding, and ongoing slope erosion in various forms such as gullying, landsliding, earthflows, and other forms of mass wasting (Bull and Kirkby 1997; Kirkby 1986; Selby 1993). Arguably, the most far-reaching perturbations affecting the natural landscape of King County during the Holocene have been human-induced modifications associated with land use practices beginning in the mid-nineteenth century, which have denuded the region of vast tracts of forest through logging, degraded fish habitat throughout most of the region due to urban and suburban sprawl, and tainted significant tracts of land and sea through poor waste disposal practices (For an introduction to some of these effects, see Booth 1990; Davis 1973; Robertson 1995; Schmelzer 2001).

Late Quaternary Landscape History

King County is a formerly glaciated landscape. During the latest glacial maximum, known in the Puget Lowland as the Vashon stade of the Fraser glaciation, the Cordilleran Ice Sheet advanced out of the mountains of British Columbia about 25,000 years ago, flowed southward across the Fraser and Puget Lowlands between the Olympic Mountains and the Cascade Range, and began retreating with the onset of climatic warming (Armstrong et al. 1965; Booth, Troost, et al. 2004; Easterbrook 2003). The Puget Lobe of the ice sheet entered the Puget Lowlands and by about 17,000 years ago reached its maximum extent near the present town of Tenino. After a very brief interval of perhaps 100 years, the ice began to retreat rapidly northward, reaching Seattle by about 16,500 years ago (Borden and Troost 2001; Porter and Swanson 1998), and finally disappearing from the lowlands soon after 10,500 years ago (Booth, Troost, et al. 2004). At its maximum advance, the surface elevation of the ice over the Seattle area was almost 0.5 km (0.3 mile) thick (Dethier et al. 1995).

The early stages of the Fraser glaciation were marked by the advance of alpine glaciers in the Coast Mountains of British Columbia, the Olympic Mountains, and in the Cascade Range. By the time the Puget lobe of the Cordilleran Ice Sheet entered the northern Puget Lowland, the glaciers formed during this early stage of alpine advance, known as the Evans Creek stade in the Washington portion of the Cascade Range, had already begun to retreat, and in most valleys were well above their maximum limits.

Ice retreat was accompanied by a complex succession of meltwater channels and ice-marginal lakes that formed behind the retreating ice front. During the early stages of retreat, meltwater trapped behind the wasting Puget Lobe flowed south across the terminoglacial outwash plain and into the Chehalis River Valley. As the ice retreated farther north, two large glacial lakes, Lake Russell and Lake Hood, along with several smaller marginal glacial lakes, were ponded in front of (south of) the ice front and continued to drain southward via a spillway through the Black Hills south of the town of Olympia to the Chehalis River Valley. The lakes continually enlarged northward as ice retreat continued, and finally coalesced into one large lake, called Lake Bretz, when the ice sheet was near the northern margin of the Lake Washington basin (Booth, Troost, et al. 2004; Thorson 1980; Waitt and Thorson 1983). By about 13,000 years ago, during the last stages of deglaciation when the retreating ice sheet had reached the vicinity of Whidbey Island north of Seattle, the lake finally abandoned its southern outlet and drained northwestward through the Chimacum valley into the marine waters of the Strait of Juan de Fuca (Bretz 1913; Dethier et al. 1995; Haugerud 2006).

North of King County, an interval of cooling called the Sumas stade was composed of several brief ice advances and retreats in the Fraser Lowland. Alpine glaciers in the mountains of British Columbia and some of the North Cascades valleys experienced a resurgence, but the response of alpine glaciers farther south was more equivocal (Heine 1998; Menounos et al. 2008).

King County Landforms

Landscapes are shaped by geomorphological and pedological processes, with geomorphology providing the fundamental template which guides and directs both the landscape processes and human interactions with those processes (Conacher 2002). The latest Pleistocene cycle of glacial advance and retreat played a major role in controlling large-scale sedimentary architecture throughout the Puget Sound basin, and each stage of the glacial cycle left distinctive suites of landforms and sediments exhibiting an orderly spatial organization. A landsystems approach derived from the concept of system tract used in sequence stratigraphy is employed to describe the effects of the glacial cycle in the county (Boggs 1995; Nummedal and Swift 1987). System tracts are linkages of contemporaneous depositional systems created during various stages of sea-level rise or fall. The concept has been modified and successfully applied in other areas of geomorphology, especially research concerned with cyclic sedimentation, for example, in the development of alluvial fans or fluvial systems (Aitken and Flint 1995; Boyd et al. 1989; Weissmann et al. 2002).

Landforms and surfaces in lowland King County were formed in three phases: ice-sheet glaciation, deglaciation, and, to a much lesser extent, Holocene erosion and deposition (Figure 2-2, Table 2-1). Each phase is exemplified by sediments and landforms representing the major settings in glacial, proglacial, and paraglacial depositional environments. For example, lowland King County is dominated by landforms associated with the ice-sheet bed and the ice-contact zone at the margins of the ice sheet during glaciation, and by landforms formed in the proglacial zone and the glacial foreland in front of the retreating ice sheet.

Table 2-1. Landsystems of King County

King County Landsystem	Depositional Setting	Glacial Cycle	Description
Mountains	Valley Glaciation	Evans Creek stade through Holocene interstade.	Landforms of the Cascade Range created during advance and retreat of alpine glaciers.
Embankment Fill	Ice-Marginal	Vashon stade	Sediments deposited into lakes or along streams in the Cascade Range foothills dammed by the east margin of the Puget Lobe.
Drift Uplands	Ice-Sheet Bed	Vashon stade	Glacial till and outwash plains below 150 m (500 feet) elevation in the Puget Lowland.
Proglacial	Recessional	Everson interstade	Recessional landforms generated during ice retreat; best expressed in the southern portion of the county.
Coastal	Postglacial	Holocene interstade	Shoreline features of Puget Sound created during bluff retreat due to wave erosion associated with sea-level rise; formed in the last 5,000 years, though most landforms are 2,500 years old or less.
Lahar	Postglacial	Holocene interstade	A single extreme debris avalanche event (Osceola Mudflow) from Mount Rainier that modified the topography of southern King County.

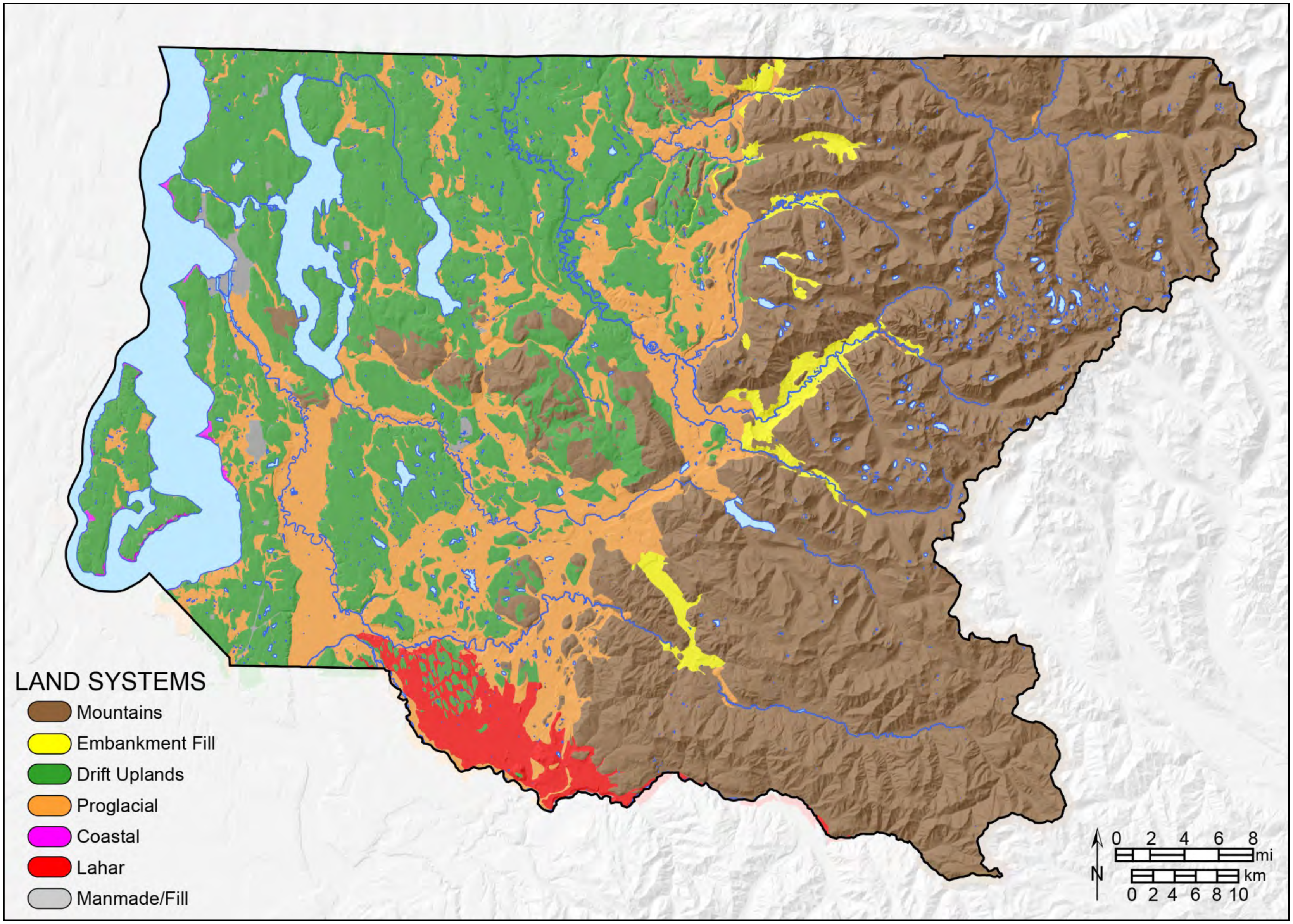


Figure 2-2. Delineation of land systems in King County.

In the following sections typical landforms associated with each phase in the glacial cycle in both the mountains and the lowlands are briefly described. Table 2-2 shows environments of deposition and typical landforms associated with glacial and deglacial phases of the glacial cycle.

Table 2-2. Generalized Relations among Environments of Deposition and Typical Landforms for the Glacial and Deglacial (Paraglacial) Periods in Lowland King County

Depositional Environment		**Typical Landforms**
Primary Glaciogenic	Supraglacial	Channels, fluvial bedforms, drumlins, moraines, eskers
	Subglacial	Lateral moraines, kame deltas and terraces, channels
	Ice-Marginal	Lateral and medial moraines, kames, kame-and-kettle topography, kettle lakes, fan-deltas
Proglacial Meltwater		Alluvial fans and terraces
		Sandar (valley outwash trains)
		Slopes (landsliding)
		Outburst flood
		Lake plains
Proglacial Glaciolacustrine		Lacustrine deltas
		Density deposits (mass movements into lake margins)

Evans Stade – Mountain Valley Glacial Landsystems

Alpine glacial advances and retreats in the Cascade Range over the past 25,000 years were conditioned by regional climate changes as well as by local short-term variation within the regional climatic pattern during the Holocene (Heine 1998; Menounos et al. 2008; Porter 1976). During the Evans Creek stade of the Fraser glaciation, the Cascade Range south of Seattle was occupied by cirque and valley glaciers, although ice fields existed along the crest of the range southeast of Mount Rainier. Each large valley in the King County portion of the Cascade Range was occupied by a long alpine glacier (Crandell 1965), though the exact downvalley extent of alpine ice has been obscured by later erosion and deposition from Puget Lobe ice. In the South Fork Snoqualmie River, by the time the Puget Lobe reached its maximum extent about 17,000 years ago, the terminus of the South Fork glacier had already retreated about 15 km (9 miles) or more from its terminal moraine, based on the lack of evidence to show the valley glacier terminated in the ice-marginal lake ponded by the lowland ice (Porter 1976).

Valley glaciers typically have extensive covers of sediment mantling the surface of the glacier, and sediments surrounding the glacier margins form large moraines and ice-contact fans (Benn and Evans 1998). Features associated with maximum valley glacier extents in the Cascade Range are poorly preserved because ice-bed features and moraine complexes have been buried by supraglacial sediment lowered onto the valley floor during glacier retreat, have been reworked by fluvial erosion, or have been buried by sediments transported off the valley slopes. Patches of drift have been preserved on lower-gradient slopes and in smaller valleys, though time of deposition of these sediments is uncertain.

Vashon Stade – Puget Lowland Ice-Sheet Beds and Ice-Marginal Landsystems

A significant portion of lowland King County preserves a gently undulating glacial ice-sheet bed only slightly modified since its deposition at the end of the Pleistocene. As the Puget Lobe advanced southward, meltwater and sediments shed from the ice sheet created a range of landforms in the lowlands in front of the ice, including meltwater channels, lakes, and piles of sediment accumulated directly at the ice front. These deposits were subsequently infilled, deformed, or modified as they were overridden by the advancing glacier. The result was the formation of a broad, low-relief upland seldom exceeding 150 m (500 feet) in elevation (Booth 1994). The surface of this upland is characterized by elongate, linear flutes oriented approximately north-south, and separated by shallow troughs; the pattern indicates subglacial deformation of unconsolidated sediment due to rapid basal sliding of the ice sheet as it advanced southward (Benn and Evans 1998; Booth 1991; Booth and Goldstein 1994).

After ice advance, but before exposure during deglaciation, the surface of the glacial fill was deeply eroded by subglacial water which created the large north-south-oriented troughs now occupied by Puget Sound and Lakes Washington and Sammamish (Booth 1994). Water also drained southeast through a complex system of shallow subglacial channels from the interior of the ice sheet toward the ice sheet margin and through a series of valleys in the adjacent Cascade Range (Booth and Hallet 1993). The most extensive subglacial channelway network is near the former eastern boundary of the ice sheet along the lower flanks of the Cascade Range, and extends from the Skykomish River south approximately 50 km (30 miles) to the North Fork of the Snoqualmie River. Five ice-marginal lakes in the Sultan, Skykomish, North Fork Tolt, South Fork Tolt, and North Fork Snoqualmie basins were fed by this channel network. In these valleys, thick accumulations of deltaic and lacustrine sediments were deposited in subaerial marginal lakes impounded against the edge of the ice (Booth 1991).

A good example of an ice-marginal depositional system is well preserved in the Snoqualmie Valley near the town of North Bend, where the ice-marginal embankment consists of a high, flat-topped ridge that extends across the Snoqualmie River Valley (Figure 2-3). Deltaic sediments were deposited upvalley from the Snoqualmie embankment at the upper end of the ice-dammed lake. As the ice sheet retreated to the north and west, the newly-opened, ice-free valleys held ice-marginal lakes that became successively lower as new outlets were uncovered (Easterbrook 2003).

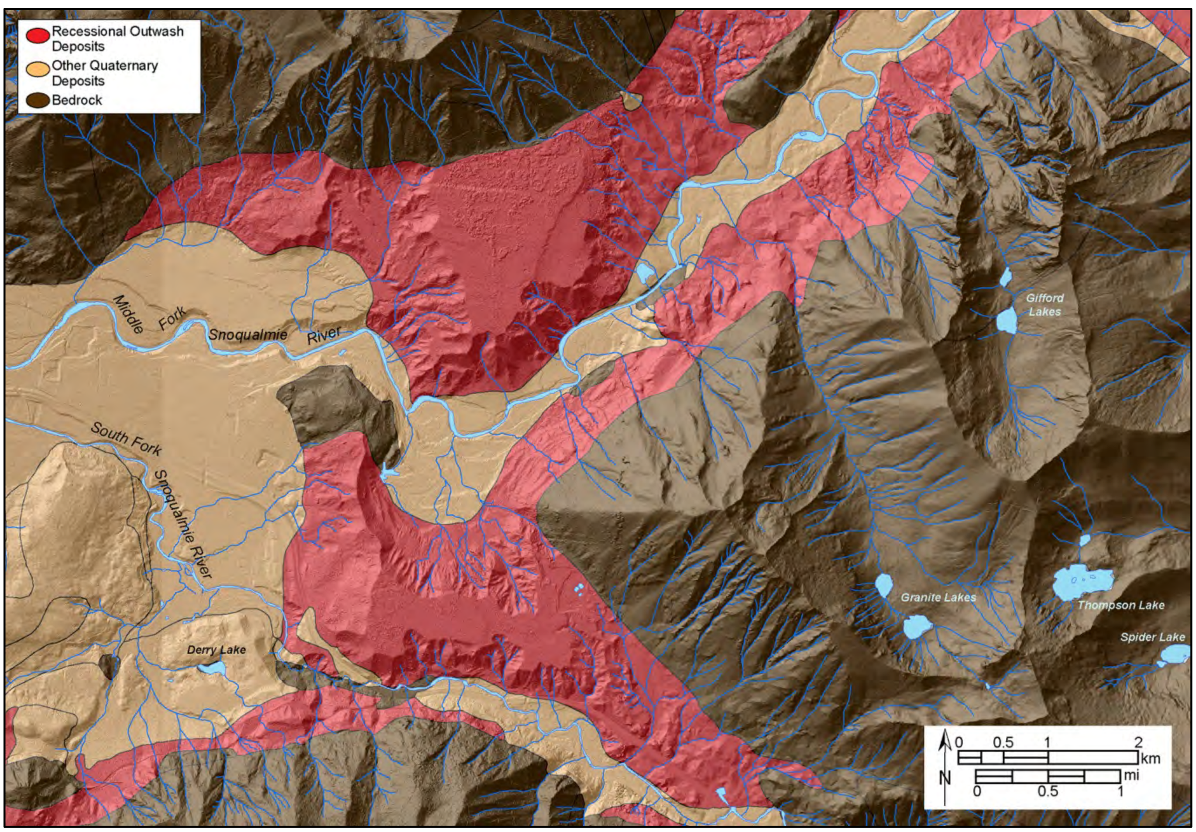


Figure 2-3. Upper margin of ice-marginal embankment, Snoqualmie River above Snoqualmie Falls.

Everson Interstade – Recessional Landsystems in the Puget Lowlands

As glaciers retreat from an area, the newly exposed glaciated terrain is subject to rapid change as fluvial, slope, and aeolian systems relax toward nonglacial equilibrium conditions (Begin and Schumm 1984; Bull 1991; Graf 1979; Phillips 2006; Schumm 1979, 1981). This period of rapid readjustment from glacial to nonglacial conditions is triggered by the instability of the unconsolidated glaciogenic sediments which are particularly easily eroded by fluvial processes. Sediment yields and rates of sediment delivery from slopes into fluvial systems are highest immediately following deglaciation, and then decline as sediment supply declines and slope profiles approach more stable profiles (Baker 1983; Benn and Evans 1998; Church and Ryder 1972; Clague 1986; Matthews 1992; Ritter and Ten Brink 1986). The operation of geomorphic processes during the period from deglaciation until the establishment of equilibrium conditions is called paraglacial, referring to "nonglacial processes that are directly conditioned by glaciations," or are characteristic of recently deglaciated environments (Ballantyne 2002; Church and Ryder 1972; Ryder 1971a, 1971b). During the paraglacial period many primary glacial landforms were eroded, reworked or entirely removed by fluvial processes. By definition the paraglacial period ends once sediment yield drops to rates typical of unglaciated terrains, although whether or not a landscape really fully adjusts following a glacial phase is difficult to determine since delayed slope responses can occur many thousands of years after deglaciation (Benn and Evans 1998). Because of the great difference in scale and effectiveness of geomorphic processes operating during deglaciation compared to those characteristic of the Holocene, this model distinguishes between paraglacial landforms created during the period of deglaciation, and the modern landscape which developed primarily under near-equilibrium Holocene geomorphic regimes (Table 2-1; Figure 2-4).

Since ice-sheet retreat creates time-transgressive surfaces, recessional landforms in varying degrees of preservation can be found throughout the lowland portion of the county, and are often preserved high on valley walls of the larger subglacially carved troughs. The most widespread expression of recessional

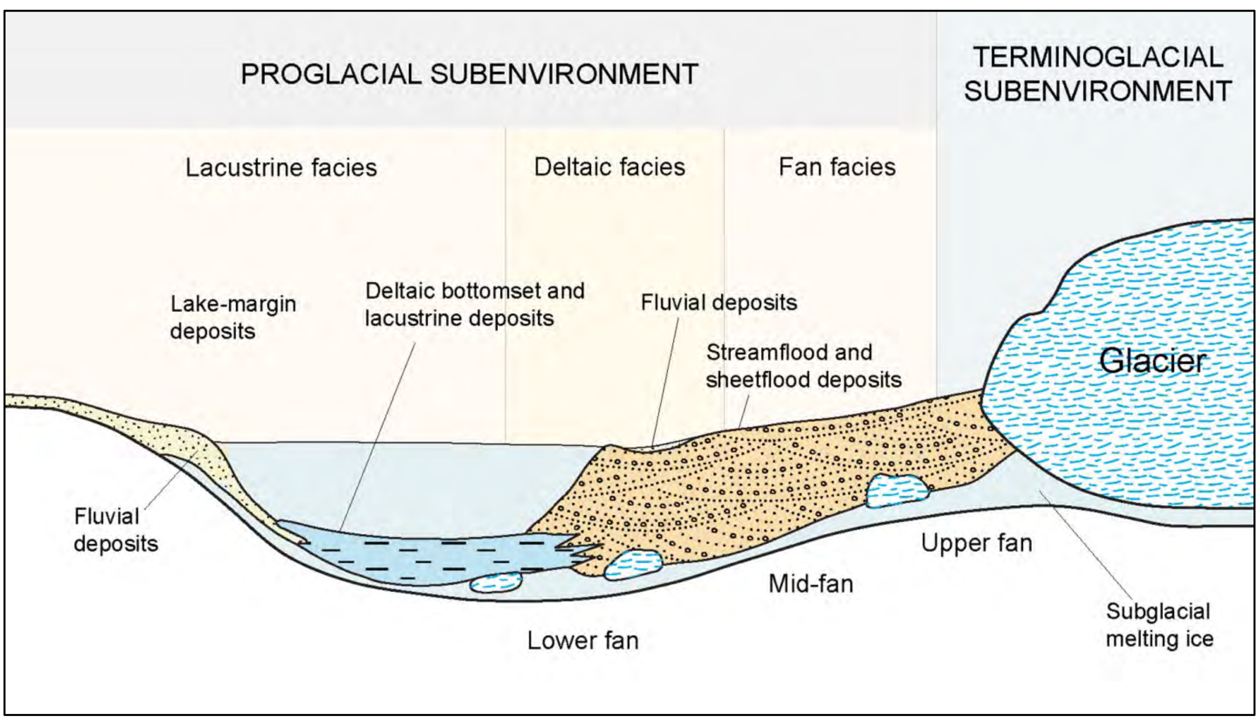


Figure 2-4. Depositional environments in terminoglacial and proglacial settings (Sinkunas et al. 2009).

landforms in terms of areal coverage, particularly the meltwater drainage system, is in the southern third of King County. Along with the drift upland surfaces that were little modified by ice-sheet retreat and subsequent Holocene geomorphic processes, these recessional landforms are archaeologically important because they would have been suitable surfaces for early human occupation. These Late Pleistocene-Holocene transitional landforms are primarily the result of deposition in either glaciolacustrine or glaciofluvial settings, as described below.

Glaciolacustrine Processes and Landforms

Lacustrine ice margins develop in a variety of situations: the glaciers may dam lakes, lakes may develop in front of a glacier due to the melting of stagnant ice beneath the proglacial surface, lakes may be dammed by moraines in front of a glacier or a glacier may simply drain into a rock basin. Meltwater introduced as an overflow or interflow tends to produce deltas and delta-like landforms consisting of three structural components: topsets, foresets, and bottom sets (Bennett and Glasser 1996). The bedload flow is rapidly deposited close to the point of entry as the velocity is checked by the standing lake water. Deposition of coarse bedload gives rise to the topsets of the delta. If sediment is deposited as underflow, then deltas tend not to develop and sediment is carried farther into the lake basin via turbidity currents (Bennett and Glasser 1996). In small lakes where significant underflow occurs a higher proportion of coarse sediment is carried farther out into the lake basin, resulting in a smaller delta dissected by channels that feed sediment lobes which broaden and merge toward the basin center. Ice-marginal lakes may form in front of glaciers or when ice dams water in a valley or against a hillside. At a stationary ice margin with high meltwater discharge an ice-contact delta may develop. Where sediment is delivered from a single or narrowly confined group of channels, delta fronts are arcuate in plan form. In contrast, where meltwater streams switch from one side of a valley to another, the outline of the delta front may be more straight (Bennett and Glasser 1996).

Deltas are also built if a glacier ends in a water body; however, such deltas migrate backward during receding ice and are covered by glaciofluvial deposits on top. Small deltas are easily formed in glacial environments because of overloaded streams during ice melting. Glaciolacustrine deltas are areas of rapid sedimentation where an incoming stream builds a large sediment body in a low-energy area of a lake, where due to lack of wave or tide energy, little lateral distribution of sediment takes place. The lakeward construction and migration of the delta takes place by overlapping lobes of sediment, also a feature of river deltas (Reineck and Singh 1980:198).

The predominant landform that results from the accumulation of lacustrine sediments and the subsequent draining of the lake, or complete filling of the lake basin by sediments, is the lake plain. Other landforms include shore features of glacial lakes that vary greatly depending on the size of the lake, the length of time the lake existed, the nature of the material forming the sides of the lake, and the supply of debris to the lake basin. Short-lived lakes may develop small depositional terraces that are destroyed within a very short period of time. Large lakes may develop major beaches with storm ridges and both wave-cut platforms and cliff lines. It is possible for a sequence of sediment accumulation to begin in a lacustrine environment accompanied by deltas constructed up to water level and then for sandurs (glacial meltwater outwash plains) to develop on top of these deltaic deposits (Church and Gilbert 1975:86, Figure 54; Price 1973:176–177). Because the glacial system produces large debris loads accompanied by high discharge, basins tend to receive large amounts of sediment, particularly during periods of deglaciation (Figure 2-5). Under these conditions, the development of deltaic accumulations is a common occurrence (Price 1973:132). Glacial lake deposits grade into extensive deltaic deposits laterally along the margins of these basins (Reineck and Singh 1980).

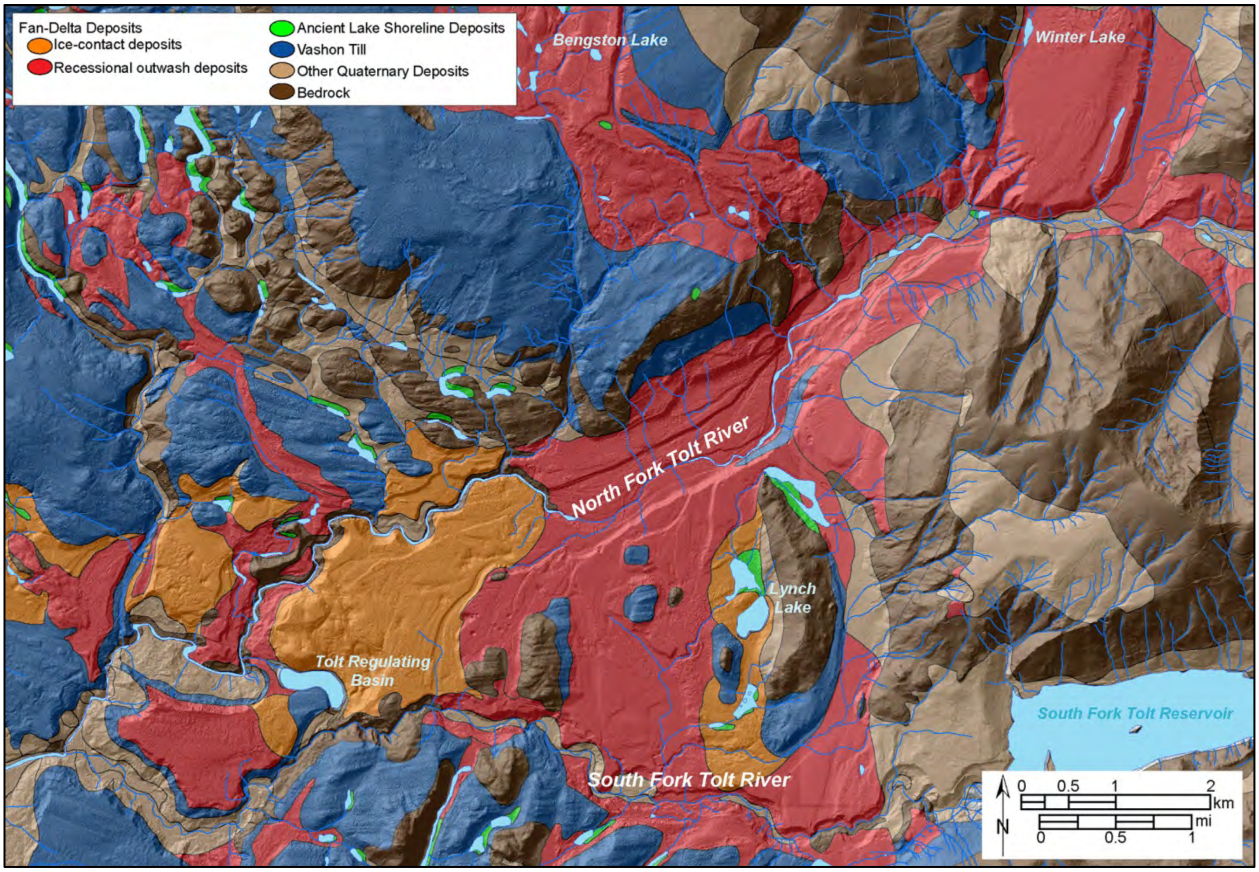


Figure 2-5. Upper Tolt River basin showing series of graded fan-deltas stair-stepping down in elevation as recessional glacial lakes lowered during deglaciation.

Some small deltas are formed when a meltwater stream meets a small glacial lake. Such deposits are fluvio-lacustrine in origin, not occurring in contact of ice, but most often in outwash plains. These meltwater streams are extremely shallow, rarely more than a few decimeters in depth, and carry abundant bedload and suspended load. If the delta is large, the transition between the fluvial and the lacustrine environments is rather gradual. Sedimentary structures in distal outwash deposits, in glaciolacustrine deltas, and lake sediments proximal to deltas are similar where the grain size is similar and deposition occurs under similar flow conditions (Reineck and Singh 1980).

Glaciofluvial Processes and Landforms

The retreat of ice is accompanied by the release of meltwater, so at the same time that direct glacial deposition is taking place, the meltwater is eroding the glacial deposits (Figure 2-6). Glaciofluvial erosion and deposition take place both within and beneath the ice in the peripheral zone of a retreating active ice sheet. Wherever meltwater streams impinge on the sub-ice surface, channels can be cut either in the drift deposits or in solid rock. Meltwaters crossing a proglacial area covered by a till sheet, fluted ground moraine, or moraine ridges will develop a drainage network that can either erode the glacial deposits, partially erode them, erode and bury them, or simply bury them. The evolution of the marginal and proglacial drainage system is largely controlled by the detailed form of the recently exposed land surface.

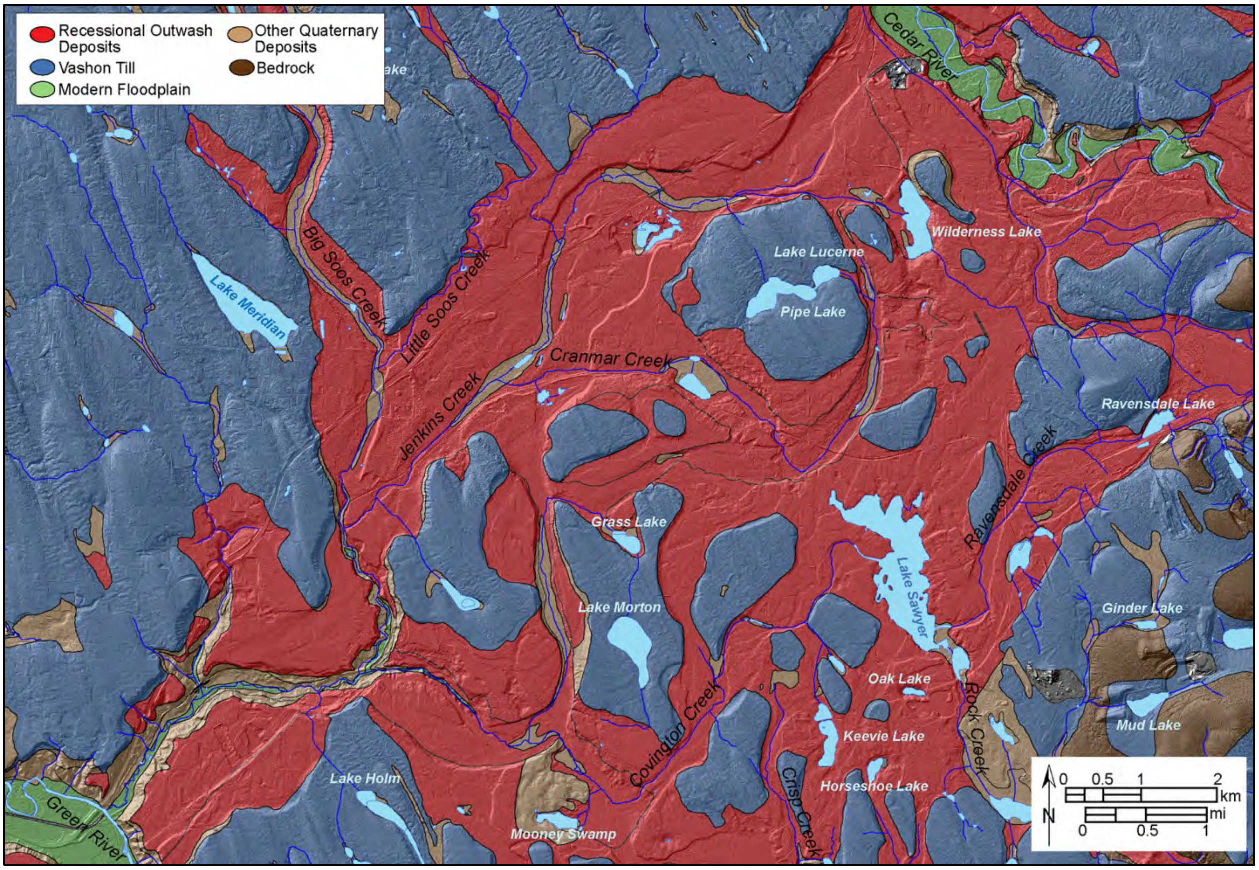


Figure 2-6. Recessional meltwater drainage system in southern King County.

A common geomorphic feature associated with glaciers is the fan-delta complex. The conditions contributing to the formation of fan-deltas include high-relief terrain adjacent to the shoreline and high-gradient bedload streams flowing into a subaqueous basin. Fan-deltas are unique environments characterized by active, frequently high-energy, sedimentation and they straddle the important transition from subaerial to subaqueous processes and resultant faces (Wescott and Ethridge 1990). For our purposes, fan-deltas are defined as tributary alluvial fans that prograde standing bodies of water and thus have a subaerial component (fan) and a subaqueous component (delta).

Delta topset beds consist of fluvial sediments and are essentially an extension of tributary valley train deposits. The channels of the streams depositing the topset beds can range from meandering to braided configurations. The key aspect of glaciolacustrine delta formation is the rapidity with which they are formed; rates of formation have measured in tens of years or, at most, hundreds of years (Gustavson et al. 1975; Wescott and Ethridge 1990). The amount of meltwater discharged into glacial lakes varies cyclically as a function of annual and seasonal changes in climate, short-term changes in weather, and diurnal changes in discharge of meltwater. A notable feature of glaciolacustrine deltas is they are large bodes of sediment built out into very low-energy environments characterized by lack of tides or effective waves, and lacking wind-generated currents which are able to effectively redistribute the deltaic sediment. In the upper portions of outwash fans, typically when stream gradients are greater than 0.005, sheet and longitudinal bars are common, and composed of poorly sorted, well-imbricated, flat-bedded gravel. When streams gradients drop to less than 0.002, large-scale festoon bedding (a form of cross-bedding) and large-scale planar cross-beds are common bedding structures. Overbank deposits form sequences of levees along the stream channel the length of the outwash fan.

Everson Interstade – Cascade Range

During alpine glacier retreat, newly exposed glaciated mountain valley walls experience rapid gully formation and high incision rates soon after deglaciation. Sediment flux quickly attenuates, however, as ravines and gullies become progressively wider until sidewall slopes decline to the point where interfluves between gullies are removed or the gully wall slopes attain stability (Benn and Evans 1998). Typically, the final stabilized form of these valley walls consists of an upper bedrock-floored source area, a midslope area of broad gullies with sidewalls resting at stable, moderate gradients, and a lower slope zone of coalescing debris cones and fans; this landform assemblage is common in many valleys glaciated during the latest Pleistocene glacial maximum, and, in the case of modern glaciers, the process can often reach equilibrium in a few decades to a few centuries after deglaciation (Ballantyne 2002; but see also Orwin and Smart 2004). In addition to landforms resulting from rapid mass movement of sediment off the valley walls, lacustrine and fluvial sediment accumulation during glacier retreat may be preserved in places on the valley floor.

Sediments of in situ glacial origin can be difficult to distinguish from those reworked by hillslope debris flows because of multiple glacier advances and retreats. Older sediment can be recycled by later glaciations, so that the alpine glacial depositional landsystem may have a long and complex history, involving both glacial and paraglacial episodes.

Isostasy and Sea-Level Change

Changes in sea level during the transition from full glacial to Holocene conditions were the result of several factors: global (eustatic) sea-level rise following the end of glaciation, local uplift of land following ice retreat (isostatic rebound), and tectonic movement on local faults that raised or lowered the land relative to global sea level (Figure 2-7).

Global sea level during the glacial maximum and in the immediate postglacial period was almost 125 m (about 390 feet) lower than today (Dragovich et al. 1994). Isostatic rebound, or uplift of land after the weight of the glacial ice was removed, caused land surfaces to rise rapidly by 60 to 80 m (197 to 262 feet) relative to global sea level (Dethier et al. 1995; James et al. 2000; Thorson 1989). Land surfaces uplifted by isostatic rebound rose more rapidly than global sea level from approximately 15,000 to 9,000 years ago and early Holocene shorelines are now found some distance inland from contemporary shorelines and at elevations up to 100 m (328 feet) above present sea level.

Although isostatic rebound substantially eased by approximately 10,000 to 9,000 years ago, global sea level continued to rise. Sea-level rise was most rapid through the early Holocene to about 5,600 years ago when the rate began to slow considerably. Sea level has been within 10 m (32 feet) of the contemporary surface elevation of Puget Sound throughout the past 5,000 years, and, in general, rose much more slowly to the present level after about 5,600 years ago (Anundsen et al. 1994; Beale 1990; Dragovich et al. 1994; Eronen et al. 1987; Mosher and Hewitt 2004; Troost and Stein 1995).

Holocene (10,000–200 years ago)

By definition, the early Holocene period represents the end of the transition from the rapid influx of massive amounts of sediment characteristic of the transitional and paraglacial periods to conditions representing more stable responses that tend to dominate Holocene geomorphology. In general, river

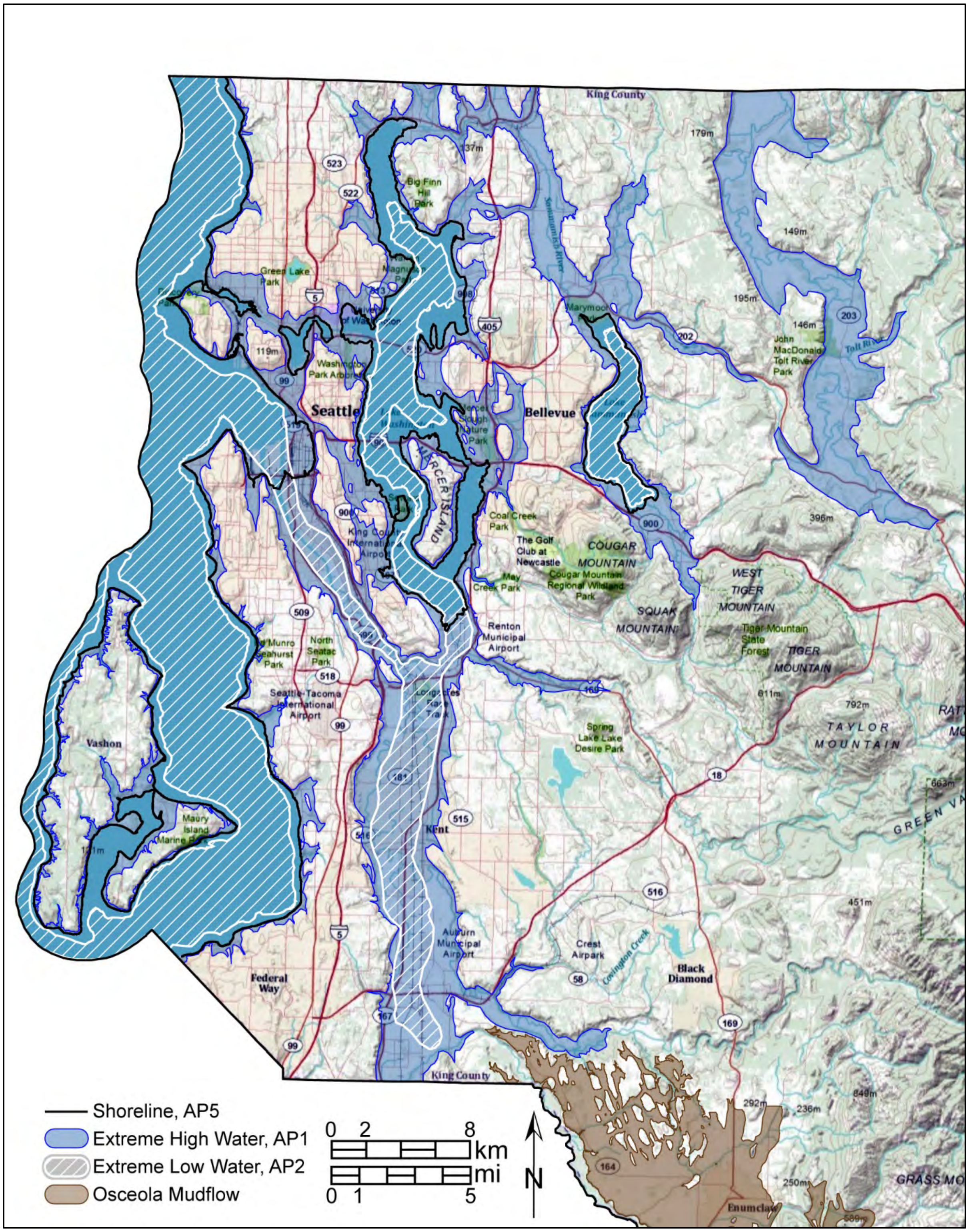


Figure 2-7. Projected post-glacial shorelines.

discharge was greatly reduced and slope profiles tended to approach equilibrium after sloughing off the mantle of loose glacial deposits. The geologic processes that have occurred over the past 10,000 years resulted in redeposition of massive amounts of sediment and burial of portions of older Pleistocene-aged surfaces, making this period critical in estimating the potential distribution of deeply buried archaeological sites across King County.

Fluvial Processes

In glaciated areas worldwide, the fluvial record pertaining to the glacial-postglacial transition between 18,000 and 6,000 years ago is complex and fragmentary (Schumm and Brakenridge 1987). In the Pacific Northwest, time, topography, geology, climate, vegetation, and land use have all contributed to considerable spatial and temporal variability in fluvial processes and outcomes in the operation of these processes (Montgomery et al. 2003). In King County, low-order streams in the headwaters region of the Cascade Range typically do not transport significant amounts of sediment, and tend to be places of accumulation dominated by colluvial sediment and woody debris. Debris flows off the basin slopes are one of the most common forms of mass wasting, and provide the principle mechanism by which sediment and woody debris are transported in first- and second-order channels (Naiman et al. 1992).

On the other hand, lower elevation reaches of rivers in the Puget Lowland portion of the county can be generally divided into two structural types. Rivers like the Snoqualmie River east of Seattle and the Duwamish River–Green River system south of Seattle occupy glacial troughs carved by subglacial incision when the Puget Lobe was at its maximum extent. Other fluvial systems, like Big Soos Creek, have incised into the drift uplands (Montgomery et al. 2003). Fluvial systems occupying former glacial troughs are generally underfit with respect to their valleys, tend to have broad level flood plains characterized by extensive wetlands and shallow lakes, and the channel belts tend to be elevated above the surrounding floodplain (Figure 2-8). In contrast, fluvial systems that developed during the Holocene and drain the drift uplands tend to have much narrower valley floors confined to steep-walled ravines.

Slope Processes

With the transition into the Holocene, sediment production from glacial landforms and glacially affected regions was greatly attenuated and sediment movement off slopes into valley bottoms achieved near-equilibrium conditions. Slope processes dominant during the Holocene, besides general slope degradation associated with soil creep and chemical solution, are landslides, mass wasting, and lahars. Many landslides in Seattle and other urban areas are due to disturbance associated with land use practices, and in rural areas of the county are often associated with deforestation or highway construction. In other cases, landsliding is due to lithology as a result of glacial advance and retreat (Figure 2-9).

Landslides and mass wasting are common along the marine littoral of Puget Sound, particularly along bluffs where Lawton Clay underlies sandy or gravelly outwash sediments. The Lawton Clay was deposited in proglacial lakes south of the advancing margin of the Puget Lobe of the Cordilleran Ice Sheet and was overridden when the glacial ice advanced over the clay and silt deposits during the southward advance. As a result, groundwater percolates through the overlying recessional outwash and perches at the top of the Lawton Clay. Due to the weight of the perched water and ongoing erosion at the base of the bluffs by waves, sections of the bluffs periodically give way. The process is particularly active in West Seattle south of Elliott Bay and along Magnolia Bluff north of Elliott Bay.

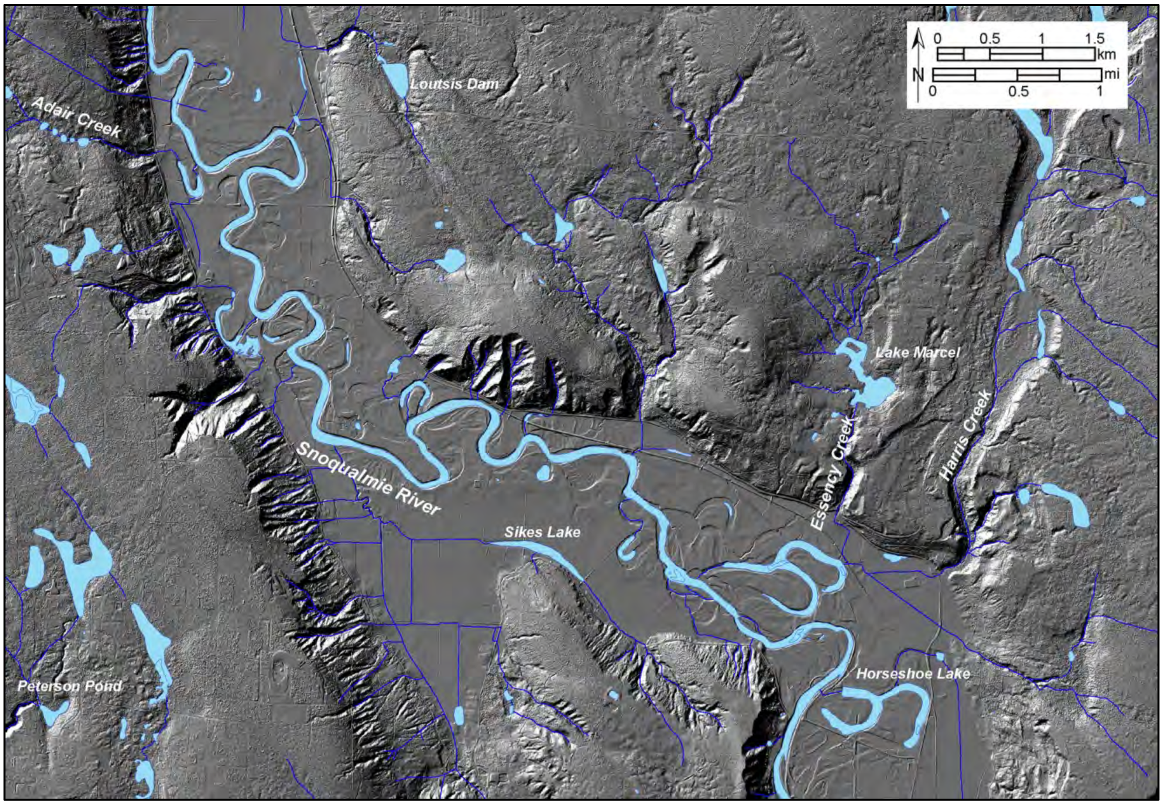


Figure 2-8. Snoqualmie River meander belt in glacially-carved trough below junction with Tolt River.

In addition to ongoing low-level slope transport and landslides, other mass wasting features include debris avalanches (lahars) originating on the slopes of Mount Rainier and the Cascade Range, and smaller events such as rock avalanches in the Cascade Range. Lahar is an Indonesian term for mudflows and debris flows originating from the slopes of a volcano. Lahars can surge tens or even hundreds of miles downstream from a volcano, and are commonly initiated by large landslides of water-saturated debris, heavy rainfall eroding volcanic deposits, sudden melting of snow and ice near a volcanic vent, or by outbursts of water from glaciers, crater lakes, or from lakes dammed by volcanic eruptions (Scott et al. 2001). The debris flows are initiated when loose masses of unconsolidated wet debris become unstable. The water may be supplied by rainfall or by melting of snow or ice, and sometimes flows are caused by lava or pyroclastic flows erupting beneath or onto snow and ice (Miller 1989).

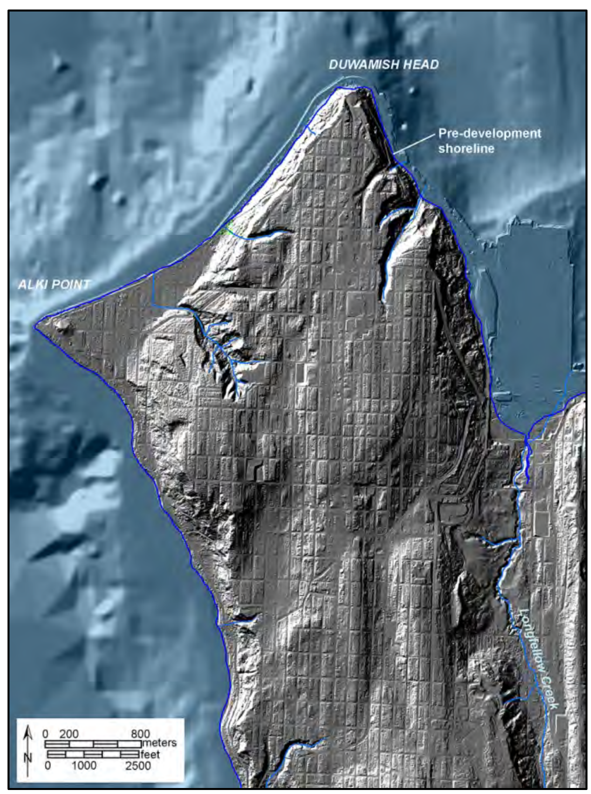


Figure 2-9. Typical pattern of Holocene erosion at Duwamish Head in West Seattle.

The largest lahar originating from Mount Rainier in the last 10,000 years is known as the Osceola Mudflow (Figure 2-10). This lahar occurred about 5,600 years ago and was at least 10 times larger than any other known lahar from Mount Rainier (Dragovich et al. 1994; Mullineaux 1970; Pringle and Scott 2001; Vallance and Scott 1997). Osceola Mudflow deposits cover an area of about 550 square kilometers (approximately 136,000 acres) in the Puget Sound Lowland, extending at least as far as the Seattle suburb of Kent and to Commencement Bay, now the site of the Port of Tacoma.

The mudflow deposits range in thickness from under a meter (a few feet) to over 30 m (100 feet) depending on the underlying topography, and buried the glacial outwash under what is now the Enumclaw Plateau. The mudflow extended across the plateau and filled topographic lows to create an extensive, poorly drained, level ground surface resulting in the subdued topography of the modern landscape. The mudflow also extended north to the bluffs that demarcated the north end of the Enumclaw Plateau, flowed over and down the bluffs, and entered the marine water of the Duwamish Embayment, which at that time was an arm of Puget Sound that extended from what is now Elliott Bay in Seattle south to Commencement Bay in Tacoma.

The White River and Puyallup River eroded Osceola Mudflow deposits over the next 5,600 years and the resulting delta filled the Duwamish Embayment. The present-day floodplain of the Duwamish-Green River Valley is alluvium derived from the Osceola Mudflow and other lahars from Mount Rainier that traveled down the White River Valley. Following the mudflow the ancestral delta at the head of the

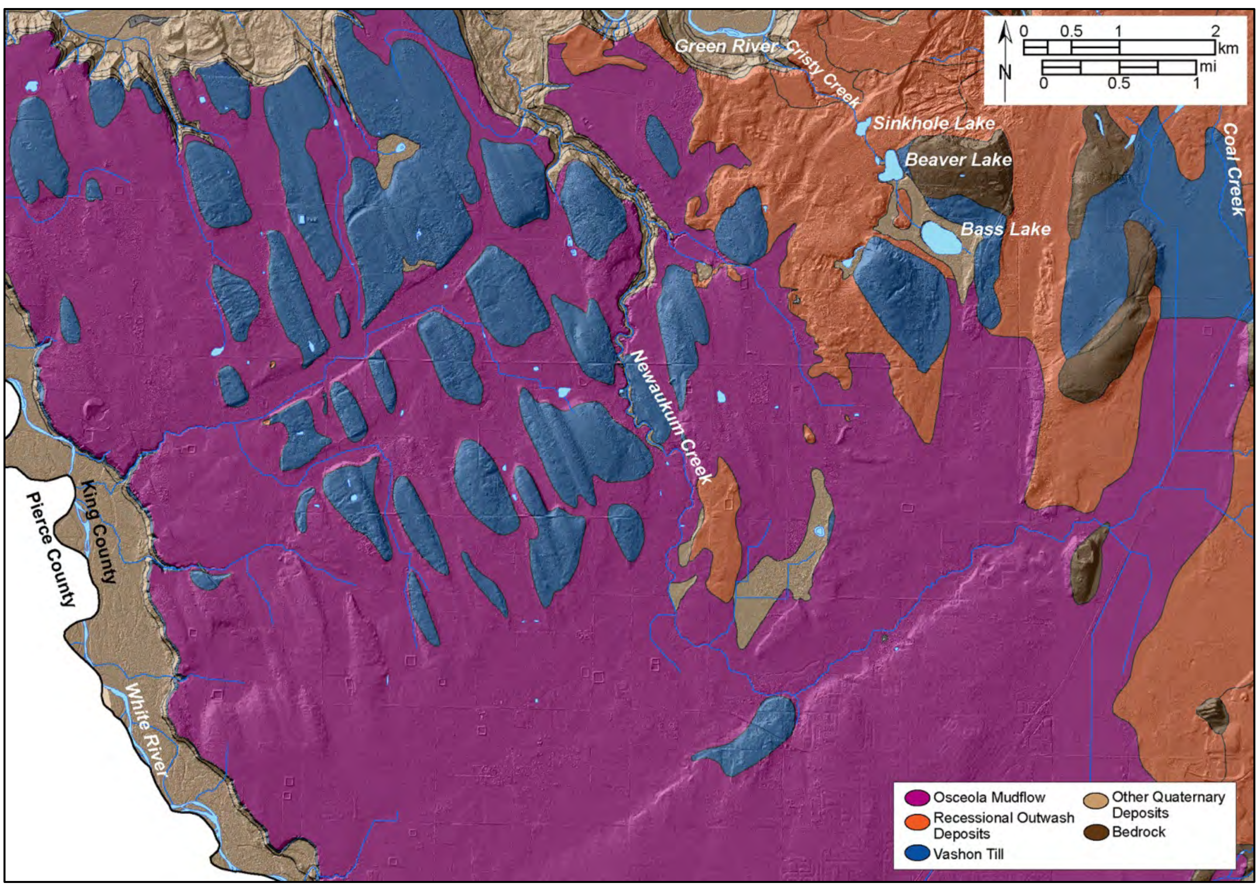


Figure 2-10. Northern margin of the Osceola Mudflow in southern King County.

embayment at the town of Auburn prograded northward at rates between 6 and 7 m (19.6 and 22.6 feet) per year (Dragovich et al. 1994).

At least six smaller debris avalanches have produced lahars in the past 5,600 years. One of these, the Electron Mudflow, was a slope failure on the west flank of Mount Rainier about 600 years ago, and was more than 30 m (100 feet) deep where it entered the Puget Sound Lowland at the community of Electron south of King County. Its deposits at the town of Orting are as much as 6 m (20 feet) thick and contain remnants of an old-growth forest (Pringle and Scott 2001; Pringle 2000). The National Lahar, occurring less than 2,200 years ago, inundated the Nisqually River Valley to depths of 10–40 m (30–130 feet) and flowed all the way to Puget Sound (Hoblitt et al. 1995).

Coastal Processes

With the reduction in the rate of global sea-level rise, waves have been much more effective at eroding the glacial deposits surrounding Puget Sound, resulting in the formation of steep bluffs along much of the Puget Sound shoreline (Downing 1983; Komar and Shih 1993; Shipman 1989, 2004). The contemporary bluffs and marine shorelines are now several hundred feet inland from the positions of the early Holocene marine shorelines due to the combination of wave erosion and rising sea level. During the early Holocene the shoreline probably was backed by gently sloping, rounded hills and ridges (Downing 1983). Sediments eroded from the bluffs are carried by longshore currents to form present-day shoreline features such as beaches, spits, barriers, and tidal lagoons. Many of these features, most notably spits and cuspate forelands that form by sediment transport along the shoreline, were ideal surfaces for human occupation and activity, and consequently are sensitive for mid- to late Holocene archaeological deposits.

Tectonics (Earthquakes)

The Puget Sound lowlands are crossed by several active fault zones. In King County a major fault, called the Seattle Fault Zone, extends from Bainbridge Island east through downtown Seattle and ends just east of the Sammamish River basin (Blakely et al. 2002; Liberty 2003; Liberty and Pratt 2008). At least one earthquake is well documented on the fault, but evidence for at least two Late Pleistocene to mid-Holocene events has been revealed in trenches excavated at Factoria and Vasa Park (Sherrod 2002). There may have been other Holocene seismic activity associated with ongoing tectonic deformation due to plate movement but these events are obscured by the thick Quaternary fill, and by deformation caused by isostatic rebound (Karlin and Abella 1992; Karlin et al. 2004). Past tectonic activity along the Seattle Fault and elsewhere plays an important role in local Native American mythology, attributed to the supernatural spirit power *a'yahos* (Ludwin et al. 2005).

Dramatic, localized changes to landforms occurred because of an earthquake on the Seattle Fault Zone around 1,100 years ago which affected shoreline, riverine, and lacustrine habitats (Bucknam et al. 1992). The earthquake generated tsunamis, and was accompanied by uplift south of the fault and subsidence to the north (Bucknam 1998; Logan and Walsh 1995; Troost and Stein 1995). Short-term effects included shifts in stream gradients, liquefaction, tsunamis that eroded bluffs and buried marine shorelines, seiches or lake tidal waves that eroded lakeshores, and mass wasting (Bucknam 1998; Karlin and Abella 1992; Karlin et al. 2004; Logan and Walsh 1995; Thorson 1998). The seiche in Lake Washington and Lake Sammamish caused large blocks of earth to slip from bluffs along the lake shorelines, carrying trees and other vegetation as intact masses of earth and forest into the lake basin. The large landslides probably caused additional lake seiches that further eroded shorelines. Other effects from the earthquake include stratigraphic "sand volcanoes" interpreted as liquefaction features in excavation walls at the Marymoor archaeological site (45KI9) directly north of the Lake Sammamish outlet, the burial of the former Sammamish River floodplain under up to a meter (3 feet) of diatomaceous slackwater deposits, and the formation of extensive marshes and oxbows on the Sammamish River floodplain, recorded during the early historic period, indicative of a lowered channel gradient (Collins 2001; Hodges 2004; Lewarch, Madson, et al. 2000).

In Elliott Bay the north end of West Seattle and the mouth of the Duwamish River were uplifted as much as 6 m (20 feet), while land subsided between three and six feet north of what is now the Interstate 90 corridor (Bucknam et al. 1992; Kelsey and Sherrod 2004; Troost and Stein 1995). The lower reach of the Duwamish River was raised, and river water may have been temporarily impounded until the river cut new distributary channels through the uplifted deltaic sediments. A tidal wave as high as 6 m (20 feet) passed along the shoreline of Elliott Bay, and numerous smaller tidal waves reverberated across the bay after the main tsunami (Atwater and Moore 1992). Thin, well-sorted layers of coarse sediments interdigitated between other sedimentary bodies in stratigraphic exposures near the marine shoreline are often cited as evidence of tsunamis (e.g., Atwater and Moore 1992; Troost and Stein 1995).

Soils

Broad-scale patterns in the distribution of soil map units in King County offer insight into the influence of glacial landforms and geomorphic processes on the Holocene development of soil patterning in the county. The following discussion focuses on the distribution of soil series classified at the order and suborder levels of the U.S. Soil Taxonomy (Soil Survey Staff 1993, 1999).

From a geologic perspective, a soil is a near-surface weathering phenomenon. Most soils share the following characteristics: they form in sediment or rock, they form over time, and their formation operates most intensively in stable landscapes (Holliday et al. 1993:30). Soils do not exist in isolation, but are organized within the landscape, and often exhibit patterning in which a group of soils, possibly far apart taxonomically, are in fact related by conditions of topography and repeated in the same relationship wherever the same conditions are met. The relationship between soils and landforms is also influenced by erosion and deposition; under these conditions the key factors influencing soil formation and patterning are relief, drainage, and time (Gennadiyev and Bockheim 2006).

When examined in detail at high resolution, the soil mantle forms a “soil landscape fabric” (Fridland 1974) composed of disks, spots, stripes, and networks of soil entities, the dynamics of which may be understood in the context of the local ecosystem (Hole 1978; Jenny 1980). This soil fabric or pattern is influenced by three primary factors (Buol et al. 1997; Hole and Campbell 1985; Jenny 1980):

- Relief: Relief is an initial site condition affecting the development of soil bodies through elevation differences, degree of slope, drainage, aspect, and slope configuration.
- Landscape position: Soils seem more sensitive to landscape position than specifically to the geologic substrate. A soil may occupy a characteristic landscape position in one region, but may shift to a different landscape position in another.
- Landforms: This is the framework of the soil cover, and consequently soils may be expressed as concentric, linear, or triangular (e.g. alluvial fans) forms which can be examined at multiple scales.

Excluding the Seattle urban area and the Alpine Lakes Wilderness in the North Cascades, 125 soil series, representing seven of the 12 soil orders in the U.S. Soil Taxonomy, have been mapped in King County

(Appendix B, Table B-1). Dominating the taxonomic classes are soil series belonging to the Spodosols (n = 39 series), Andisols (n = 23 series), Inceptisols (n = 26 series), and Entisols (n = 20 series). Spodosols are forest soils with subsurface accumulations of iron and aluminum that have been bound to humic material translocated from the surface. These soils often occur under coniferous forest in cool, moist climates. Andisols are soils formed in volcanic ash, other volcanic ejecta such as scoria, or volcanic rocks. Both Spodosols and Andisols are widespread throughout the temperate zones of west-facing mountain slopes in the Pacific Northwest, and support some of the most productive forest land in the continental United States. In King County, soils associated with these two orders are found predominantly on the west-facing slopes of the Cascade Range in the eastern portion of the county (Figures 2-11 and 2-12).

Inceptisols occur in a variety of ecological settings but are most often found on fairly steep slopes, young geomorphic surfaces, and on resistant parent materials. Entisols are soils of recent origin developed in unconsolidated parent material. Typically, these soils do not contain diagnostic genetic horizons except for the development of a surficial A horizon. Since Entisols include all soils that do not fit into one of the 11 other soil orders, they are characterized by great diversity in environmental setting. In King County, soils belonging to these orders are predominantly found in the Puget Lowland. The glacial drift uplands are dominated by soils belonging to Inceptisols, while Entisols predominate in the flood plains of the lowland rivers (see Figure 2-11).

The remaining 17 soil series belong to Histosols, Alfisols, or Mollisols. Alfisols are found under forest soils and typically contain a subsurface horizon of clay accumulation under a slightly leached upper profile. Mollisols have thick, dark A horizons and are most often associated with grasslands and steppe environments. Soils belonging to this order are most common under prairies in southern King County which have formed in sandy outwash. Histosols are accumulations of plant matter, often referred to as peat or muck, and are found in a variety of environmental settings in King County, including kettles, behind shoreline barriers along Puget Sound, in meander cut-offs and distal portions of riverine flood plains, and along lake shores.

Including the soil series belonging to the Histosols (n = 8), 16 soil series can be classified as wetland soils at the suborder level (denoted by the “aqu” prefix), that is, these are soils saturated long enough during the year to experience reducing conditions (Appendix B, Table B-2). Geographically, most of these wet soils are found in the lowland region of King County, with only one soil series, the Klaber series, found in the forested upland portion of the county.

King County Watershed Summaries

King County has seven major watersheds, described in this section in terms of each basin’s physical configuration and evolution. Beginning on the western edge of the county, from north to south, the major watersheds include Central Puget Sound, Cedar River–Lake Washington, Sammamish River, Snoqualmie River, Skykomish River, Duwamish River–Green River, and the White River. The river basins and divides served as travel corridors, and allowed ready access to resources at higher elevations for people moving from the marine littoral zones and lower reaches of river systems to the foothills and upper regions of the Cascade Range.

Central Puget Sound Basin

The Central Puget Sound watershed is the westernmost drainage system in the county, and encompasses the western marine shoreline of King County and all of Vashon and Maury Islands. Streams in this watershed drain directly into Puget Sound, often via steep, narrow ravines and gullies incised into the steep bluffs fronting the sound. Most landforms are undulating to level glacial drift plains composed

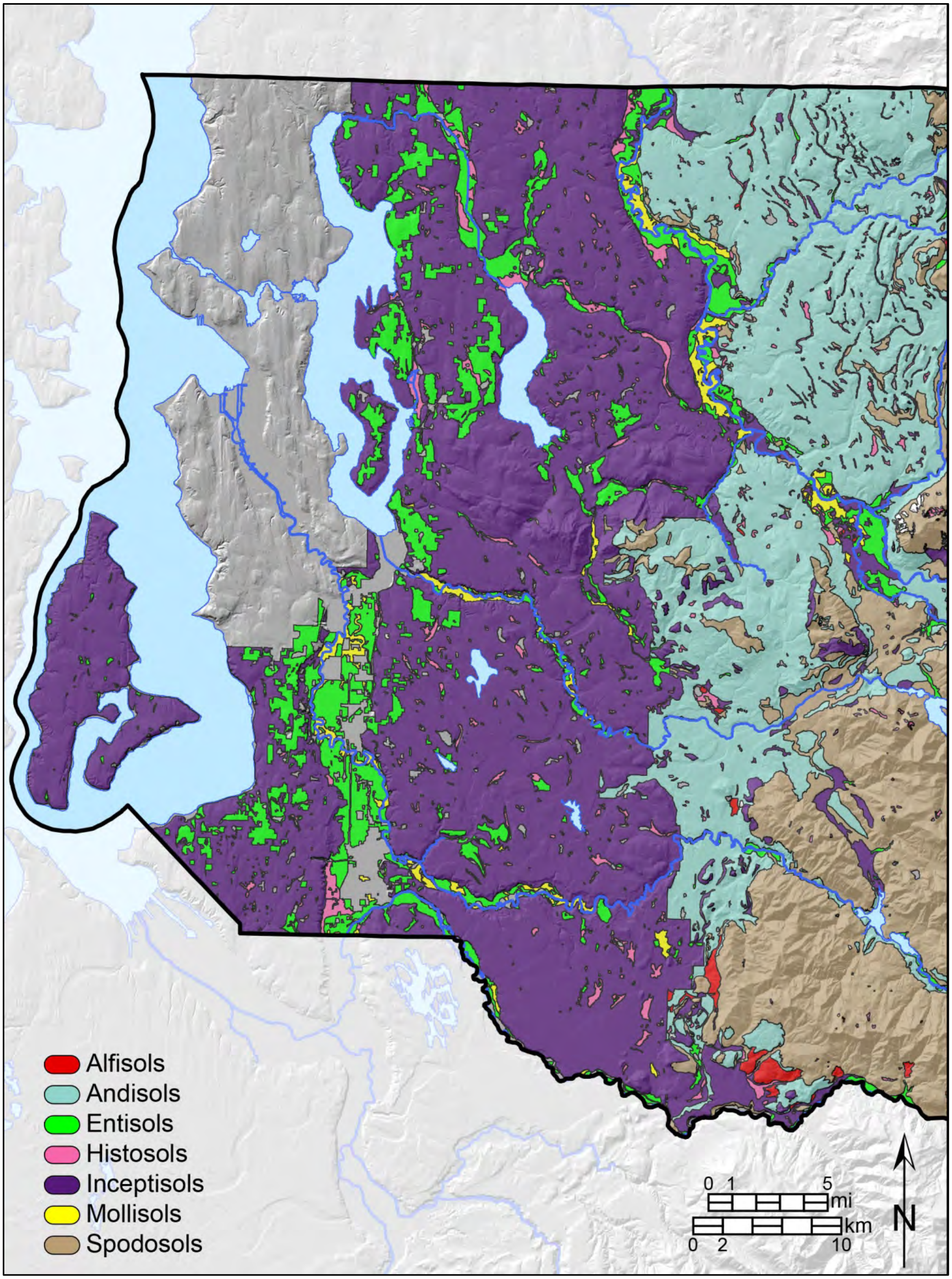


Figure 2-11. Distribution of soil orders in the Puget Lowland in western King County.

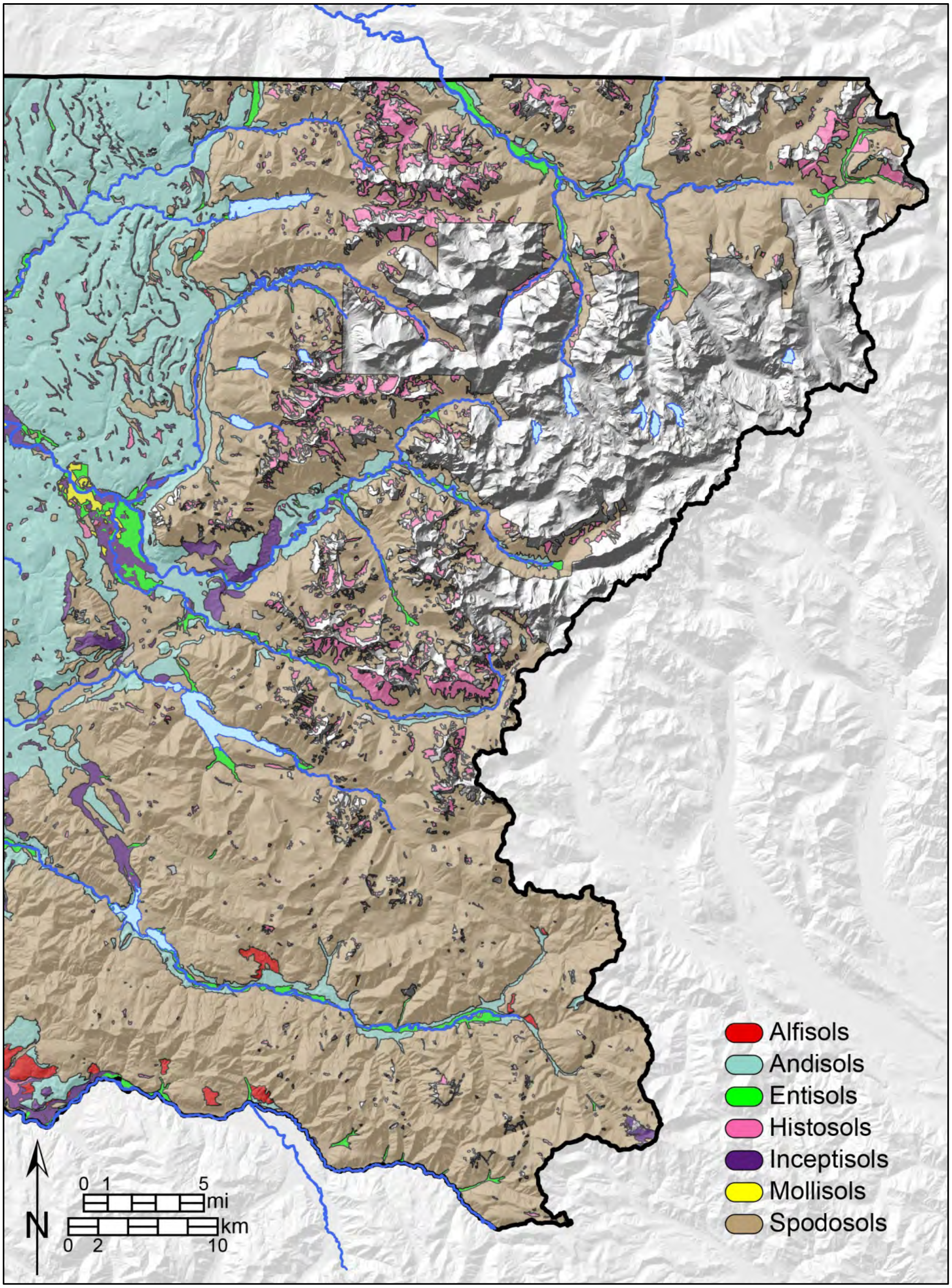


Figure 2-12. Distribution of soil orders in the mountainous regions of eastern King County.

of glacial outwash deposits, which have kettle lakes, swamps, and peat bogs in depressions on the surface of the glacial deposits. The elevation of the drift uplands ranges up to 150 m (500 feet) above sea level. Bluffs 30 to 60 m (100 to 200 feet) high above the marine shoreline occur from West Seattle south to Federal Way.

Vashon Island and Maury Island are separated from the King County mainland and the Kitsap Peninsula by Puget Sound. Although the pattern of ice retreat is different from that of the west side of the Puget Lowland, in general, Vashon and Maury Islands have many topographic and drainage characteristics similar to the drift uplands farther west (Haugerud 2009). Steep bluffs rise along much of the shoreline of Vashon Island. Quartermaster Harbor is a sheltered embayment on the south end of Maury Island, but most of the contemporary marine shoreline of King County is exposed to winds and seasonally intensive wave action.

Cedar River–Lake Washington Basin

The northern and central portions of King County include the watersheds of the Cedar River-Lake Washington, Sammamish River, Snoqualmie River, and Skykomish River. The Cedar River-Lake Washington watershed extends from the northwest corner of King County, and trends southeast and east to the crest of the Cascade Range. Recessional meltwater channels from the retreating Puget Lobe of the Cordilleran Ice Sheet are now occupied by the Cedar River and smaller drainages, such as Soos Creek.

Lake Washington is a former marine embayment that was connected to Puget Sound during the immediate postglacial period. After the Puget Lobe of the Cordilleran Ice Sheet retreated north and the Duwamish and Lake Washington embayments were flooded by the marine water of Puget Sound, the Cedar River eroded glacial sediments in the ancestral Cedar River Valley and formed a delta at the river mouth, south of the contemporary south end of Lake Washington. The delta expanded through time and blocked the south end of the Lake Washington embayment. The surface elevation of Lake Washington has fluctuated throughout the past 14,000 years due to seismic activity and shifts in the locations of channels of the Cedar River and the Duwamish River–Green River (Thorson 1996, 1998). Old shorelines dating prior to 5,000 years ago are inundated, and at the north end of Lake Washington they are approximately 30 m (100 feet) below the contemporary surface elevation of the lake (Thorson 1998).

During the early historic period, the Cedar River did not flow directly into Lake Washington, but joined the Black River approximately 1.5 km (1 mile) south of the lake. The Black River was the outlet for Lake Washington during the early historic period, and flowed 5.3 km (3.3 miles) west to a confluence with the Green/White River (Chrzastowski 1981:3). However, the Cedar River probably flowed into Lake Washington at various times prior to the historic period. Geologists indicate the channel moved across the deltaic floodplain at the north end of the Cedar River Valley through avulsion or major shifts in the location (Chrzastowski 1981:4; Thorson 1996). During floods documented in the early historic period, the Cedar River branched into multiple, low topographic channels on the Black River–Cedar River floodplain south of Lake Washington. Many of the flood stage channels probably were former distributary channels of the delta that had been abandoned (Chrzastowski 1981:4).

In 1916, the lower reach of the Cedar River was permanently diverted into the south end of Lake Washington, from the historic period confluence with the Black River. At the same time, the surface elevation of Lake Washington was lowered by 2.7 m (9 feet) as part of the construction of the Lake Washington Ship Canal and Hiram S. Chittenden Locks in Salmon Bay. The outfall of Lake Washington shifted from the Black River, at the south end of the lake, to the Montlake Cut on the west side of the central portion of the lake. The combination of the lowered surface elevation of Lake Washington and the diversion of the Cedar River from the former confluence with the Black River removed the main sources of the Black River, and reduced the flow of the former river to a small brook (Chrzastowski 1981; Mullineaux 1970:8). The Duwamish River–Green River channel north of the former confluence of the White River–Green River and the Black River continued to be called the Duwamish River, even though the channel actually became the lowermost reach of the Green River (Mullineaux 1970:8).

The headwaters of the Cedar River are at the crest of the Cascade Range. The North Fork of the Cedar River begins near Yakima Pass at an elevation of 1,100 m (3,600 feet) above sea level. The South Fork of the Cedar River begins near Meadow Pass at a similar elevation. The upper reaches of the Cedar River drainage have steep gradients, and have down-cut westward through steep-sided glacial valleys to the former Cedar Lake, now Chester Morse Lake reservoir. Cedar Lake was a moraine-dammed lake formed during deglaciation when a spur of the continental glacier in the Snoqualmie River and Cedar River Valleys left behind a recessional moraine. The moraine impounded the flow of the Cedar River and Rex River to form Cedar Lake. Downstream from Chester Morse Lake, the Cedar River has incised through the bedrock and glacial deposits that comprise the foothills of the Cascade Range. Topography in the area varies from relatively level river terraces and glacial outwash terraces, to hills composed of glacial moraines and bedrock outcrops. The contemporary river channel exits the Cascade Range foothills near Landsburg, approximately 32 km (20 miles) upstream from Lake Washington, and the Cedar River drainage forms a natural travel corridor from Lake Washington to the crest of the Cascade Range. Much of the floodplain from the lowlands east to Chester Morse Lake is relatively level and at elevations below 300 m (1,000 feet). At an elevation of 470 m (1,540 feet), Chester Morse Lake provides a relatively level, low-elevation landform that penetrates into the heart of the central Cascade Range. Steep ridges and mountains rise from the shoreline of Chester Morse Lake to elevations greater than 1,220 m (4,000 feet). Relatively steep gradients of the upper reaches of the drainage extend 23 km (14 miles) upstream to the crest of the Cascade Range.

Sammamish River Basin

The Sammamish River watershed is east of the Cedar River–Lake Washington drainage system and includes Issaquah Creek, Lake Sammamish, Evans Creek, and the Sammamish River (Livingston 1971:Figure 9). The water bodies fill an embayment carved by the Puget Lobe of the Cordilleran Ice Sheet. The watershed encompasses portions of the Newcastle-Grand Ridge Hills and the Eastern Drift Plain between the Sammamish River Valley and Snoqualmie River Valley, from the Snohomish County line south to Interstate 90. The Newcastle–Grand Ridge Hills are composed of east-trending bedrock hills, including Cougar Mountain, Squak Mountain, and Tiger Mountain. Numerous small tributaries of the Sammamish River have relatively low gradients and wide floodplains. During the early historic period through the mid-twentieth century, the Sammamish River had numerous meanders and the floodplain was covered by marshes and oxbow lakes. The Sammamish River is the largest tributary of Lake Washington. Segments of the Sammamish River have been channelized as a means of flood control, most notably in the vicinity of Marymoor Park.

Snoqualmie River Basin

East of the Sammamish River watershed, the Snoqualmie River watershed encompasses the Eastern Drift Plain east of the Sammamish River Valley from the Snohomish County line south to Interstate 90, portions of the Cascade Range foothills east of the Snoqualmie River Valley, and the Cascade Range. The Snoqualmie River is part of the Snohomish River drainage system, and fills an ancestral channel of the

Snoqualmie River that was eroded and filled with glacial deposits during Pleistocene glacial events. The Snoqualmie River watershed includes much of the northeast portion of King County. Snoqualmie Falls divides the Snoqualmie Valley into an upper valley system and a lower valley system, the falls flowing over a bedrock face that delineates the farthest upstream advance of the bottom or keel of the Puget Lobe of the Cordilleran Ice Sheet. The upper valley, east of Snoqualmie Falls, is surrounded by abruptly rising ridges and mountains, and has three major tributaries: the North Fork, the Middle Fork, and the South Fork. The upper reaches of the Middle Fork and South Fork extend east to the crest of the Cascade Range. The South Fork provides a relatively low elevation crossing of the Cascade Range via Snoqualmie Pass, at an elevation of approximately 910 m (3,000 feet). The Middle Fork provides a more circuitous route to the crest, at an elevation of approximately 1600 m (5,200 feet).

Skykomish River Basin

The South Fork of the Skykomish River is a major tributary of the Snohomish River system. The Skykomish River watershed, northeast of the Snoqualmie River drainage, drains a small portion of the far northeast corner of King County. The watershed is composed of steep mountain slopes, narrow stream drainages, and undulating mountain tops and ridges with numerous alpine lakes. The level though narrow floodplain in the upper reaches of this stream provides a travel corridor to the crest of the Cascade Range from the lower reaches of the Snohomish River drainage. The Tye River extends east from the east end of the South Fork, at an elevation of 300 m (1,000 feet), and provides a narrow, relatively level floodplain and creek terrace complex to the crest of the Cascade Range at Stevens Pass at an elevation of 1,236 m (4,056 feet).

Duwamish River–Green River Basin

The Duwamish River–Green River drainage extends south and east from Elliott Bay from the south end of downtown Seattle to the town of Auburn, and then east to the crest of the Cascade Range. The contemporary middle and lower reaches of the Duwamish River–Green River Valley, south of Elliott Bay to Auburn, occupy an area that was an arm of Puget Sound until approximately 5800 cal BP. What was once a steep-walled fjord, called the Duwamish Embayment (Dragovich et al. 1994; Mullineaux 1970), was gradually filled with alluvium deposited by the White River, Green River, and Cedar River following the Osceola Mudflow approximately 5,600 years ago. In the early historic period, the delta of the Duwamish River had arrived at the south end of Elliott Bay, and had spread across a much wider area than the narrow river valley to the south. The delta of the Duwamish River in the early 1800s had a complex system of distributary channels (Collins and Sheikh 2005).

Natural and artificial changes in the locations of river channels in this watershed created some confusion in naming contemporary river systems. Prior to 1906, the White River and Green River had a confluence at Auburn, where both rivers exited from deeply incised valleys. The channel with the combined White River–Green River flow was called the White River in the valley bottom (which was thus the White River Valley) from Auburn north to the confluence with the Black River in Tukwila. The river channel from the confluence of the White River and the Black River north to Elliott Bay was called the Duwamish River (Chrzastowski 1981:4; Mullineaux 1970:7). A flood and subsequent logjam in 1906 changed the positions of the Stuck River and White River channels and stimulated the change of names for the river channels. The Stuck River was a small distributary channel of the White River, on the south side of the White River floodplain. The Stuck River turned south after exiting the incised White River Valley and flowed into the Puyallup River watershed. The main channel of the White River flowed north through Auburn to the confluence with the Green River. In 1906, a logjam in the Stuck River and White River floodplain, south of Auburn, diverted the flow of the White River south into the Puyallup River drainage system. During the 1906 logjam, the White River was impounded and captured the channel of the former Stuck River, and the combined flow and sediment load entered the Puyallup River system. Subsequent modifications of the floodplain permanently diverted the White River channel. The Green River continued to occupy the channel that formerly carried the combined flow of the White River and the Green River north to Elliott Bay. Following the convention observed prior to 1906, the river channel north of the confluence of the Green River (formerly the White River) and the Black River, in Tukwila, was called the Duwamish River.

The lowland reaches of the watershed include parts of the Seattle Drift Plain, the West Seattle Drift Plain, the Des Moines Drift Plain, the Covington Drift Plain, and the Enumclaw Plateau. Bluffs 30 to 90 m (100 to 300 feet) high demarcate the sidewalls of the Duwamish River–Green River Valley north of Auburn.

The middle reach of the Green River enters the broad Duwamish River–Green River Valley east of Auburn, and was formed by the ancestral channel of the Green River when the river eroded into glacial outwash deposits. What is now the middle reach of the Green River was the lower reach of the river before 1906. The east end of the middle reach of the Green River was down-cut into a very narrow, steep-sided valley, called the Green River Gorge.

The upper reach of the Green River extends from the west edge of the Cascade Range foothills, where the river cut into bedrock, east to the crest of the Cascade Range. The North Fork of the Green River flows south from the Cedar River divide into a confluence with the main stem of the river, east of Howard Hanson Dam. The contemporary North Fork occupies the former channel of the main stem of the river, which flowed northwest into the Cedar River drainage system prior to Pleistocene glaciation. During the advance and retreat of an Early Pleistocene ice sheet, glacial ice blocked the north end of what is now the valley of the North Fork of the Green River, and impounded the river and glacial meltwater in a proglacial lake. During the recessional phase of the glacial episode, the water level of the proglacial lake rose to an elevation of approximately 430 m (1,400 feet). Lake water spilled over a topographic low point and eroded fractured bedrock along a fault to create the steep-walled, incised rock gorge directly west of Howard Hanson Dam (Galster 1989:233).

Much like the upper reaches of the Cedar River and the Snoqualmie River, the upper Green River floodplain provides a relatively low-gradient access corridor into the Cascade Range. The uppermost reaches are surrounded by large west-east-trending ridges ranging in elevation from 1,190 to 1,280 m (3,900 to 4,200 feet). The south side of the watershed includes the north side of the Grass Mountain–Huckleberry Mountain ridge system, which extends from the town of Enumclaw east to the crest of the Cascade Range. These ridge crests also provide a nearly continuous travel corridor between the glacial drift plains in the Puget Lowland and the crest of the Cascade Range. The large ridge systems also have numerous side ridges that rise from the valley bottom to the ridge crest. The sidewalls of the major ridges in the Green River and White River Valleys, such as Huckleberry Mountain and Grass Mountain, are not as steep as those in the watersheds to the north, and the valleys have a greater number of side ridges that rise from the floodplains to ridge crests. The headwaters of the main stem of the Green River begin near Blowout Mountain, with small tributaries near passes at the crest of the Cascade Range, such as Green Pass and Tacoma Pass, at elevations between 1,460 and 1,740 m (4,800 and 5,700 feet). The Sunday Creek drainage, a major tributary of the main stem of the Green River in the northeast portion of the watershed, provides access to Stampede Pass, at an elevation of 1,119 m (3,672 feet). The Green River watershed is different from watersheds to the north in that the Green River watershed has more small tributaries that arise from lower elevations at the crest of the Cascade Range.

Also within the Duwamish River–Green River watershed is the Enumclaw Plateau, a unique landform that is part of a glacial outwash drift plain once extending from the Puyallup River on the west to the Green River on the north. Surface topography and sediments of the drift plain were altered by the Osceola Mudflow. The mudflow rerouted the ancestral channel of the White River from a floodplain at the south end of the glacial drift plain to a north-trending channel that incised into unconsolidated glacial deposits to form the contemporary steep-sided river valley. The surface of the Enumclaw Plateau in King County is 150 to 230 m (500 to 750 feet) above sea level and includes low, north-south-trending moraine ridges that rise above the mudflow deposits. Ridges are separated by relatively level prairies and woodlands that developed on the surface of Osceola Mudflow sediments. The flat areas are often waterlogged because of the high clay and silt content of the mudflow sediments.

White River

The portion of the White River watershed in King County includes the west edge of the Enumclaw Plateau and the south side of the Grass Mountain–Huckleberry Mountain ridge system. The Greenwater River, rising from the base of Huckleberry Mountain, is a major tributary of the White River, and provides a relatively level access corridor to the crest of the Cascade Range at Naches Pass, at an elevation of 1,460 m (4,800 feet). The upper reaches of the White River extend south into Pierce County, and serve as a relatively level corridor leading to Mount Rainier, to the tributary streams of the White River, and to the ridge systems and drainages that rise to the crest of the Cascade Range. Side ridges extend upslope from the White River and Greenwater River floodplains to the crest of the Grass Mountain–Huckleberry Mountain ridge system and provide access routes to the higher-elevation ridge crests.

VEGETATION AND PALEOCLIMATE OF KING COUNTY

A general understanding of vegetation change in and around King County, combined with knowledge of modern plant distributions and their soil, elevation, and community associations allows us to infer distribution of past plant communities. These estimations serve to highlight areas of King County that are most likely to have had important pre-contact plant resources as well as animal resources, using plant resources as a proxy, in the past.

High topographic relief, the influence of maritime climate, and a wide variety of soils create a complex mosaic of vegetation communities through Western Washington. General trends in Holocene climate and vegetation change for this region are well known but local vegetation change in response to changing climate conditions has been highly variable. In lowland King County during the period of interest for archaeological research there is evidence for open-canopied Douglas-fir/pine forests, grassland prairies bordered by oak forest ecotones, marshy wetlands along lakes, closed-canopied western hemlock climax forests with moist maritime components (western redcedar) and dry-adapted components (Douglas-fir, alder). This mosaic of communities is maintained by disturbance, including natural fire and windfall events, as well as, potentially, pre-contact human management. The result is a perpetually dynamic mosaic that is difficult to pinpoint in paleo-reconstruction except in the most general terms.

Modern Vegetation

Modern vegetation associations of lowland King County are characterized by the *Tsuga heterophylla* zone, as described by Franklin and Dyrness (1973). This zone is dominant in the Puget Lowlands, adapted to a wet, mild, maritime climate. Douglas-fir (*Psuedotsuga mensiesii*) is the dominant tree in the modern forest due to logging, fire, and other disturbance. Climate in this zone varies with latitude, elevation, and topography and vegetation associations may also be affected by moisture gradients. Common trees include: Douglas-fir, western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), grand fir (*Abies grandis*), Sitka spruce (*Picea sitchensis*), western white pine (*Pinus monticola*), lodgepole pine (*Pinus contorta*) (on glacial drift substrates) and Pacific silver fir (*Abies amabilis*) in the Cascades. Riparian sites commonly have hardwood species such as red alder (*Alnus rubra*), big-leaf maple (*Acer macrophyllum*), golden chinkapin (*Castanopsis chrysophylla*), black cottonwood (*Populus trichocarpa*), and Oregon ash (*Fraxinus latifolia*). Dominant understory species vary with substrate and moisture gradient. Camas is most commonly found in the open spaces or "prairies" of the *Tsuga heterophylla* zone. These are usually sites with poor soils, or high water content in winter. Similarly, it is also found in poorly drained bog meadows of the *Abies amabilis* and *Tsuga mertensiana* zones described below, associated with sedges, rushes, and other species that thrive in very moist habitats.

Modern vegetation zones generally vary by elevation (Figure 2-13). At elevations between approximately 700–1,300 m (2,300–4,270 feet) above sea level vegetation transitions to the wetter, cooler *Abies amabilis* zone (Franklin and Dyrness 1988). Common tree species include: Pacific silver fir, western hemlock, noble fir (*Abies procera*), Douglas-fir, western redcedar, and western white pine. Understory vegetation is dominated by Ericaceous genera including huckleberries (*Vaccinium* sp.), salal (*Gaultheria* sp.), rhododendron (*Rhododendron* sp.), prince's-pine (*Chimaphila umbellata*) and *Pyrola*. Composition of the vegetation communities varies with moisture regime. In these forests Pacific silver fir is a climax species, establishing in the shaded understory provided by pioneering Douglas-fir and noble fir. At lower elevation western hemlock is more common in the understory, while at higher, moister elevations Pacific silver fir dominates. In this zone shrub alder (*Alnus sinuata*) communities occur in avalanche tracks and areas with abundant seepage water. Mountain meadows of bracken fern (*Pteridum aquilinum*) and thimbleberry (*Rubus parviflorus*) are commonly found near shrub alder communities.

Subalpine elevations between approximately 1,250–1,850 m (4,100–6,070 feet) above sea level are described as the *Tsuga mertensiana* zone by Franklin and Dyrness (1988). Dominant species in this zone for the central west Cascades include noble fir, Alaska cedar (*Callitropsis nootkatensis*) and mountain hemlock (*T. mertensiana*), with variations dependent on temperature, moisture, snowpack and geography. The most common association in this zone is *Tsuga-Abies/Vaccinium membranaceum* (hemlock-fir/huckleberry). After fire disturbance in this zone, huckleberry, beargrass (*Xerophyllum*), mountain ash (*Sorbus*) and *Spirea* species thrive and can be maintained through repeated burning. In poorly drained areas of this forest zone there are commonly bog meadows and marshes composed of sedge (*Carex*), cotton-grass (*Eriophorum*), horsetail (*Equisetum*), and *Sphagnum*, as well as other less common taxa.

Above the tree line there are many variations of shrub and herb meadow communities. Mount Rainier, while not in King County, provides the best analogue for nearby montane environments. Franklin and Dyrness (1988) describe a wide diversity of meadow habitats on Mount Rainier, including heath-huckleberry, dwarf sedge, dry grass, and herbaceous communities.

Reconstruction of Past Climate and Vegetation

Reconstruction of past climate and vegetation are closely linked in the Pacific Northwest because our understanding of climate change is based primarily on records of reconstructed vegetation. One challenge in reconstructing Late Pleistocene and Holocene habitats in King County is the absence of detailed local records covering the wide range of elevation represented within the county. To provide the most thorough reconstruction, the data are compiled from regional sources ranging from

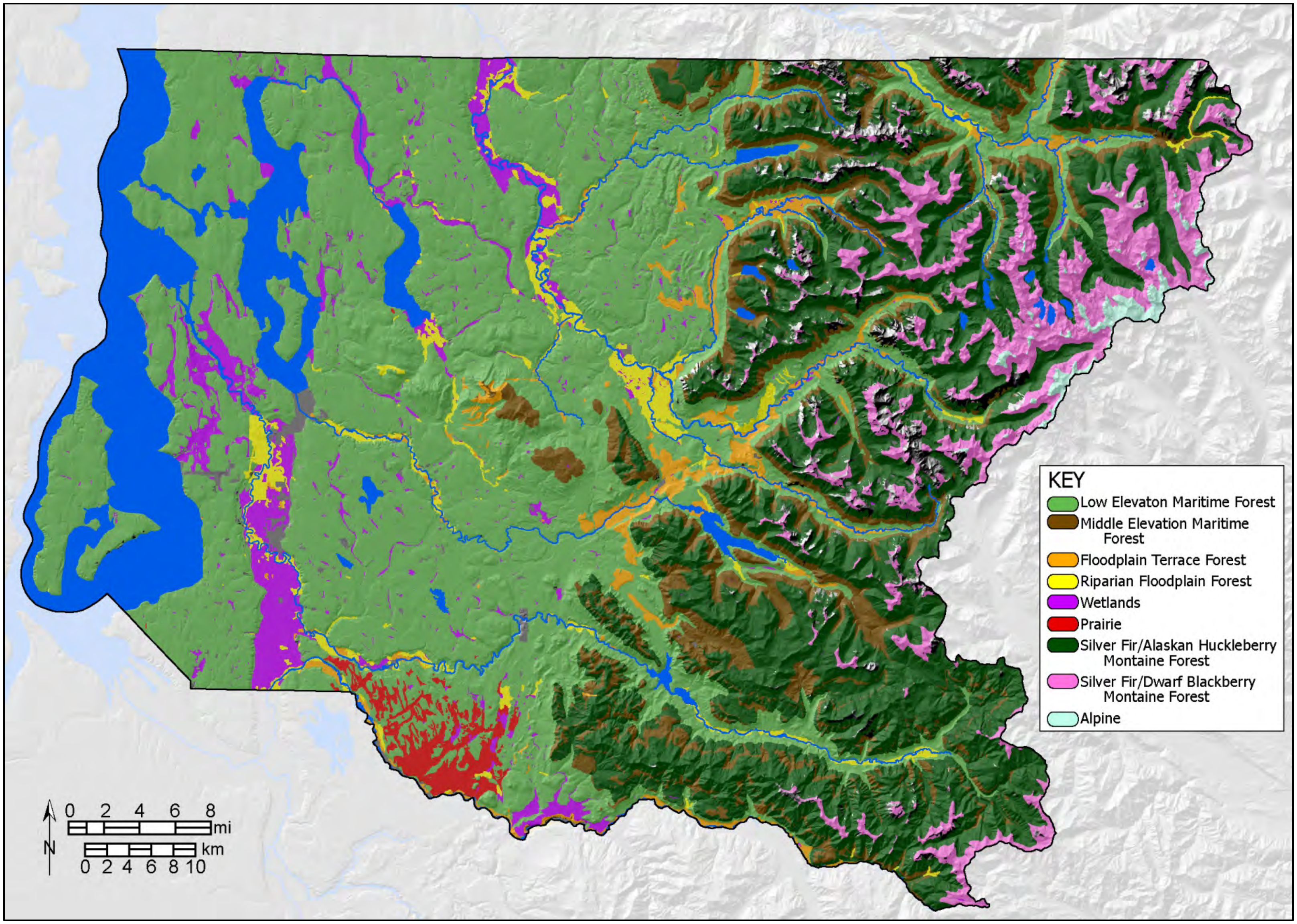


Figure 2-13. Modern vegetation distribution in King County.

southwestern Washington to the North Cascades and Olympic Peninsula, and from local sources from sites in and near King County. The regional data provide a picture of broad trends in both climate and vegetation change and provide details of changes in vegetation zones at high elevation. Coupling these data with local records in and around King County, we can more accurately predict past habitats throughout the county.

Regional Climate Changes

The Pacific Northwest has had four major climatic regimes over the past 16,000 years (Barnosky et al. 1987; Brubaker 1991; McLachlan and Brubaker 1996; Sea and Whitlock 1995; Sugita and Tsukada 1982; Whitlock 1992). During the maximum extent of glacial ice into Puget Sound around 17,000 cal BP it was much cooler and drier than the contemporary climatic regime. As the ice retreated between 17,000 and 13,000 cal BP, the region experienced a drier and somewhat warmer climate than previously. Between approximately 13,000 and 7000 cal BP, the combination of an orbit closer to the sun and greater exposure to the sun in the summer months gave the Northern Hemisphere more solar radiation (Sea and Whitlock 1995; Whitlock 1992). The increase in solar radiation in summer caused higher temperatures, less precipitation, and more severe and more frequent summer droughts and colder winters than today. Around 7000 BP, regional climate began changing again, to a cooler, moister regime, with temperatures near the range of the contemporary maritime climate found in most of coastal Puget Sound. The maritime climate was fully established by approximately 5,000 years ago. In the last 5,000 years short-term fluctuations in temperature and precipitation have occurred. Periods of neoglacial cooling between about 2,600 and 2,800 years ago (Porter and Denton 1967) and Little Ice Age (500–100 cal BP; AD 1450–1850) cooling (Burbank 1981) have been recorded in glacial moraines. Persistent drought conditions coupled with an increased fire regime that was well-documented in the Fraser River Valley corresponds with the Marpole archaeological phase and its inferred cultural reorganization between about 2400 and 1200 BP (Lepofsky, Lertzman, et al. 2005). A period of warming during the Medieval Climatic Anomaly (1100–700 cal BP; AD 850–1250) is recorded in tree-ring records (Graumlich and Brubaker 1986). A more recent study of high resolution charcoal records from Battleground Lake in southwestern Washington suggests that warming during the Medieval Climatic Anomaly and cooling during the Little Ice Age influenced lowland fire regimes in Western Washington (Walsh et al. 2008).

Regional Vegetation Changes

General patterns of Holocene vegetation change in Western Washington are summarized from regional pollen records (Anundsen et al. 1994; Barnosky 1981, 1985; Cwynar 1987; Gavin et al. 2001; Leopold et al. 1982; McLaughlin and Brubaker 1995; Prichard 2003; Spooner et al. 2007, 2008; Whitlock 1992) During glaciation, ice-free areas of southwestern Washington were vegetated with a tundra and subalpine mix of species including Engelmann spruce, lodgepole pine, subalpine fir, grasses, sedges, sagebrush, and other herbs. As the ice began to retreat ca. 14,000 cal BP lodgepole pine established in the raw soils of the Puget lowland, quickly followed by Sitka spruce and western hemlock. Higher-elevation records suggest an extensive open spruce-pine parkland existed until approximately 12,000 cal BP. Climate warming between 12,000–10,000 cal BP is illustrated by the establishment of trees at upper elevations in the North Cascades (Prichard et al. 2009; Spooner et al. 2007, 2008). During this time lowland forests were invaded by Douglas-fir from the south, associated with red alder and bracken fern, evidence of a fire-prone, disturbed environment (Cwynar 1987). Records indicate an increase in charcoal accumulation during this time, suggesting a higher incidence of fire disturbance (Cwynar 1987; Gavin et al. 2001) related to the warmer, drier climate conditions. Between 10,000 and 6000 cal BP Western Washington experienced the warmest and driest conditions of the Holocene. At this time subalpine parkland expanded into alpine tundra on the Olympic Peninsula (Gavin et al. 2001), mixed conifer forests dominated upper elevations in the North Cascades (Prichard 2003; Spooner et al. 2007, 2008) and high percentages of alder, bracken fir, and Douglas-fir pollen in lowland sites suggest vegetation communities adapted to warmer, drier conditions than existed previously, or presently (Whitlock 1992). After approximately 6000 cal BP modern vegetation communities established throughout Western Washington. During the last 6,000 years western redcedar associated with western hemlock became an important component of the maritime mixed conifer and alder forest at mid-low elevations. At higher elevations, Alaska cedar, mountain hemlock, and silver fir established in response to the somewhat cooler, moister conditions (Dunwiddie 1986; Gavin et al. 2001; Prichard 2003).

King County Vegetation Changes

Pollen records of Late Pleistocene and Holocene vegetation change in King County are sparse, consisting of only two studies at Lake Washington in the early 1980s (Leopold et al. 1982; Newman 1983). Nearby records include a lake sediment core from Hall Lake, just north of King County in Snohomish County (Tsukada et al. 1981); lake sediment cores from Nisqually and Mineral Lakes in south Puget Sound (Hibbert 1979) and two short lake sediment cores from locations on Mount Rainier (Dunwiddie 1986; Tweiten 2007). Combined, these records provide an understanding of the complexity and diversity of pre-contact vegetation communities in King County.

Figures 2-14 to 2-17 consist of maps estimating broad vegetation categories from the end of the Pleistocene through the Holocene. These maps show vegetation reconstruction during several Analytic Periods between the end of the Pleistocene and the late Holocene. These periods are used to characterize broad, distinct periods in the development of the archaeological record of King County, a framework introduced in those terms at the end of Chapter 4 and further used to conceptualize the theoretical land use model and GIS archaeological sensitivity model outlined in subsequent chapters. As noted in the discussion here, however, broad-scale changes in vegetation across King County during this same timespan do not neatly coincide with the divisions between archaeological Analytic Periods. The maps in Figures 2-14 to 2-17 convey reconstructions of past vegetation within the Analytic Periods of the archaeological record: Analytic Period (AP) 1 (14,000–12,000 cal BP), AP 2 (12,000–8000 cal BP), AP 3 (8000–5000 cal BP), and AP 4 (5000–2500 cal BP). The fifth period, AP 5 (2500–200 cal BP), is a time during which modern vegetation regimes were established, as shown on the previous map in Figure 2-13.

In general, pollen data from sediment records from in and around King County corroborate regional patterns of vegetation change (Dunwiddie 1986; Hibbert 1979; Leopold et al. 1982; Newman 1983; Tsukada et al. 1981; Tweiten 2007). Following deglaciation an open-canopied pine-spruce parkland dominated, with herbaceous and shrub species. As the climate warmed toward the mid-Holocene however, records from this part of Western Washington suggest development of open grassland/prairie communities. At the same time that Cwynar (1987) documents warmer, drier adapted forests of Douglas-fir, pine, and alder to the north near Darrington, Washington, there is an increase in grass pollen, as well as the presence of oak in records further south near Seattle and Mount Rainier (Hibbert 1979; Leopold et al. 1982; Newman 1983; Tsukada et al. 1981). During the warmest period of the Holocene, approximately 10,000–6000 cal BP, pollen records in and around King County illustrate lowland communities composed of grass, bracken fern, Douglas-fir, alder, and oak. This suggests that vegetation at this time was a mosaic of warm-adapted forests and open grasslands, probably with oak and Douglas-fir surrounding them, similar to the oak-fringed prairies of present day western Oregon and Fort Lewis, Washington. Fire disturbance was likely a prominent factor in maintaining the mosaic of open grasslands throughout the lowland forest. Oral histories from Salish Indians indicate that the Tribes regularly burned the lowland Douglas-fir forests to improve hunting and berry production (Leopold and

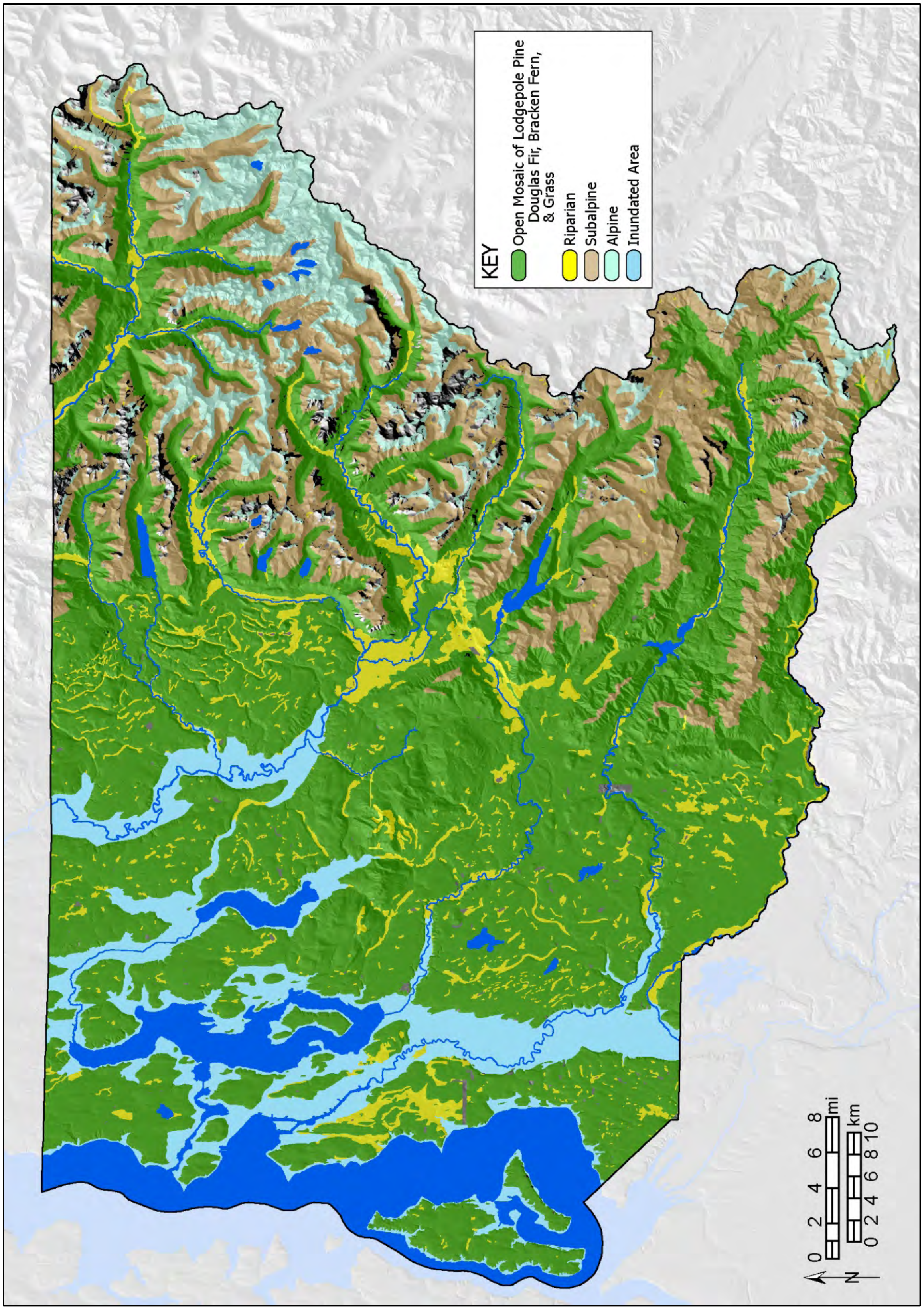


Figure 2-14. Paleovegetation map of Analytic Period 1 (14,000–12,000 cal BP).

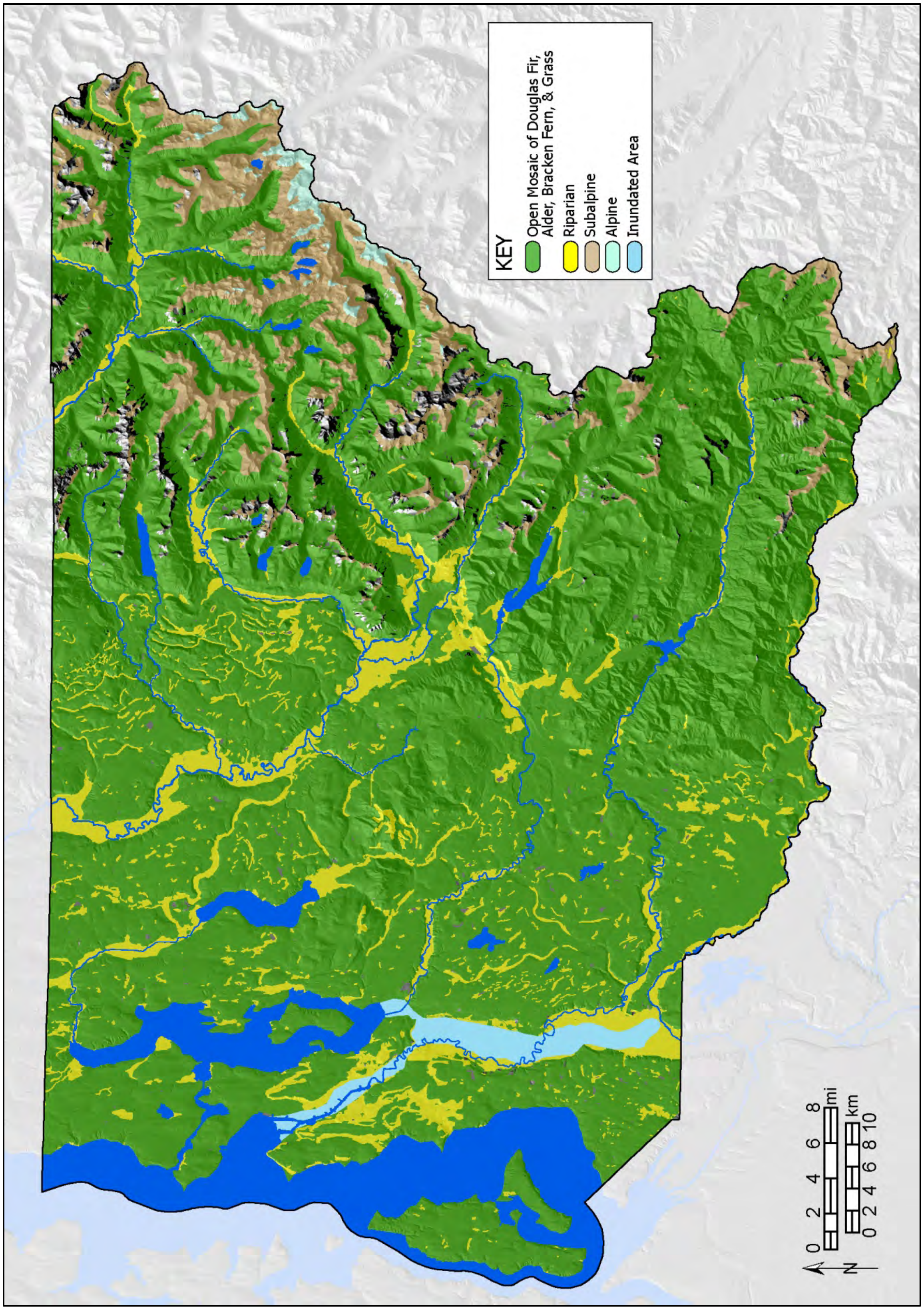


Figure 2-15. Paleovegetation map of Analytic Period 2 (12,000–8000 cal BP).

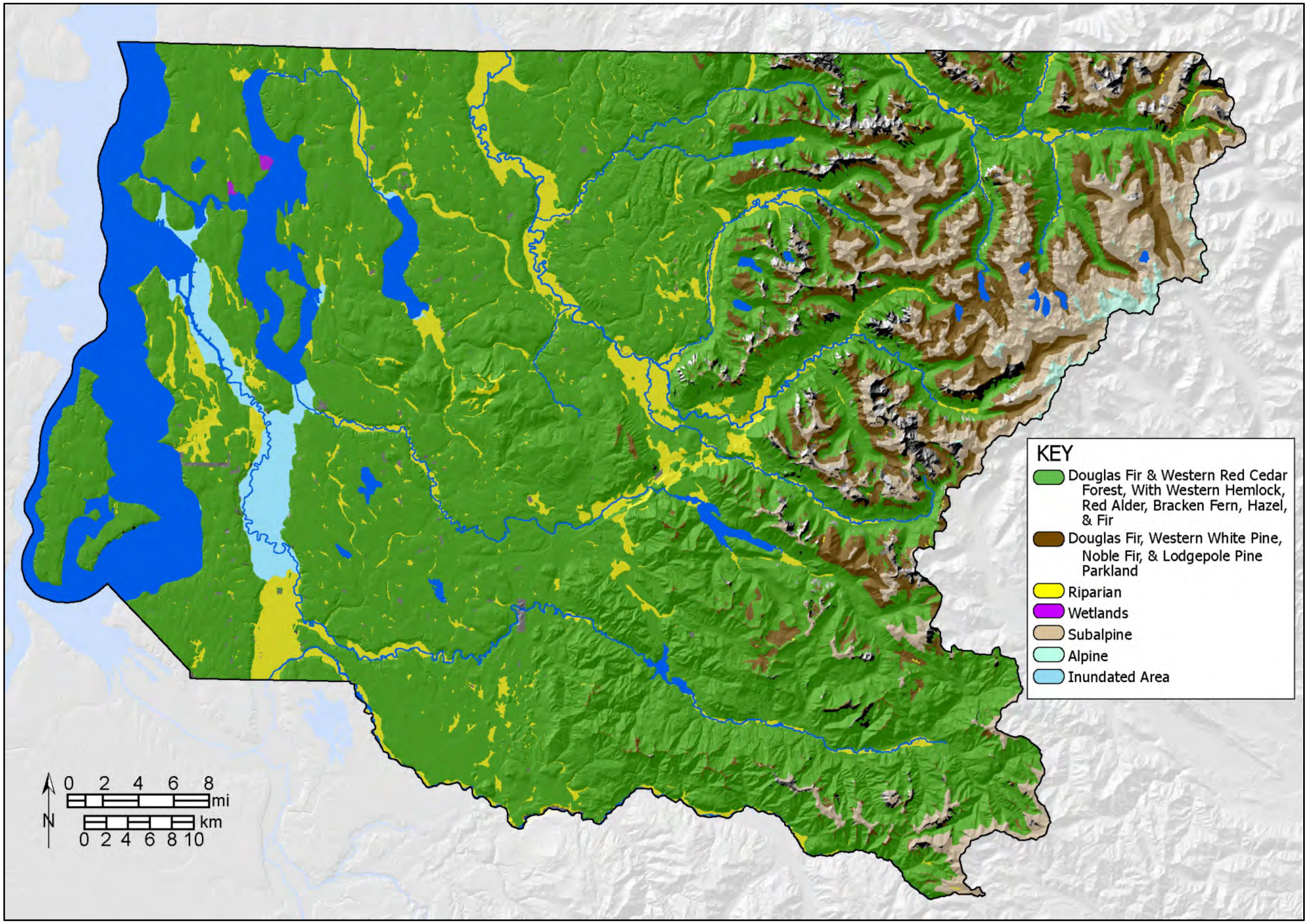


Figure 2-16. Paleovegetation map of Analytic Period 3 (8000–5000 cal BP).

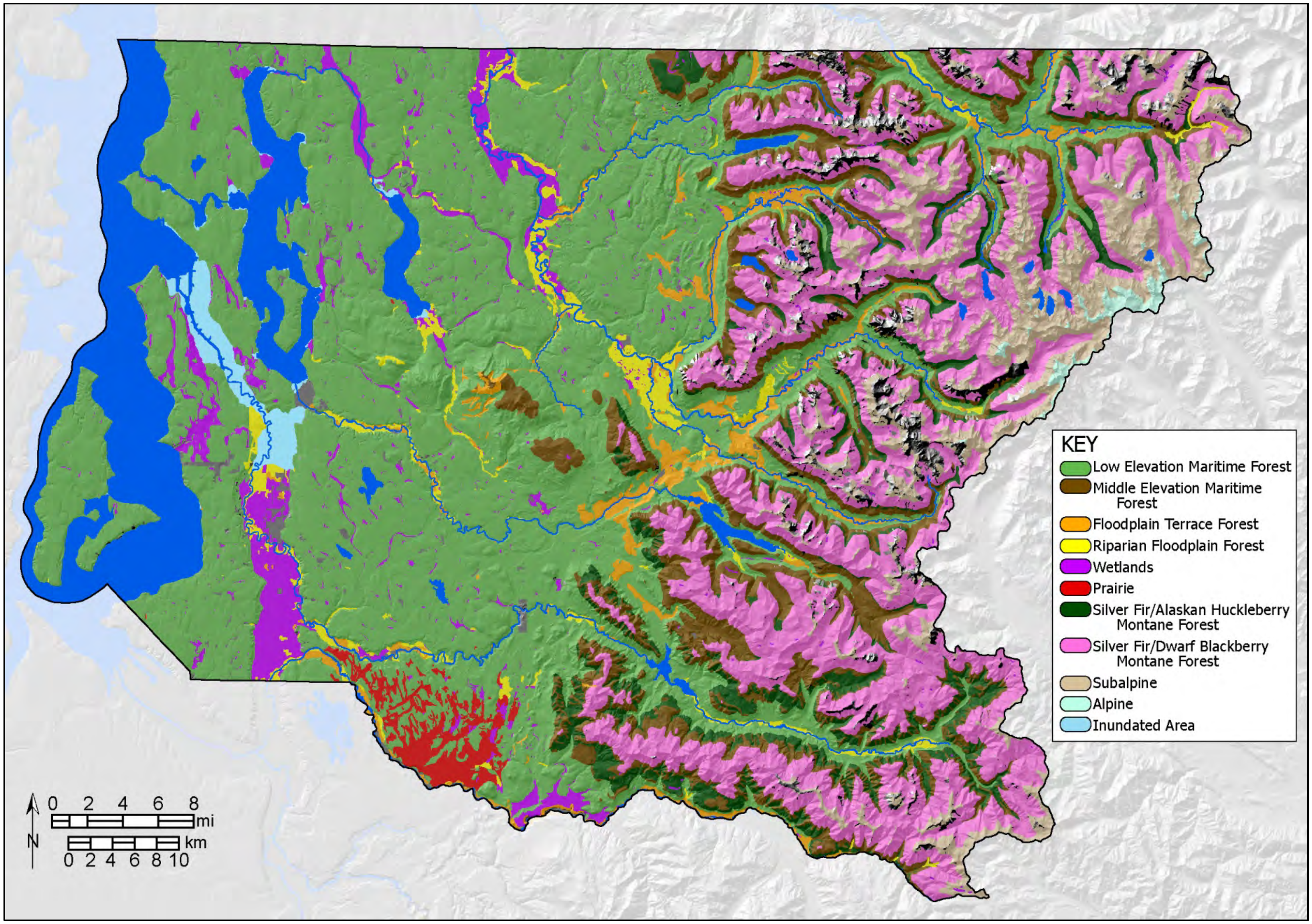


Figure 2-17. Paleovegetation map of Analytic Period 4 (5000–2500 cal BP).

Boyd 1999). Also during this time western hemlock began to establish and dominate as an understory component. The record from Mercer Slough at Lake Washington illustrates the development of marsh and willow thickets around the lake at approximately 7000 cal BP (Newman 1983). The author suggests this is a result of lower lake levels increasing marsh habitat along lake shore as a result of drought conditions during this period. Two studies on Mount Rainier document changes in the vegetation at higher elevation (Dunwiddie 1986; Tweiten 2007). Both records begin at the time of Mazama ashfall, about 7650 cal BP.

The pollen records indicate an open mixed conifer forest with increasing presence of western hemlock, mountain hemlock, and Alaska cedar at about 2500 cal BP (Dunwiddie 1986) perhaps in response to cooler, moister conditions. At this time there is also evidence for increasing incidence of fire in beargrass and huckleberry communities that may have been related to human activity (Tweiten 2007). Throughout this area, modern vegetation communities were established 3,000 to 6,000 years ago. The prairies noted during early Euroamerican exploration and settlement of the interior Puget Lowlands are some of the most notable vegetation associations in King County and its vicinity. Although all these prairies evolved into their current state during the late Holocene, their origins and character vary despite their tendency to be lumped together under the term "prairie". Arthur Kruckeberg (1991:285) describes this semantic issue in a most succinct and meaningful way:

> *Ecologists quibble over the use of the word "prairie" as appropriate to these lowlying* [sic]*, flat openings in Northwest forest. The word came west with the pioneers who had spanned mile after level mile of tall- and short-grass prairie in middle America. There, the vast treeless plains between rivers displayed a rich sea of grass on a deep and fertile soil blown out of the perimeter of the old Wisconsin ice sheet. The deep black soil of the midwest prairies contrasts with the shallow stony soils of western Washington… Yet an on-the-ground view of a Puget Sound prairie does bring the midwestern landform to mind. And so ingrained is this usage of the term that the purists need not try to change it.*

Kruckeberg focuses his discussion of the ecological aspects of prairies on the patches of grassland and Garry oak (*Quercus garryana*) within closed canopy forests that are most characteristic of the southern Puget Lowlands in Pierce and Thurston Counties. However, his observation that these particular prairie soils and vegetation associations tend to form on gravelly outwash sediments is pertinent to the areas termed prairies in King County as well. The most prominent prairie in King County is the Muckleshoot Prairie, which has evolved on the Enumclaw Plateau and thrived on its surface sediments composed of Osceola mudflow deposits laid down atop glacial outwash sediments over 5,000 years ago. The Buckley soils that comprise much of the plateau and host open pockets of prairie vegetation developed atop the Osceola mudflow deposits, and have very thick, well-developed A horizons similar to Mollisols found in different parent material on the oak prairies in the southern Puget Lowlands (cf. Ugolini and Schlichte 1973). Everett soils develop on some gravelly glacial outwash terraces of interior lowland King County. Despite an association with conifer forest listed in the county soil survey (Snyder et al. 1973:14), the more level areas of Everett series soils are also closely associated with places described by early Euroamerican settlers as prairies, including the Meridian Prairie near Covington and Sallal Prairie and other grasslands above Snoqualmie Falls mapped as Barneston series soils (Goldin 1992).

ANIMALS AND ANIMAL HABITAT IN KING COUNTY

The diversity and abundance of marine and terrestrial animals along the Northwest Coast is exceptional and have perhaps been the most notable features of the environment studied by anthropologists and archaeologists working in this region. Shellfish beds, marine and anadromous fish populations, ungulates such as deer and elk, marine mammals, and birds all played important roles in seasonally-structured Native American subsistence cycles. These animal populations were not static through the Holocene, and changes in their biogeography would have had a direct impact on changes in human land use. Major categories of economically important animal taxa are discussed in this section, including general descriptions of their modern biogeography and what is known of their changing abundance and distribution from the Late Pleistocene through the Holocene.

Shellfish

The marine shoreline of King County, along with shell-bearing freshwater stream and lake beds, provides a mosaic of microhabitats associated with certain kinds of invertebrates. Molluscs and other invertebrates such as crabs, shrimp, barnacles, and sea urchin are abundant in the marine waters of Puget Sound along the shoreline of King County, from the perpetually inundated offshore subtidal zone to rocky reefs and upper intertidal zone beaches that are only inundated at the highest tides and strongest storm surges. Freshwater mussels are notable for their distribution in certain stream and lakebeds in King County, a very different habitat than that of their marine counterparts. Along tidewater shores, invertebrate species composition varies by substrate, salinity, and wave energy (Harbo 1997; Kozloff 1996). A variety of gathering opportunities would therefore be available to hunter-gatherers, yielding an array of dependable subsistence resources year-round. Major shifts in shellfish population, in contrast to the subtle seasonal fluctuations of shellfish availability related to tidal phases, occurred when the relatively delicate balance between habitat requirements was disrupted. Subsidence or uplift of a beach during an earthquake by a meter or more, for example, would drastically reorganize the sedimentary composition of a beach and the extent to which different portions of the beach were exposed to surf. Geological events such as earthquakes are an ideal environmental lens for examining variability in shellfish habitat and, by extension, human utilization of shellfish populations in King County (e.g., Larson and Lewarch 1995).

Modern studies of marine shellfish populations provide some indication of species distributions and habitat associations (Dethier 2006). Most of these studies are based on sampling intertidal and subtidal zones for particular invertebrate taxa (e.g., Goodwin 1973a, 1973b). High-energy headlands and reefs, for example, are ideal for a common association of mussels (*Mytilus* sp.), barnacles (cf. Balanidae), and many kinds of gastropods such as limpets and whelks. In contrast, soft sand and mud substrates in low-energy, lower intertidal and subtidal bays are the preferred habitat of geoducks (*Panope generosa)* (Figure 2-18). Some of the most economically important native shellfish species are adaptable, however, to a range of substrates and beach configurations, and are therefore found on many stretches of moderate-energy sandy and gravelly beaches common to the King County shoreline. These include littleneck clams (*Protothaca staminea*), butter clams (*Saxidomus gigantean*), horse clams (*Tresus* sp.), and cockles (*Clinocardium* sp.). These species are also common constituents of archaeological shell midden deposits. Harvest of other abundant marine invertebrates such as crabs was undoubtedly a common occurrence yet their shells are rarely identified in archaeological sites. Taphonomy (such as density-mediated destruction of particular kinds of shell in an archaeological site) or inability of analysts to recognize small fragments of crab shell in faunal assemblages may account for this absence.

Limited biological research has been conducted on freshwater shellfish on the west side of the Washington Cascades (Koenig 2000; Nedeau et al. 2007), however the discovery of a freshwater mussel midden with an array of Native American tools along Bear Creek in northern King County demonstrates the importance of this resource (Younger 1993). A targeted study of freshwater mussel (*Margaritifera falcata*) populations along a stretch of Bear Creek and its tributaries near Woodinville suggests that their habitat preference for streams with relatively cool water, sandy and gravelly substrates, and sufficient

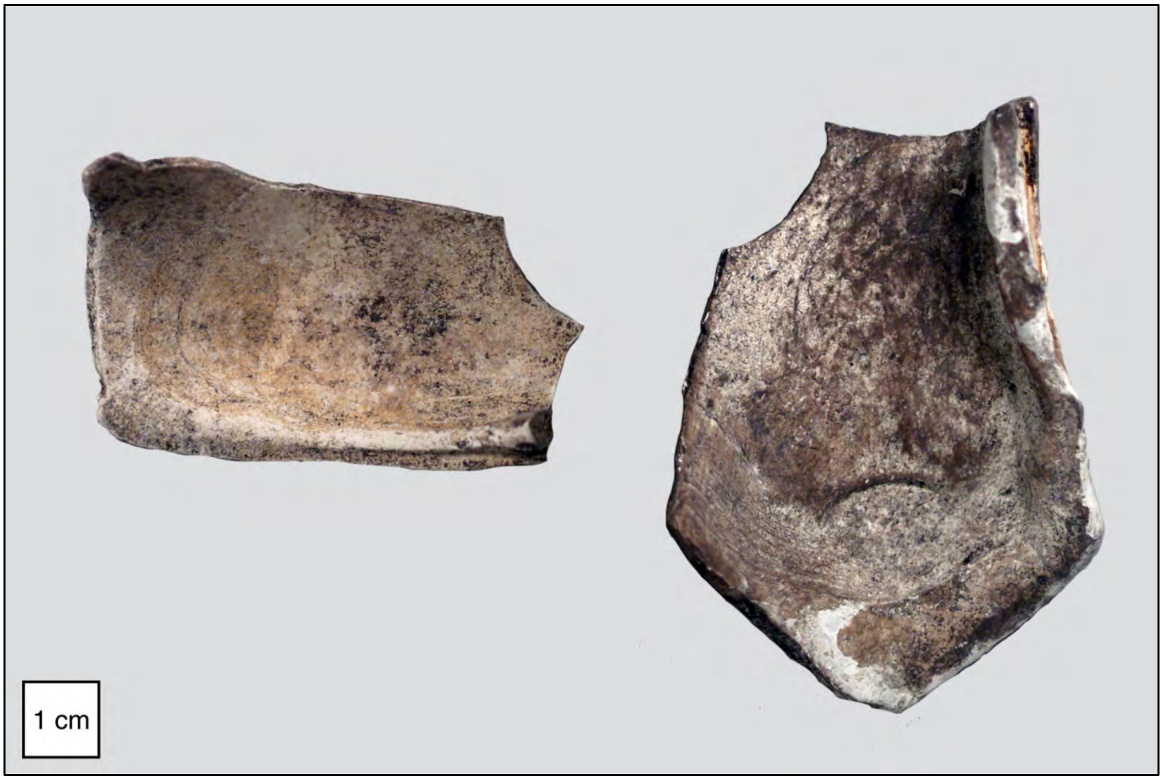


Figure 2-18. Archaeological geoduck shell from a shell midden near Mukilteo.

current velocity to prevent sediment deposition may support wide distribution in moderate-gradient streams in the interior lowlands of King County. This research (Toy 1998) found mean density of mussels in the study areas to be about 55 per square meter, and maximum age of an individual mussel in excess of 90 years. One critical factor for recruitment of freshwater mussels in western Washington is a suitable population of host fish onto which the mussel larvae attach, usually juvenile salmonids that require similar stream and substrate qualities for adequate growth (Stock 1996).

Marine Fish

Puget Sound is home to at least 250 species of marine fish that comprise over 60 taxonomic families (Miller and Borton 1980). Most of these fish are infrequently observed by humans, live in small populations, or tend to congregate far offshore and at depth not normally reached by hook and line or net. Many species, however, are common nearshore residents and became economically important to the human occupants of Puget Sound long before the arrival of modern commercial fishermen. Marine fish habitats of Puget Sound substantially vary by bathymetry, substrate, aquatic vegetation, and salinity and other aspects of water chemistry. The floor of Puget Sound drops steeply from the mean high tide shoreline to its bottom, with maximum depths along the King County shoreline in excess of 200 m (66 feet) near Three Tree Point and Richmond Beach. Interspersed with shallows and shoals near the mouths of steep drainages, these marine habitats are moderately productive for an array of fish taxa. The Duwamish Embayment and Quartermaster Harbor between Vashon Island and Maury Island, however, comprise a more varied gradient of bottom depths, salinity, and aquatic vegetation that supports a much more diverse population of marine fish.

Of the cartilaginous fishes, ratfish (*Hydrolagus colliei*), skates (*Raja* sp.), and the most common small resident shark, the dogfish (*Squalus acanthias*), are common in the marine waters of King County and are frequently represented in local archaeological shell midden assemblages. Herring (*Clupea harengus pallasi*) are abundant in Quartermaster Harbor and the Duwamish Embayment. Codfish (Family Gadidae), rockfish (Scorpaenidae), surfperch (Embiotocidae), sculpin (Cottidae), and flatfish (Order Pleuronectiformes) are composed of numerous species available along much of the King County shoreline (e.g., Miller and Borton 1980; Palsson 1990; Williams et al. 2010). Sturgeon (*Acipenser* sp.) is a large-bodied fish genus with ethnographic and archaeological precedent of being utilized by Native American groups north of the Central Puget Sound region (e.g., Suttles 1974). Although uncommon today in the central and southern Puget Sound, they have been observed offshore and as far inland as Lake Washington (Wydoski and Whitney 2003) and would have been an easily caught, high-return resource. Many of the smaller schooling marine fish such as herring, smelt (Osmeridae), and sandlance (Ammodytidae) are consumed by larger fish and sea mammals. Some fish taxa that are not directly economically important to humans may therefore still be part of a subsistence network connecting humans and marine life (e.g., Monks 1987). Reliance on the year-round availability of a diverse array of marine fish prior to Euroamerican settlement has been demonstrated at several coastal and estuarine shell middens in King County (e.g., Butler 1987; Kopperl 2001; Wigen 1995).

Anadromous Fish

Anadromous salmon and trout (*Oncorhynchus* sp.) were critical elements of the hunter-gatherer economy in Western Washington (e.g., Fladmark 1982; Schalk 1988), and archaeologists working in the Pacific Northwest have presented two broad and fundamentally different hypotheses of how and why salmon were incorporated into pre-contact subsistence systems (Schalk 1988:116–120). Schalk suggested that productive salmon runs were present on the Northwest Coast throughout the postglacial period. Intensive salmon processing and storage began when hunter-gatherers developed technologies for mass harvesting in response to growing carrying capacity pressure. The hypothesized impetus for hunter-gatherer economic change in his model is a combination of an imbalance between human population and available subsistence resources, development of new storage and processing technologies, and shifts in the regional climate, which reduced the terrestrial biomass available from elk and deer by the mid-Holocene. Systematic and intensive exploitation of riverine resources, primarily anadromous salmonids, reached full development within the past 3,000 years, and marine resources somewhat more recently (Schalk 1988:109–120).

Fladmark (1982) offered a different perspective on hunter-gatherer utilization of marine resources and the importance of salmon, suggesting that salmon runs were not sufficiently productive for hunter-gatherers until about 5,000 years ago when sea level and river gradients stabilized and a more maritime climate developed in the region. Stabilized sea levels lowered stream and river gradients, encouraging the development of more abundant spawning habitat for salmon. A cooler, moister climate with more precipitation also improved salmon productivity. Historic known and presumed distributions of King County spawning grounds for all salmonid species are compiled in Figure 2-19.

Landscape ecology and fisheries biology research suggests that salmon runs were established soon after retreat of Pleistocene glaciers. This is based on 1) the hypothesized existence of refugia populations on Kodiak Island, portions of the Queen Charlotte Islands, and the west coast of Vancouver Island; and 2) direct observation of very rapid colonization of streams by salmon as modern glaciers have retreated (Augerot and Foley 2005:52; Milner et al. 2007). Although modern deglaciation of stream valleys near Glacier Bay National Park in southeast Alaska was followed within 15 years by colonizing runs of sockeye salmon (*O. nerka*) and coho salmon (*O. kisutch*) (Mann and Hamilton 1995; Milner and Bailey 1989), the scale of deglaciation at the end of the Pleistocene across a very large area devoid of established salmon runs may have required centuries as opposed to decades for recolonization.

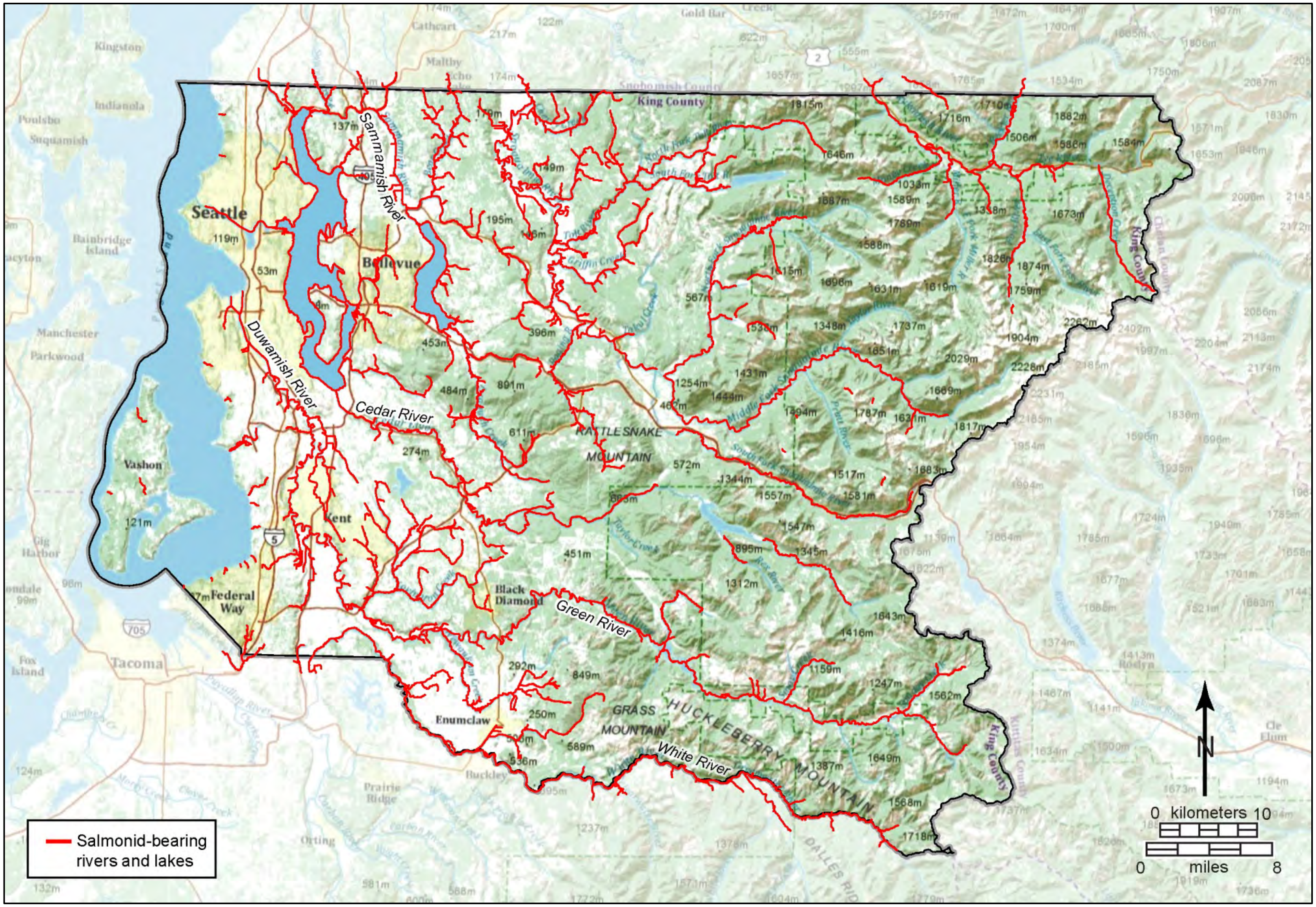


Figure 2-19. Historic known and presumed salmonid spawning distribution in King County.

Archaeological data from the Columbia River south of Puget Sound contribute to our knowledge of salmon biogeography and demonstrate hunter-gatherer salmon fishing prior to the mid-Holocene (Butler 1990a; Cressman 1960). Isotopic studies of the remains of Kennewick Man suggest a marine component of his diet that likely included salmonids (Chatters 2000:299, 2001a:128–129), and residue analysis of artifacts at the Bear Creek Site in Redmond, Washington, indicate at least some salmonid use near the Pleistocene-Holocene transition in the Puget Lowlands (Kopperl et al. 2015). To the north as well, salmonids were the dominant fish taxon identified in the early Holocene components at Namu on the middle coast of British Columbia (Cannon 1991), and were present in small numbers in the earliest components of the Glenrose Cannery site (Matson 1976). Given the likely availability and demonstrated capacity in the archaeological record, hunter-gatherers in Puget Sound fished for salmon throughout the Holocene.

Characterizing changes in salmon population during the Holocene is a much more complex task than establishing the existence of populations. Population trends of individual runs of particular salmon species are starting to be understood on a yearly and decadal scale, a focus of modern fisheries management that must take into account natural and hatchery stocks and significant historic alterations to salmon spawning habitat (e.g., Washington State Conservation Commission 2000). We may hypothesize based on knowledge of general salmonid population trends, however, that the period of environmental warming and low precipitation throughout the North Pacific between around 12,000 and 7,000 years ago probably resulted in Puget Sound salmon runs that were small and fluctuating in timing and density. Salmon runs became more reliable in terms of higher density of returning fish and predictable return times after 7,000 years ago, when the cooler maritime climate developed. Data from salmonid biology and archaeology therefore offer some support to both hunter-gatherer salmon use models (Fladmark 1982; Schalk 1988)—Salmonids would have been available to early Holocene hunter-gatherers as Schalk notes, but may have been somewhat unstable as a population and unpredictable as a subsistence resource prior to mid-Holocene climatic amelioration.

In their comprehensive review of Pacific Northwest zooarchaeological data and broad-scale testing of resource intensification and depression hypotheses, Butler and Campbell (2004:360–366) calculated salmon abundance indices from zooarchaeological assemblages spanning the Holocene found in the Puget lowlands and other areas along the Northwest Coast. Examining the ratio of salmon remains to all fish remains in these assemblages, salmonids comprise a small but persistent percentage during the early Holocene, with the exception of the Glenrose Cannery site on the Fraser River delta, where they comprise the majority of fish remains. After about 4000 cal BP, this index is quite variable, suggesting that salmonids were available to early Holocene hunter-gatherers, but it wasn't until after the mid-Holocene that their abundance, or some other factor making them more profitable, prompted their more dramatic inclusion in the diet of local and regional Native American communities.

Climatologists and fisheries biologists have identified natural patterns in climate change and ecosystem variability in the North Pacific Ocean, termed the Pacific Decadal Oscillation (Francis et al. 1998; Hare and Francis 1995; Mantua and Hare 2002. Fisheries biologists largely ignored the role of the oceanic stage of salmon life history until recent years, having focused instead on riverine environments that affected salmon spawning and downstream migration (Hare and Francis 1995). Fisheries studies now demonstrate large-scale natural fluctuations in salmon runs that have been linked to climate fluctuations and shifts in ocean currents in the North Pacific, such as El Niño. Temporal fluctuations in salmon runs are conditioned by characteristics in the North Pacific Ocean and marine waters offshore of the Pacific Northwest. The cyclical fluctuations appear to be inherent factors in salmonid population biology, independent of environmental characteristics of lacustrine and riverine habitats that affect spawning. Fisheries biologists demonstrated a 20- to 30-year cycle in salmon productivity linked to ocean temperature and plankton productivity. Large-scale, rapid changes in the atmospheric pressure over the North Pacific Ocean cause shifts in circulation patterns and ocean properties. This results in opposite trends in salmon productivity in the northern Gulf of Alaska and Bering Sea than along the more southerly Pacific Northwest coast. Salmon runs in the Pacific Northwest are larger when the local environment is cooler than average, which allows the California Current to bring nutrient-rich waters to the ocean surface.

Studies demonstrating inherent cyclical patterns in fish productivity suggest that an assumption in archaeological models of salmon as a stable resource base, either throughout the Holocene or just over the past few millennia, may be untenable. A comparison of two North Pacific climatic indices, the Pacific Decadal Oscillation and the Aleutian Low Pressure Index, with measures of Pacific-wide harvest of salmonids is shown in Figure 2-20 and showcases these relationships. Recent use of changes in nitrogen isotopes in lake sediment cores as a proxy for sockeye salmon abundance has given fisheries scientists and archaeologists an additional means of testing hypotheses regarding the relationships between salmonids, climate, and humans extending back over 2,000 years in some parts of the North Pacific region (Finney et al. 2002; West 2009), and may soon inform such research in the Puget Lowlands.

Current fisheries biology and archaeological data strongly suggest that salmon were available in Puget Sound throughout the entire postglacial period, although in both cases the data may be considered robust only for the past few thousand years. One of the few efforts to model the post-glacial biogeographical history of salmonids in a nearby river system is provided by a geomorphic examination of the physical evolution of the Skagit and Stillaguamish basins (Beechie et al. 2001), which stand as an

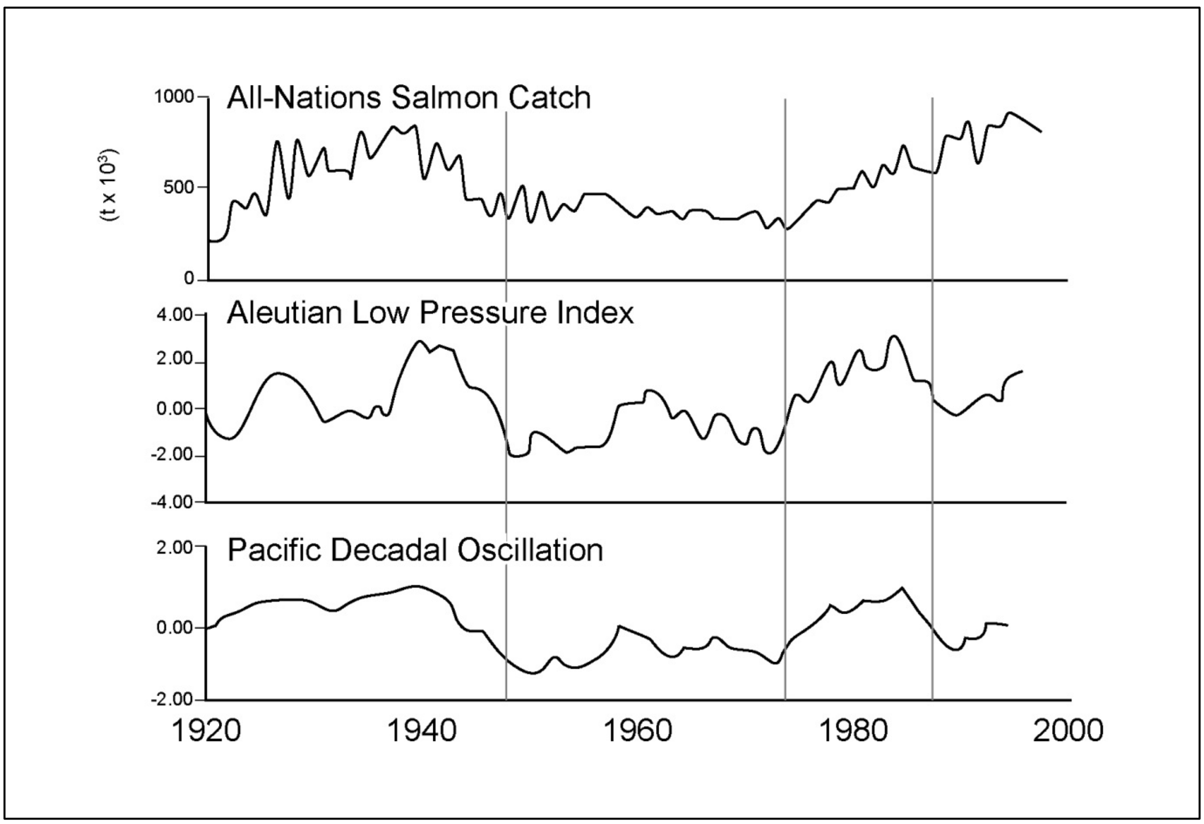


Figure 2-20. Comparison of North Pacific salmonid productivity with two North Pacific climatic indices during the twentieth century (adapted from Robin Brown and C-CIARN Fisheries 2005:46).

environmental laboratory generally similar in setting to the river systems of King County and hosting all major species of salmonids. Like many of the larger rivers in King County, the Skagit and Stillaguamish River systems have been profoundly affected by glacial retreat, relative sea-level changes affecting hydrologic characteristics of the stream channels, and lahars that deposited massive amounts of sediment downstream. The several thousand years following glacial retreat saw down-cutting of major rivers into glacially deposited sediments, causing the gradient of their tributaries to increase and consequently decreasing the habitability of these side streams. This process continued until massive lahars originating on Glacier Peak about 12,500 cal BP for the Stillaguamish and Skagit Rivers substantially disrupted salmon habitat and caused dramatically increased erosion and sedimentation in river systems, although plant and animal recolonization was probably well-established within a few decades and near completion within a few centuries. Down-cutting of major rivers continued until the mid-Holocene, maintaining a relatively poor habitat for most salmonids, the exception being steelhead trout (*O. mykiss*) and coho salmon that tolerate small streams with moderate gradients. After about 5500 cal BP, sea level stabilization and delta aggradation held constant or extended the mouths of major rivers into former estuaries, and the bedrock terrain, glacial terraces, and general floodplain configurations of river valleys probably attained a close approximation of their present conditions. Following some of the basic principles of this model, broad-scale changes in the suitability of King County river systems for salmonid habitat may be hypothesized, and specific expectations for the explanatory and GIS sensitivity models are described in Chapter 8 of this document.

Numerous studies have been conducted on Pacific Northwest salmon stocks to document the genetic relationships and life histories of individual salmon runs (Cramer et al. 1999; Gustafson et al. 1997; Johnson et al. 1997; Weitkamp et al. 1995), and state and local government agencies have collaborated for management purposes to map distributions of salmon stocks within the individual watersheds that comprise King County. These watershed units include the Snohomish River basin (Haring 2002), the Cedar and Sammamish River basins (Kerwin 2001), the Green and Duwamish River and Central Puget Sound Watersheds (Washington State Conservation Commission 2000), and portions of the Puyallup River basin (Kerwin 1999). The recorded distributions of salmonid species in King County lakes, rivers, and streams are also available from the King County GIS Center, and from analyses of salmon stocks. Almost all but the smallest tributary streams in King County have contemporary or presumed past salmon runs (Williams et al. 1975). Access to upstream spawning areas on some streams has been blocked by historic-period construction of features that do not allow fish passage (e.g., culverts, dams, roads, trails, and erosion control structures). Data indicate that, on average, salmon runs were larger and more predictable over the past 5,000 years than they are today. Fluctuations in the size and density of salmon runs occurred many times in the past 5,000 years, but regional-scale degradation of spawning habitat did not occur as often as today. The upstream extent of salmon stocks in King County is therefore probably underestimated by using contemporary data. Timing of seasonal change in river flow and changes in water temperature are critical elements in salmon spawning in streams and rivers (Cramer et al. 1999).

The most abundant salmon stocks in King County are Chinook (*Oncorynchus tshawytscha*), sockeye, and coho salmon. Land-locked sockeye salmon, called kokanee, also were abundant in the early historic period. Contemporary Puget Sound Chinook salmon have a limited ocean migration range compared to other salmon stocks, generally utilize stream gradients of less than 3 percent for spawning beds, spawn in stream reaches at elevations generally below 370 m (1,200 feet), and fluctuate in abundance in approximately 20- to 30-year cycles (Cramer et al. 1999:iii–vi). Chinook spawning beds have been recorded at elevations as high as 760 m (2,500 feet) in a few streams associated with spring runs (Cramer et al. 1999:2.1). Chinook salmon generally spawn and rear in large channels with low gradients, which are in the lower reaches of most drainage basins. The contemporary Duwamish River–Green River drainage and Cedar River–Sammamish River drainage have approximately the same number of linear miles of chinook spawning beds (Cramer et al. 1999:Figure 2-3). Fall Chinook runs are most common in the Cedar River–Sammamish River system. In the Sammamish River drainage, Swamp Creek, North Creek, Little Bear Creek, and Big Bear Creek support contemporary fall chinook runs (Cramer et al. 1999:Figure 2-7, Table 2-2). The lower reach of the Cedar River supports a fall chinook run, while fall chinook runs in the Duwamish River-Green River basin extend to the headwaters of the Green River. Newaukum Creek and Big Soos Creek have chinook runs in the middle reaches of the drainage (Cramer et al. 1999:Figure 2-7, Table 2-2). Spring runs of chinook salmon migrate up the White River drainage (Cramer et al. 1999:Figure 2-7).

The largest contemporary sockeye salmon runs in Southern Puget Sound are associated with the Lake Washington–Cedar River drainage system. Sockeye runs ascend the Cedar River to spawn in the lower and middle reaches below Landsburg. In the Sammamish River drainage, sockeye spawn in Big Bear Creek and Issaquah Creek. Most tributaries of Lake Washington, including first and second order streams, support runs of sockeye. Sockeye salmon also spawn on gravel beaches along the east side of Lake Washington (Williams et al. 1975:8-03). Their adaptation to lakes as spawning habitat makes sockeye salmon unique amongst anadromous salmonids.

Coho salmon move upstream from August through November. Most streams in the Lake Washington drainage basin support runs of coho salmon (Williams et al. 1975:8-02). The Cedar River and tributaries below Landsburg have extensive spawning beds used by coho salmon. Issaquah Creek, Evans Creek, Big Bear Creek, Swamp Creek, Little Bear Creek, and North Creek in the Sammamish River basin all support contemporary coho runs. The Duwamish River-Green River drainage has extensive contemporary coho salmon runs. All drainages in the system that can be accessed by salmon support coho runs. Coho also spawn in the main stem of the Green River, in gravel beds along the Green River Gorge. The White River supports coho salmon below the Buckley Diversion Dam.

Freshwater Fish

Unlike their marine counterparts, freshwater fish populations are relatively small and spatially constrained by stream and lake habitats. Despite their different population dynamics, freshwater fish are usually a dependable subsistence resource that may be easier to harvest at times than marine fish given their aggregation in the narrow confines of streams and lakes. Economically important native freshwater (non-anadromous) fish species found in King County today include lamprey (Family Petromyzontidae), landlocked salmon and trout, peamouth minnow (*Mylocheilus caurinus*), northern pikeminnow (*Ptychocheilus oregonensis*), and several species of sucker (Family Catostomidae). Larger and deeper lake habitats, most notably Lake Washington, host a wide array of freshwater fish in addition to several runs of anadromous salmonids (Wydoski and Whitney 2003).

Terrestrial Mammals

Large terrestrial mammals are an important focus of archaeologists investigating subsistence systems in Western Washington because of all subsistence resources commonly used in the region (with the exception of whales on the outer Olympic coast), they provided the greatest biomass and caloric return for energy expended (Burtchard 1998; Mierendorf 1986; Mierendorf et al. 1998; Schalk 1988). During the Holocene period in Western Washington, key terrestrial mammal species for hunter-gatherer subsistence were elk (*Cervus canadensis*), deer (*Odocoileus* sp.), mountain goat (*Oreamnos americanus*), and marmot (*Marmota* sp.). Elk herds are seasonally mobile, moving from the lowlands in the spring, to high elevation vegetation zones in the summer, and back to lower elevations in the winter. Deer are mobile as well, but do not congregate in herds. The seasonal movement of elk and deer would likely have shaped the seasonal mobility patterns of hunter-gatherer groups to some extent. Concentration of elk herds on floodplains and in open patches within low elevation Pacific Northwest forests during the winter “yarding” season within a well-defined winter range represented patches of large-bodied, high return prey. Burtchard (1998) and Schalk (1988) identified general kinds of landforms by elevation where elk and deer would be expected to congregate. By extension, hunter-gatherer archaeological sites would be expected to be associated with these areas with seasonal concentrations of terrestrial biomass. Archaeologists would also expect hunter-gatherers to combine food procurement and procurement of technological materials into “multi-task” locations and camps. As the complexity of the hunter-gatherer settlement pattern increased through time in the Puget Sound basin, the importance of “yarding” by elk probably decreased, and this resource was probably harvested through different kinds of hunter-gatherer task groups operating out of a wider range of site types.

Western Washington has several subspecies of mule deer. Black-tailed deer (*O. hemionus columbianus*) are more common in lower elevation landforms, while other subspecies (cf. *O. hemionus hemionus*) roam the western crest of the Cascade Range from home ranges centered on the eastern slopes and valleys of the Cascades. Black-tailed deer are more territorial than other subspecies, have smaller home ranges, and migrate less frequently (Ingles 1965:429; Kie and Czech 2000:638). Deer require nutritious forage and are termed “concentrate feeders” because they do not readily digest as wide a range of fibrous plants as elk (Wisdom and Cook 2000:697). Deer browse leafy forest understory vegetation, grasses, and sedges (Ingles 1965:429; Kruckeberg 1991). In the winter, cedar, hemlock, red alder, lichen, and moss add to the diet. Black-tailed deer have higher population densities in areas where successional stages of vegetation have been disturbed and closed canopy old growth forests are punctuated by open patches of shrubs and grass. Home range size is conditioned by different types of habitat, habitat patch shape and spatial arrangement, and contrast between adjacent patches (Wisdom and Cook 2000:697). Deer move to higher elevation vegetation zones in summer seeking abundant herbaceous forage, and return to lowlands when snow falls. Deer are not herd animals, although mule deer can concentrate in large numbers in winter ranges and black-tailed deer may temporarily form large feeding bands where the forage is the best during severe winters (Nyberg et al. 1985; see also Marshall 1977 for ethnographic accounts of winter aggregation of deer elsewhere). Svendsen (1992) noted some accounts that black-tailed deer and elk did not coexist, yet further investigations demonstrated that deer and elk often shared the same range but that elk herd size sometimes decreased the density of deer browsing in an area.

Elk form large herds, pioneer and exploit a variety of habitats, and move in response to changes in weather and forage (Wisdom and Cook 2000:694). Contemporary elk populations and ranges in Western Washington generally are reduced compared to pre-contact population dynamics, however the release of Rocky Mountain elk in the twentieth century near southeast King County has created modern populations in some areas that are likely greater than in the past (Spencer 2002:5–6). Figure 2-21 shows this modern distribution in King County and the surrounding area. Elk have been termed “intermediate feeders” because they browse on less fibrous suites of plants and shrubs than bison, but consume more fibrous mass than deer. Elk are dietary opportunists that browse on forbs, deciduous trees, deciduous shrubs, and graze in meadows (Ingles 1965; Larrison 1976; Wisdom and Cook 2000:697). Large populations of elk may alter the species composition and successional stages of vegetation patterns, especially after disturbance of landscapes by fire (Kruckeberg 1991:206; Wisdom and Cook 2000). Continual consumption of understory and ground cover by elk combined with ground disturbance from trampling and erosion from hooves often produces an open, patchy landscape within closed canopy

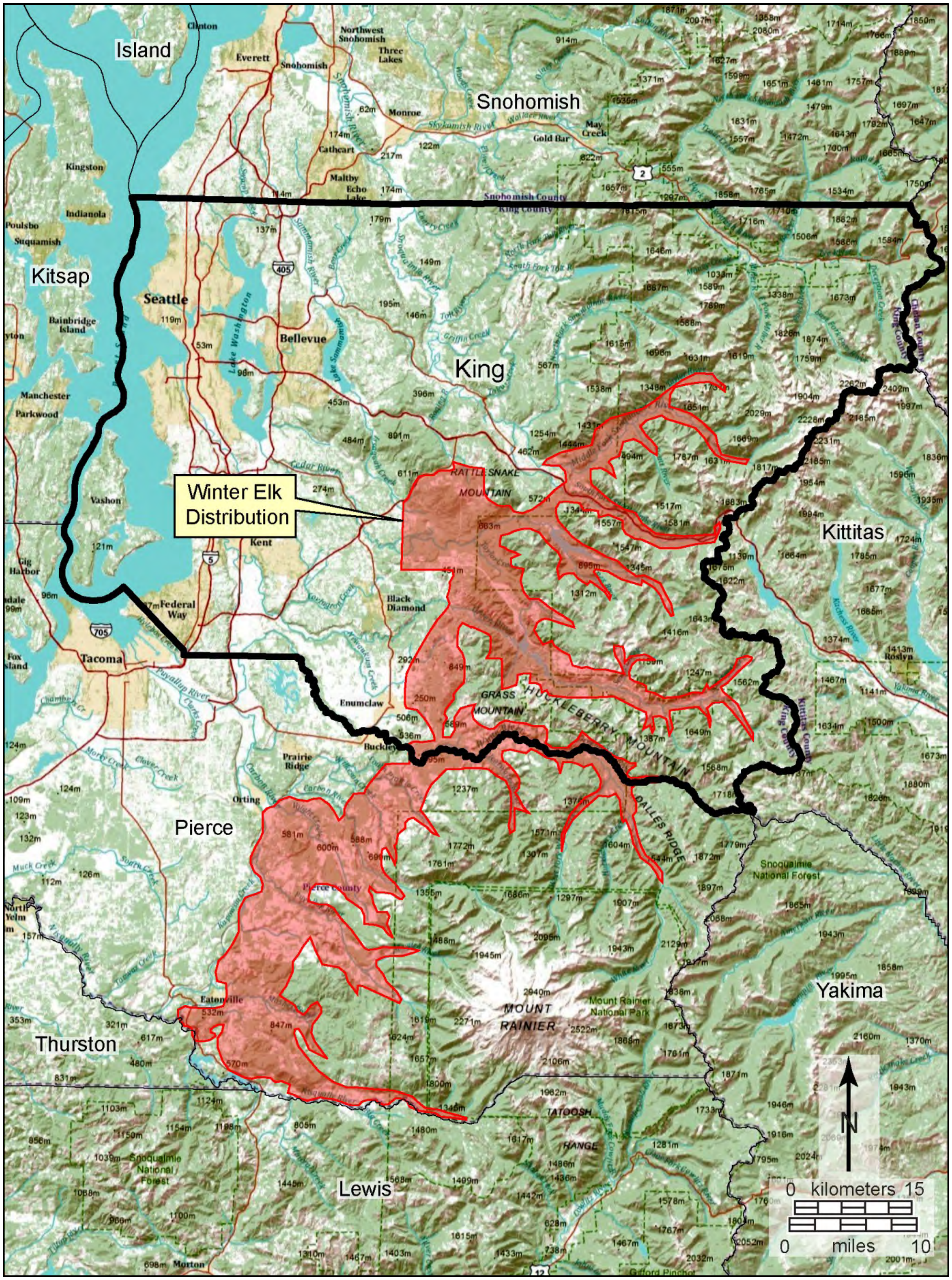


Figure 2-21. Modern elk distribution from the North Rainier Elk Herd (adapted from Spencer 2002:7).

forests (Kruckeberg 1991:207). In the winter, elk herds of both sexes concentrate in a limited winter range, while summer herds in the alpine meadows are smaller, and have a higher percentage of females and calves (Wisdom and Cook 2000:696). Zahn (1985) demonstrated that during periods of summer heat, elk herds in closed canopy forests preferred old growth and denser understory vegetation for bedding and browsing than nearby vegetation in open but warmer areas.

Deer and elk were not the only terrestrial mammals utilized by hunter-gatherers, but their migration patterns probably conditioned mobility patterns and subsistence organization to a greater degree than other terrestrial species. Mountain goats and marmots are large- and small-bodied prey that would have provided both subsistence and non-food resources to hunters in alpine settings. Mountain beaver (*Aplodontia rufa*) is a small species of rodent that has been occasionally identified in relatively substantial quantities in archaeological faunal assemblages in both mountain (e.g., Burtchard 1998) and lowland (Blukis Onat, personal communication 2007) settings. Canids have been identified in small numbers in some more intensively analyzed archaeological faunal assemblages, however the nature of pre-contact domestic dog populations and their role in human society is much less understood than in other parts of the northwest such as the Pacific coast of the Olympic Peninsula (e.g., Crockford 1997).

The paleontological (and to a much lesser extent, archaeological) record of the region provides some data regarding large terrestrial mammals that inhabited the recently deglaciated landscape of the Puget Lowlands but were extinct by the beginning of the Holocene. Ancient bison (*Bison antiquus*) has been found in association with archaeological material at several Paleoindian sites on the Columbia Plateau such as the Lind Coulee Site (Daugherty 1956; Irwin and Moody 1978). West of the Cascade Range, several Pleistocene-aged bison have been found in peat bogs on Orcas Island and Vancouver Island (Schalk et al. 2007), one of which dating to about 13,500 cal BP exhibits taphonomic evidence suggesting butchery by humans (Kenady et al. 2007). The ambiguousness of artifact associations with Mastodon remains in a peat bog near Sequim (Gustafson et al. 1979) does not preclude the availability of such animals to Late Pleistocene hunters, attested to by several paleontological finds made in the central and northern Puget Sound lowlands. Although the extinction of the Columbian mammoth (*Mammuthus columbi*) is estimated to have occurred by 17,000 to 15,000 years ago (Barton 1999), a 13,000- to 12,000-year-old extinct North American ground sloth (*Megalonyx jeffersonii*) in buried peat uncovered during construction at Sea-Tac International Airport (McDonald 1998) suggests a wider range of large mammals may have been available to the earliest human occupants of present-day King County. Schalk et al. (2007) have hypothesized a highly productive ecosystem in the Puget Sound and Straits region during the several millennia following glacial retreat that was capable of supporting large terrestrial herbivore populations and a hunting adaptation that focused on them.

Marine Mammals

Seals, sea lions, and porpoises are common residents of Central Puget Sound and provided valuable sources of protein, fat in the form of blubber and oil, and hides and other body parts important to hunter-gatherers for making an array of implements. Most whales are only occasional visitors to the southern reaches of Puget Sound, following concentrations of salmon, herring (in the case of minke [*Balaenoptera acutorostrata*] and humpback [*Megaptera novaengliae*] whales), and concentrations of smaller invertebrate prey (in the case of gray whales [*Eschrictius robustus*]). Both migratory and resident pods of orca, or killer whales (*Orcinus orca*), are more abundant in Puget Sound relative to baleen whales. Little is known of the population dynamics of modern whales, aside from their recorded distributions, observed behaviors, and targeted prey, despite close scrutiny by wildlife biologists, habitat managers, and government policy-makers (Angell and Balcomb 1982; Osborne et al. 1988). Archaeologically, whale remains are present in small amounts in shell midden deposits. These fragments are often modified and reflect much more on decisions regarding technology than the role whales may have played in the subsistence of Puget Sound Native communities.

Harbor seals (*Phoca vitulina*), California sea lions (*Zalophus californianus*), and Steller sea lions (*Eumetopias jubatus*) are common pinnipeds that spend much of their time in solitary pursuit of food (usually fish) and occasional periods congregated in much larger groups. Harbor seals are year-round residents of Puget Sound and tend to be the least gregarious of the pinnipeds, occasionally hauling-out along protected stretches of the coast or isolated rocks generally inaccessible to humans. California sea lions can attain three to four times the body size of harbor seals and congregate as small haul-outs of males (females remain south of the Pacific Northwest) on conspicuous points of land and small islands in the fall and winter in Puget Sound. Steller sea lions can reach over twice the body size California sea lions, up to 1,100 kg (2,425 lbs), and males and females arrive yearly in peak numbers in fall and winter. Modern haul-out sites of these animals have been mapped by the Washington Department of Fish and Wildlife (Jeffries et al. 2000). No haul-outs for harbor seals are immediately off the King County shoreline but several California sea lion haul-outs are in Shilshole Bay, on rocks and buoys off West Point and Alki Point, and on buoys near Three Tree Point and Point Robinson. Given the extent of modern development and habitat alteration (including placement of those buoys), seal and sea lion haul-outs may have been much more numerous along the King County shoreline prior to Euroamerican settlement.

Migratory Birds

Birds represent an important hunter-gatherer resource providing meat for subsistence and feathers, skins, and bones used for decorative and utilitarian implements. Resident and migratory waterfowl, shorebirds, and raptors are common along the marine shoreline of King County and in a variety of lowland settings such as lakes and wetlands (Angell and Balcomb 1982). Hunn (1982) and Wahl and Paulson (1991) recognize several basic bird habitats within King County, describing the associations between bird species and freshwater marshes, meadows, forests, and other habitat types in addition to shore-zone associations. There have been few archaeological studies of pre-contact bird hunting and consumption in Western Washington to date, but focused analysis of bird remains from archaeological sites such as the work of Bovy (2005) highlights their value in testing hypotheses regarding past hunter-gatherer subsistence and environmental changes that disrupt coastal habitats. Analyses of archaeological bird remains have been conducted using the few large samples collected in King County, most notably from the West Point Site (Larson and Lewarch 1995), however birds usually play a peripheral role in pertinent regional models of hunter-gatherer subsistence (e.g., Burtchard 1998, Schalk 1988) given their cost of acquisition relative to caloric returns and secondary role in ethnographic descriptions of the seasonal subsistence round. Broad-scale explanatory models may have difficulty attributing specific aspects of bird utilization to long-term culture change and estimated bird habitats may not play a major role in county-wide archaeological sensitivity modeling given their dispersal across the landscape and co-occurrence with other important resources, however this role may be reassessed with further zooarchaeological analysis and environmental data. Certain shoreline water-pass landforms such as the low portage between Vashon Island and Maury Island are mentioned in historic accounts as flyover areas where nets were stretched to catch birds (Carey 1985), and may be considered more sensitive for the archaeological remains of specialized bird-hunting sites.

CHAPTER 3. Ethnohistoric Period Indian Groups in King County

The ethnohistoric period is defined in this document as the period beginning in AD 1792, when Captain George Vancouver first entered Puget Sound, and ending about AD 1860, several years following the signing of the Treaties of Point Elliott, Medicine Creek, and Point No Point. This period encompasses a span of time in which important data about Native American settlement and subsistence was made available in a direct, albeit substantially transformed, fashion. Ethnographic data regarding Northwest Coast Native Americans have been collected by anthropologists since the end of the 1800s. With the exception of the earliest accounts to be recorded in a systematic anthropological manner, such data are not derived from direct observations of people and their lifeways during the ethnohistoric period of interest in this context statement.

Ethnographic data are derived from the direct observation of human behavior, in contrast to archaeological data that consist of a wide variety of cultural material remains and their depositional contexts in the natural environment. This is also in contrast to ethnohistoric data, which are derived from the study of human cultures by examining historic records, which include written testimony, maps, oral tradition, and other primary source materials. In some cases, most notably for the Northwest Coast near the time of initial Euroamerican contact, such use of historical documents has been seen as a supplement to a sometimes sparse archaeological record from this particular time (e.g., Gunther 1972; Hajda 2005), while more formal implementations of ethnohistoric methods often use a subjective, emic perspective to investigate the experiences between aboriginal and colonizing groups (e.g., Harkin 2003; Simmons 1988). Ethnographic data, along with historical records and ethnohistorical analyses, can be used to explore the relationship between material remains that constitute the archaeological record and observed societal changes. Ethnographic data, the term used in this context document to denote the entire corpus of written and oral accounts of Native American lifeways from the time of initial Euroamerican contact onward, is most useful when strong similarities can be demonstrated between environments and technologies of the past and the ethnographically documented culture of a region. In this regard, analogies derived from ethnographic and/or ethnoarchaeological observations can aid in the interpretation of past events and processes, and development of hypotheses to explain the past (e.g., Watson 1979:278).

Some authors believe that combining ethnographic, historical, and archaeological data in studies of culture change suffers from the problem of "mixed epistemologies". The goals of archaeology, history, or cultural anthropology are regarded from this perspective as so different and their approaches to the problems of cultural change so divergent that they cannot be combined without difficulty (Wilson 1993:23). A contrasting view is that ethnographic "models" can provide the basis for formulating sampling designs that vary with the archaeological objective, such as obtaining analytically meaningful samples of the archaeological record to investigate specific problems (Kramer 1979). The relationships, techniques, and functions that can be or have been observed and that may appear to be highly appropriate to interpret archaeological remains are still hypotheses, however, and must be tested before they can be accepted as explanations for the archaeological record (Kramer 1979; Watson 1979). The direct historic approach often used by archaeologists in the Pacific Northwest to explain an evolutionary trajectory ending at the time of Euroamerican contact and settlement, and recorded in great detail by ethnographers, must come to terms with this (e.g., Matson and Coupland 1995).

The explanatory framework used in this document to examine changes in Native American settlement, subsistence, and other aspects of life in King County must make certain assumptions about human behavior. While acknowledging that variability exists in those behaviors and that such variability must be a focus of ongoing archaeological and anthropological research, many of these basic assumptions are derived from ethnographic data. Even explanatory models that explicitly limit the input of ethnographic sources of data often rely on them in one form or another. This chapter is intended to summarize ethnographic data in a manner that both informs the hypotheses and expectations of the explanatory and sensitivity model at the center of this context statement. It is also intended to provide background information for future research designs that may be applied to the King County archaeological record at a variety of scales. Regardless of the specific ways in which data from the ethnographic period is used by archaeologists, however, the overview in this chapter is most relevant to the most recent pre-contact culture historical periods described in Chapter 4, and is likely to be of much more limited applicability to earlier periods.

REGIONAL ETHNOGRAPHIC DATA

Ethnographic data was collected for Native Americans whose traditional territories encompass portions of King County, including the Duwamish, Puyallup, Muckleshoot (Duwamish, Green and White River groups, and Upper Puyallup), Snoqualmie, Suquamish, and Tulalip Tribes (Snoqualmie, Skykomish, and Snohomish). The ethnographic period spanned a time when these communities were undergoing the pressures of an increasing non–Native American population that dramatically affected their cultures. Ethnographic accounts of human land use comprise the bulk of available data, however stories of interactions between the human and the supernatural comprise an important component as well. These stories tell of the origins of animals, plants, notable landmarks, and geologic processes that manifest themselves in the archaeological and geological records as well (e.g., Ballard 1929; Blukis Onat 2006; Hilbert 1985; Ludwin et al. 2005; Miller and Blukis Onat 2004; Thrush 2007). Data sources were reviewed for this project that provide information on ethnographic settlement and subsistence, technology for activities such as resource acquisition and processing, elements of social organization that might affect the archaeological record, trade, and non-subsistence activities that may be represented in the archaeological record.

Primary source material was used nearly exclusively, although sources vary widely in reliability and for some, the intent of the document requires consideration when using the materials. For example, some of the information associated with the Indian Claims Commission cases may be biased in favor of one side of a case or the other. Sources examined for the preparation of this chapter include ethnographic studies, anthropological field notes, community histories, memoirs, cartographic records, Office of Indian Affairs correspondence, dockets and exhibits from the Indian Claims Commission cases from the 1950s and from the Court of Claims cases in 1927, newspaper files, and a few records of the U.S. Forest Service.

The ethnography of some groups in King County has been better documented than for others. For example, Marian Smith's ethnography of the Puyallup-Nisqually (Smith 1940a) is extensive, and can be extrapolated to some degree for neighboring groups such as the Duwamish and the Green and White River people. Arthur Ballard's body of work is particularly valuable, especially his testimony before the Indian Claims Commission, in formulating a more complete understanding of the Duwamish, and the Green and White River Indians (Ballard 1951). Though Haeberlin and Gunther (1930:7) named their monograph *Indians of Puget Sound*, the "…tribes most fully described…are the Snohomish, the Snoqualmie and Nisqually...[with] some information about the Skykomish and Skagit, while casual references are made to many other Puget Sound groups" (Tweddell 1953). Tweddell (1953) relied heavily on Haeberlin and Gunther (1930) in his testimony before the Indian Claims Commission, but also conducted his own fieldwork with the Snohomish people. Harriet Turner (1976) and Kennedy and Larson (1984) expanded Snoqualmie ethnography. The best authorities for the Suquamish are Snyder (1968) and James and Martino (1984). Researchers using this document should rely on the primary source materials when possible, to avoid the perpetuation of incorrect or misleading ethnographic information cited in secondary sources.

TRADITIONAL CULTURAL PLACE STUDIES

Several traditional cultural places studies were more recently undertaken in King County to satisfy federal requirements under the National Historic Preservation Act and its implementing regulations (36 CFR 800) for the consideration of the impacts of project undertakings on properties of traditional religious and cultural importance or significance. These are geographic places prominent in a particular group’s cultural practices, beliefs, or values. These practices, beliefs, and values must also be widely shared within the group, passed down through generations, and have served a recognized role in maintaining the group’s cultural identify for at least 50 years. The term “traditional cultural property” is often used as a substitute term, although it does not appear in law or regulation. The term was coined by the National Park Service (NPS) in its guidance document *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1990).

Traditional cultural places studies are conducted with the participation of the involved Tribes and usually involve archival review, interviews with Tribal elders and culture committees, identification of traditional cultural places that may be significant, and report preparation. Most of these studies are not available to the public or to researchers in their original form because information they contain is considered sensitive by the Tribes that participated in them. For some studies, versions with redacted sections or modified summaries are available to researchers on a need-to-know basis.

The first investigation of this kind in King County was conducted before the NPS developed guidelines for traditional cultural places studies (Parker and King 1990) and was undertaken for the Cedar River Watershed (Larson 1987a). Interviews were conducted with Snoqualmie people, and researchers may contact the Snoqualmie Tribe for the report on a need-to-know basis. In 1994, a traditional cultural places study was undertaken with the cooperation of the Muckleshoot Indian Tribe, Suquamish Tribe, and Duwamish Tribe, for the Alki Transfer/CSO Facilities Project (Larson 1996). A summary of findings was produced to accompany this study and approved for public access by the Muckleshoot Indian Tribe’s Culture Committee. The Alki Transfer/CSO Facilities Project Traditional Cultural Property Study summary of findings is a general report of methods and results (Larson 1995a:1).

Seattle Public Utilities contracted for a traditional cultural places study of the Cedar River Watershed in 2000 (Dugas and Robbins 2002), which included the participation of the Colville Confederated Tribes, Snoqualmie Tribe, Tulalip Tribes, and the Yakama Nation. Sections of the report are available to the public, including the introduction, methodology, evaluation of traditional cultural properties, potential impacts, and cultural background. Researchers on a need-to-know basis may contact Seattle Public Utilities for instructions on contacting the participating Tribes for specific information about traditional cultural properties identified in the study. The Muckleshoot Indian Tribe has recently conducted its own traditional cultural properties study of the Watershed.

Also in 2000, a consultant for the Muckleshoot Indian Tribe conducted a traditional cultural places study of the proposed Crystal Mountain Master Development Plan project area (Larson and Forsman 2001). Although that project area is in Pierce County, Muckleshoot elders provided information about mountain use that is a contribution to the ethnographic record of the region. Again, the Muckleshoot Indian Tribe Culture Committee approved an agency copy of the report with sensitive information redacted and available on a need-to-know basis.

ECONOMY

This section presents subsistence and technical constituents of the economy for Native Americans in King County, general environmental characteristics for food sources, and types of harvesting, processing, and preparation methods that could be useful in identifying ethnographic-period resource type locations. The ethnographic settlement pattern and subsistence cycle for the Native American groups of Central Puget Sound has been documented by Ballard (1951), Gibbs (1855, 1877), Kennedy and Larson (1984), Lane (1973a, 1973b, 1973c, 1975a, 1975b, 1975c, 1983, 1987), Larson (1987a, 1993), Larson and Forsman (2001), A. Smith (2006), M. Smith (1940a, 1941), Turner (1976), Tweddell (1953), and Waterman (1973). Some of Arthur Ballard's notes are included in the records of Marian Smith. Recent regional synthetic discussions of subsistence and settlement that incorporate at least some ethnographic data are also informative (Butler and Campbell 2004; Deur and Turner 2005; Turner and Hamersley-Chambers 2006).

Settlement

Native American groups in King County shared a general settlement pattern based on permanent residency in winter villages and dispersal in the spring, summer, and fall to other locations for resource acquisition and preparation. The following sections briefly describe villages of various Tribal groups in King County near the time of Euroamerican contact and some general characteristics of their temporary seasonal camps. Settlement patterns were already changing at the time of contact as a consequence of disease epidemics that decimated Native American populations. Following the Treaty of Medicine Creek (1854) and the Treaty of Point Elliott and Treaty of Point No Point (both 1855), settlement was no longer self-determined by those same Tribal groups (Marino 1990), although many families and individuals refused or delayed resettlement on the treaty-mandated reservations.

Villages

Villages were located to maximize access to fall salmon fishing and were often at the confluence of two rivers or a river and stream. Exceptions included villages on Elliott Bay and Lake Washington. Villages were sited on higher ground to permit drainage. Puyallup villages consisted of one to three houses arranged in a single row along the riverbank or shoreline (Smith 1940a:4), while Duwamish villages had as many as eight to 10 "large" houses per village (Duwamish et al. 1927a). Some villages also had a potlatch house, which was also the shaman's house, located "…generally across the stream from the other house [sic] of the village. They were of the same construction built on a somewhat larger scale" (Smith 1940b:7, 19).

Duwamish Villages

The Duwamish lived in winter villages on the Duwamish River, the Black River, the lower White (now Green) River, the Cedar River, Elliott Bay, Salmon Bay, Lake Union, and Lake Washington. Ethnographic sources indicate that the Duwamish had at least 25 recorded villages in their territory (Ballard 1912, 1929; Duwamish et al. 1927b; Duwamish et al. 1993; Harrington ca. 1909; Petite 1954; Smith 1940a; Tecumseh 1927, Waterman ca. 1920, 1922; see also Thrush 2007). The Duwamish had four villages on the Duwamish River, near present-day Pigeon Point, Kellogg Island, Georgetown, and Tukwila; five villages on the Black River; three villages on the lower White River; two villages on the Cedar River; three villages on Elliott Bay; one village on Salmon Bay; one village on Lake Union; and six villages on Lake Washington. One of the Lake Washington villages, at the mouth of the Sammamish River, has been attributed to the Sammamish, a group that ethnographers have described as associated with the

Duwamish and/or the Snoqualmie. As of 2015, the federal government has denied recognition of the Duwamish Tribe. Many descendants of the Duwamish are enrolled in other federally recognized tribes.

Muckleshoot Villages

The Skopamish (Green River), Smulkamish (Upper White River), and Stkamish (Lower White River) peoples are now known as the Muckleshoot. Ethnographic sources indicate the Skopamish occupied at least 16 winter villages along the Green River between present Auburn and Black Diamond, including villages at the former confluence of the White and Green Rivers, at Soos Creek, at Burns Creek, at Newaukum Creek, at Flaming Geyser, at Mineral Springs, and other places along the Green River (Ballard 1912, 1929, 1951; Smith 1989; Waterman ca. 1920). The Smulkamish had their primary villages along the Upper White River above present-day Auburn, including a village on the southeast portion of the present Muckleshoot Indian Reservation and at the mouth of Boise Creek (Waterman ca. 1920). Other Smulkamish villages were recorded on Muckleshoot Prairie, near the east edge of the present-day Muckleshoot Indian Reservation, and Osborne Prairie near present-day Enumclaw (Ballard 1929, 1951). The Stkamish had three winter villages on the Lower White (now Green) River between present-day Kent and Auburn (Ballard 1912, 1929, 1951; Smith 1989). The descendants of the Skopamish, Smulkamish, and Stkamish are members of the Muckleshoot Indian Tribe. Descendants of the Upper Puyallup villages are members of the Puyallup Tribe and the Muckleshoot Indian Tribe (Lane 1973a:ii).

Snoqualmie Villages

The Snoqualmie lived in villages from the confluence of the Snoqualmie and Skykomish Rivers, along the Snoqualmie River, to present North Bend and at the mouth of Issaquah Creek. The Snoqualmie had at least 13 villages in their territory (Kennedy and Larson 1984; Teit 1928; Waterman ca. 1920). The Snoqualmie villages from the Tolt River to Snoqualmie Falls, often assigned to the “Upper Snoqualmie,” were at present-day Carnation and Fall City, at the mouth of Stoessel Creek, at the mouth of Griffin Creek, at the mouth of Tokul Creek, and at Snoqualmie Falls. Upper Snoqualmie villages above Snoqualmie Falls included two prairie villages at the present-day town of Snoqualmie and one village on a prairie near present-day North Bend. Lower Snoqualmie villages were at the mouth of Cherry Creek and at present-day Issaquah. Two Snoqualmie villages were at Cathcart and at the confluence of the Snoqualmie and Skykomish Rivers within or near the areas also inhabited by the Snohomish (Kennedy and Larson 1984:31–32). Descendants of the Snoqualmie are members of the Snoqualmie Tribe.

Puyallup Villages

The Puyallup lived mainly in villages on the Puyallup River and tributaries of the Puyallup River in Pierce County (Lane 1973c:ii). In addition, the Shohamish, a band strongly affiliated with the Puyallup, had at least four villages on Vashon Island (Ballard 1929; Smith 1940a; Waterman ca. 1920), all on Quartermaster Harbor. An additional village, which was probably Puyallup, was recorded on Dumas Bay on the shoreline near Dash Point (Ballard 1929) in King County. Descendants of the Puyallup are members of the Puyallup Tribe of Indians.

Villages of Other Tribal Groups

The Snohomish, Suquamish, and Skykomish did not have ethnographically recorded winter villages within King County. Each group had hunting and/or fishing areas within King County, however, and had both economic and kinship ties with those communities established within present-day King County. The descendants of the Suquamish are members of the Suquamish Tribe. The descendants of the Skykomish and Snohomish are primarily members of the Tulalip Tribes.

Camps

People left the villages in the spring to gather early plants, to harvest salmon at spring salmon fishing locations, and to go clamming. Summer camps were sited at shellfish and fishing locations. Late summer camps were sited at huckleberry patches with proximity to good hunting. An important characteristic of camps is that they were usually multi-purpose in the acquisition of resources. Although a group of people at a camp might have primarily pursued a major resource, they usually harvested a variety of other available resources as well. Gibbs (1877:194) commented that camps were generally found near the skirts of timber which border open lands, while Carter (1978:15) expanded upon this theme, saying:

> *…thus firewood and shelter are readily available. A nearby source of water was another prerequisite. Such a setting could be found in conjunction with a preferred fishery, a mountain meadow or prairie rich in camas or roots, an area populated with game, an established berry collecting locality, or any combination of the four.*

Family groups might spend a few days or a few weeks camping in a location for resource procurement. Camps that were occupied for a few weeks at the mountain huckleberry areas may be characterized as base camps because smaller berrying groups and hunters cached food stores and more immediate provisions here before making forays into more remote areas. Those who remained in the camp to prepared berries and meat often collected or hunted nearby. The berrying and hunting base camps were similar to the seasonally reoccupied shellfish gathering summer camps reported by Smith (1940a:26) at Redondo Beach and on Vashon Island. The camps were often the focus of joint summer gatherings for family groups whose members were related by marriage. For example, Smith (1940a:26) reported that the people who camped at Redondo Beach were from the Upper Puyallup villages, White River villages, and the village at the confluence of the White and Green Rivers. Vashon Island hosted joint summer gatherings for many Puyallup villages (Smith 1940a:26).

Suquamish Indians camped along the King County shoreline from Meadow Point, north of Shilshole Bay, south to at least Seattle, with Duwamish, and perhaps Snohomish and Snoqualmie relatives (Suquamish Tribe v. United States of America 1955:13; Tweddell 1953:93; Wandrey 1975:32). The Seattle waterfront, which included Duwamish villages, hosted campsites after non–Native Americans established the town of Seattle, beginning in 1852. Native American labor contributed to the growth of the early settlement, but in 1865 a City ordinance prohibited Native American residence within the city limits (Thrush 2007). Suquamish Indians came to Seattle to sell clams they collected on the Port Madison Reservation, and other Tribal groups stopped in Seattle on their way to the hop fields of the Puyallup and White River Valleys. According to Bagley (1916:96, 98), the Native Americans in the 1860s were beginning to be driven away from the camps they most likely inhabited in the 1850s, if not earlier.

> *The beach along the waterfront from Columbia Street to Madison Street was usually lined with their shacks until they were finally driven away by the advancing tide of business enterprises…Their sweathouses ornamented the beach just west of First Avenue on the beach above ordinary high tides, prior to the grading of the street* (Bagley 1916:96, 98).

In a recent account of Native American history paralleling the establishment and growth of the City of Seattle, Coll Thrush (2007:53–54) noted that the efforts of the Indian Agents of the government to coerce Native American communities to vacate the area did not succeed, at least as anticipated. Distinct bands moved camps north and south of present-day downtown Seattle, as well as across Elliott Bay to abandoned occupation sites. Other individuals and families that relocated to the newly established reservations returned to Seattle in subsequent years for seasonal employment, helping lay the foundation for Seattle's economic growth.

Clamming camps were established by the Green River groups, Upper Puyallup, and the White River Indians, from Alki Point south to Adelaide Beach (Harrington ca. 1909:Frame 0326, 0341; Swindell 1941; Upchurch 1941). The Duwamish shared camps with these groups in the northern stretch, and the Puyallup in the southern stretch (Larson 1993:52). Blukis Onat and Hollenbeck (1981:444) noted that the Snoqualmie also went to Redondo Beach and Normandy Park Beach, presumably to gather clams.

Fishing camps were also along the King County shoreline (Lane 1975a, 1987) at the locations of permanent villages, and at places in the rivers where salmon rested in holes, or could be captured in fish traps and weirs. The salmon season consisted of distinct runs from May or June through December, while the preponderance of salmon was taken during the fall (September through December). Family groups may have visited other villages during the salmon fishing season for social exchange and to fish for different kinds of salmon than those available near their own villages.

Camps for digging fern roots and camas were established on prairies throughout King County, including Snoqualmie Prairie (Kennedy and Larson 1984:57), Meridian Prairie, Cameron's Prairie, Muckleshoot Prairie, Nason's Prairie (Ballard 1951:1:6; Smith 1989), prairies near Kent (Duwamish et al. 1933:688), Jenkins Prairie near present-day Covington, and mountain prairies.

Huckleberry camps were often large base camps established near huckleberry fields and connected by mountain trails. Berry camps were established "...in and adjacent to meadows and fire-created openings in the mountains, usually near lakes or streams" (Mack and McClure 2002:39). In the Cascades, huckleberry camps have been documented at Mule Springs (Miss and Nelson 1995) and Twin Camps (Hedlund 1979:11), and on meadows on Huckleberry Mountain (McCullough 1970:37).

Base camps for hunting were often, but not always, associated with huckleberry camps. Hunters could travel for several days from a base camp location, caching meat in smaller overnight camps before returning to the base camp. Native American hunters traveled throughout the Cascade Range to the highest elevations in pursuit of animals, camping when they needed to stay overnight.

Subsistence

The subsistence of each village was similar throughout the region to the extent that every village depended on salmon, shellfish, meat, and plants. However, a village's environmental setting affected the degree of dependence on a given resource. Each village occupied an environmental niche that conditioned the availability of the resources above, either through direct access or through trade. For example, villages on the lower stem of the Duwamish River and camps on Vashon Island had greater access to shellfish and marine mammals and lesser access to deer and other products of the inland hunt. Alternately, the White and Green River groups, the Upper Puyallup, the Snoqualmie, and the Skykomish were renowned as hunters. The latter groups were also midway between the saltwater groups at the mouths of the rivers and along the Puget Sound shoreline and the Plateau Indians, east of the Cascade Range, thus giving them trade advantages as "middlemen". Arthur Ballard (1951:2:332) wrote of the importance of an "economic unit" when he discussed the subsistence of the Green River Indians:

> *I should say that it was necessary to have this entire area in order to provide the different elements of subsistence; the rivers and the streams with the fish, the prairies for the roots and berries and the mountain region with the other, the trees and berries for the game to feed on. It*

> *was necessary for their living, the forests, the fish, the roots and berries and the four-footed beasts, this would be an economic unit.*

The annual subsistence cycle was fine-tuned to accommodate changes in the weather that affected the movement of animals and the ripening of plants. For example, if the weather was too dry, animals retreated higher into the mountains, and people followed the animals. Other seasonal fluctuations affected the location of medicine plants and huckleberries. Because berries occupied an elevation gradient, the berry picking season was lengthened by following the berries to higher elevations as they ripened (Smith 1964). Certain environments were managed to increase the abundance of particular resources such as shellfish beds (e.g., J. Williams 2006), or to promote the health and diversity of a suite of resources within a particular area, most notably the maintained prairies and meadows in many interior areas along the southern Northwest Coast (e.g., Norton 1979). Appendix C presents tables listing subsistence resources documented in the local ethnographic literature.

Fish

Salmon was the most predictable and single most important food source for all of King County's Native American groups. All six species of the genus *Oncorhynchus* (Pacific salmon and trout) were available to Native Americans in King County: Chinook, coho, chum (*O. keta*), pink (*O. gorbuscha*), and sockeye salmon, and steelhead/rainbow trout. Salmon entered the rivers in the spring, summer, and fall, but the spring and summer salmon were best eaten fresh, before the "growth of the organs of reproduction has reduced the richness of the flesh" (Smith 1940a:235). The fall dog salmon or chum salmon runs drove the subsistence cycle and were critical to the survival of villages through the winter. Dog salmon, having a relatively low oil content, is best for curing for winter stores because when dried it can be stored for an indefinite period of time. Herring, silver smelt, and freshwater fish, especially rainbow trout, were the primary fish in addition to salmon that supported Native Americans in King County, depending on the location of the village. The various fish species for which ethnographic references are made to their traditional use for food or raw material (such as the oil obtained from dogfish) are listed in Appendix C, Table C-1.

Shellfish

Shellfish, primarily clams, and other kinds of invertebrates were harvested and consumed by Native American groups in King County, either raw or cooked (Haeberlin and Gunther 1930; Larson 1993; Smith 1940a; Tweddell 1953). Dried clams, strung on tanned cedar bark, were stored in baskets in the winter houses but were also an important trade item for King County groups with Native American people east of the Cascades. Ethnographically recorded categories of invertebrates traditionally used for food or as implements by local Native American groups are listed in Appendix C, Table C-1.

Mammals and Birds

Deer, elk, and black bear were the most sought-after prey of hunters throughout the region. Mountain goat, rabbit, and beaver were hunted more often by inland groups such as the Snoqualmie, White and Green River groups, and the Upper Puyallup. All groups took small animals and birds, such as chipmunks, ducks, quail, grouse, and pheasant (Larson and Forsman 2001:24; Smith 1940a:247; Smith 2006:185; Turner 1976). Mention of marine mammal hunting in the ethnographic literature of pertinent Native American communities in the vicinity of King County is limited. Tweddell (1953:538) noted that the Snohomish engaged in summer and winter seal hunting to an extent similar to that of their northern neighbors, and implied that other central and southern groups hunted seals more infrequently. Earlier ethnohistoric accounts do indicate widespread utilization of harbor seals, porpoises, and very occasionally whales (e.g., Eells 1985:53, 58). Elmendorf (1960:105–106) gives perhaps the most detailed ethnographic account of seal hunting, in which the Twana of the Hood Canal region west of Puget Sound commonly hunted individual seals "asleep" in open water by canoe and harpoon or net. At certain locations where seals would haul-out some distance above water, they would set stake traps and startle larger aggregations of seals off the rocks and onto their traps.

Animals provided meat but also were essential as raw materials for clothing, utensils, medicine, and other items. Turner (1976:94) wrote of the myriad ways that the Snoqualmie used deer:

> *…deer skin was tanned on both sides and used for shirts, trousers, leggings, moccasins and belts. A cluster of dew claws was tied to buckskin and used as a rattle…the spinal cord was removed and dried. It was split into long strips, and used for fishing line, thread and string. Deer horns were boiled and used for spear points. The deer stomach was dried and used as a sack, and tied with bear grass. Haeberlin and Gunther write that deer tallow was rubbed in the hair to make it smooth.*

Hunting could have taken place throughout the year and was one of the few subsistence activities that occurred in the winter if people needed the meat. Ethnographically and archaeologically documented mammal and bird species are listed in Appendix C, Table C-2.

Plants

The importance of plants and plant gathering may have been underestimated by ethnographers for all Native American groups in King County, as per the case that has been made for this occurring in the Pacific Northwest in general (e.g., Deur and Turner 2005). The location of huckleberry patches conditioned the placement of the hunting and berrying camps in the fall (Smith 2006) and berry fields were burned regularly to promote healthy bushes with big berries (Duwamish et al. 1933; Larson and Forsman 2001:29; Mack and McClure 2002). "Nearly any edible berry was subject to collection, these including salmonberries, huckleberries, native blackberries, raspberries, salalberries, serviceberries, wild strawberries, and blackcaps" (Haeberlin and Gunther 1930:21). Fern roots, camas bulbs, sunflower roots, and wapato, or Indian potatoes, were the most common roots. Camas was associated with wet prairies and wapato with land flooded by fresh water, such as ponds and lakeshores. Medicinal plants like prince's-pine, squirrel tail, and licorice fern are currently sought by Native American people in King County and may have been gathered during the ethnographic period. Other plants like cedar, cattails, beargrass, and cherry bark, as well as pitch from various conifers, were sought for technical purposes. Appendix C, Table C-3 lists plant categories that were traditionally used for food, medicine, ceremonial purposes, or as raw material for implements.

Managed Microenvironments

Certain portions of the landscape used by Northwest Coast Native Americans have long been recognized as anthropogenic, including a variety of plant habitats that have been managed by humans to benefit the production of useful species (Turner and Peacock 2005). Stewardship of certain resources was clearly a goal and intentional changes to portions of the environment are still visible in some places today, although agriculture never developed in this region prior to Euroamerican settlement (a semantic debate with long-term scholarly and political consequences—see Deur and Turner 2005; Suttles 1951, 2005). Prairies are commonly cited as such managed environments, where regular burning of low-lying vegetation created open areas interspersed within closed canopy woodland. These are not natural prairies in Western Washington, but artificial ecotones that attracted ungulates and small game, provided ample plant resources, and improved berry production (e.g., Hedlund 1983; Lepofsky et al.

2005; Norton 1979; Schalk 1988; Turner 1999). The Muckleshoot Prairie near the Enumclaw Plateau and portions of the Snoqualmie Valley are the most prominent remnants in King County of these managed environments and have deep soils that mimic those in natural prairie environments (e.g., Kopperl 2006a; Ugolini and Schlichte 1973; S. Williams 2006). Others like Jenkins Prairie and Meridian Prairie on the Covington Plateau are shown on early General Land Office cadastral survey maps. Ethnographic accounts and archaeological data for these areas and other prairies and meadows in the region reflect their importance to local Native American communities, their extended kin groups, and visitors from more distant places (e.g., Ballard 1929:78; Hunn 1990:130–131; Norton 1979; A. Smith 2006:115; M. Smith 1940b:5–8).

Resource management occurred closer to the shoreline as well. Shellfish beds are a resource increasingly recognized as having been managed in certain places along the Northwest Coast. Intertidal areas ringed and leveled with rocks cleared from within the area improve suitable substrate for certain bivalve shellfish, allow increased density of the shellfish beds, and prevent sediment erosion within the protected area. Although there are no documented accounts or physical remains of such features in King County, they are well known in the northern Gulf of Georgia in British Columbia (J. Williams 2006) and semicircular stone features that may have also, or alternatively, served as tidal fish traps have been observed along the Strait of Juan de Fuca on the Olympic Peninsula (Gary Wessen and Ross Smith, personal communications 2010). In many places along and immediately above the beach, salt marshes provided natural habitat for springbank clover and Pacific silverweed, the roots of which were used for both food and as prestige goods (Deur 2005). This natural habitat was enhanced and enlarged by construction of terraced gardens, some of which were documented by early ethnographers and have been more recently acknowledged by anthropologists as a means not only of resource management but also of delineating ownership and social status (Deur 2002, 2005).

The time depth and explanations of the origin of and reliance on these different kinds of managed environments is the subject of recent inquiry by anthropologists and archaeologists. Ames (2005) provides a review of some intensification models that explain the reasons why subsistence emphasis on certain plant resources increased over time. Both general anthropological models (e.g., Winterhalder and Goland 1997) and those that focus on use of camas and other root crops on the Columbia Plateau (Ames and Marshall 1981; Peacock 1998; Thoms 1989) hypothesize intensification as a response to some combination of population growth, territorial circumscription and reduced access to other more sought-after resources, and environmental changes that increased the availability and abundance of plant resources. As Ames (2005:93) notes, increased effort to manage places on the landscape for plant cultivation, or shellfish harvesting, is one expected outcome, along with the development of the technological means (gathering, processing, and storage tools and features) and social structures (efficient labor management) needed to succeed.

Other Resources

Lithic sources were known by Native American groups. Snoqualmie people used a “flint” quarry near North Bend, and Muckleshoot groups flintknapped at a “flint” quarry near Arch Rock on the Cascade crest (Ballard 1951:2:462). Although Arch Rock is in Pierce County, the location suggests that other lithic sources may occur along the crest or in other suitable outcroppings in the Cascade Range. Ochre was also a mineral sought by ethnographic-period groups (Hedlund et al. 1978). Oral history accounts suggest spring water was sought for medicinal and spiritual reasons (Larson and Forsman 2001). Springs along trails were known and used as interim destinations along the journey, either for replenishing the traveler’s water supply or as a criterion for establishing a campsite.

Technology

The sophisticated technology of the Native Americans of King County is reflected in their material culture: their houses and canoes, fishing gear, hunting and plant collecting equipment, and other everyday tools. The material culture of these communities in turn reflects the potential range of archaeological remains of portable implements (i.e., artifacts) and non-portable loci of activity and the built environment (i.e., features).

Permanent Houses

Planked houses of the winter villages had shed roofs that could be expanded to "prodigious size." Old Man House for example, in Suquamish, was reportedly 1,000 feet long (Waterman and Greiner 1921:16). Duwamish shed houses were assigned to medium and large size categories by Duwamish elders during a 1920s land claims case (Duwamish et al. 1927a). Medium houses measured 48 by 96 feet, and large houses were 60 by 120 feet. The Snohomish also had shed style houses (Haeberlin and Gunther 1930:16). Houses with gabled roofs were reported for the Puyallup (Smith 1940a:281). Discussion in the literature suggests that the shed style is the older of the two styles and that the gabled roof may be a historic development (Mauger 1978:238; Haeberlin and Gunther 1930:16; Waterman and Greiner 1921:14). Gambrel houses were familiar to the Black River Duwamish groups but the structure may have been a historic adaptation or modification of the shed style (Larson 1987b:2–28). By the late ethnohistoric period, adjacent houses of different styles were not uncommon in many communities, as shown in an 1898 photograph (Figure 3-1) of Tulalip houses. Large potlatch houses were reported to be the biggest houses in villages where they were located. For example, the potlatch house at "Ha-ha-poos" near the Duwamish No. 1 Site (45KI23) measured 60 by 360 feet (Duwamish et al. 1927a), and the potlatch house of the Snohomish at Tulalip measured 43 by 115 feet (Haeberlin and Gunther 1930:17).

Figure 3-1. Tulalip houses and canoe, Tulalip Indian Reservation, Washington, 1898.

Some houses in King County probably had central pits, large features constructed for additional warmth and located at the center of the primary living space. Hearths were inside the central pits. Waterman and Greiner (1921:19) believed that the typical shed house had a central pit and that the practice may have been omitted in "later times." Part of the case they make for central pits, in addition to their observation of "housepits" in old village sites, is that the Lushootseed word for "village site," literally means "a collection of housepits" (Waterman and Greiner 1921:2). Waterman (ca. 1920:217) observed an "ancient site" with shell midden and housepits on Quartermaster Harbor, on Vashon Island. Smith (1940a:286) reports that gabled houses also had central pits, though her example was a Nisqually house built in 1882.

Tribes in the Puget Sound area positioned their fire hearths down the center of smaller, narrow houses or around the sides of large houses in front of the bed platforms. Fires were built on the ground, against a log or in pits excavated at least one foot below ground surface (Elmendorf 1960:162; Smith 1940a:286); some may have been raised or surrounded by a bank of earth or shell (Smith 1907:29). Raised fireplaces appear to have been used by the Suquamish at Old Man House. As described by Costello (1974 [1895]:21), "besides the vast amount of crumbled shell mounds there are other and smaller mounds about the site that look as if they might have served the purpose of an elevated fire place."

The Puyallup also adjusted their house floors for water run-off on porous ground using ditches (Smith 1989). Houses may have been swept clean, depending on the personal preference of the occupants. Smith (1940a:279) reported that on a daily basis the Puyallup swept or brushed the floor with hemlock boughs and sprinkled it with water. Other elements of house construction that may manifest archaeologically are floors, fire hearths, house posts, and wall boards, although post-depositional preservation of these features is rare in many circumstances and they may go undiscovered or unrecognized given typical archaeological sampling strategies in the region.

The village "yard" may have been characterized by embankments against the plank house, beaten paths between the houses and the high water mark, canoe paths, enclosures for potato patches, and cooking and storage pits (Gibbs 1877:196). An embankment composed of a layer of dirt 5 feet wide and 1 foot high was recorded for a Puyallup house on Salmon Creek. The embankment was covered with mats for people to sit on (Smith 1989). A house on the banks of Newaukum Creek in the Green River Watershed "…was a big one and had dirt dug out to a depth of about three feet and heaped against the house to protect it from the wind" (Smith 1989). Figures 3-2 and 3-3 show the preference for situating permanent structures, including lone houses and camp buildings, along the coast near easy low-bank access to beaches.

Additional structures in a village might have included menstrual huts, smokehouses, outdoor fish racks, sweathouses, and burials and cemeteries. Fish racks were also found inside houses and were commonly hung over the fires at the sides as opposed to being set in the center of the houses, and could be pushed against a wall when not in use. Woodsheds may have been built against some houses as lean-tos, or as freestanding structures. Sweathouses, round or ovoid, with slightly excavated floors to hold hot rocks, were located with access to the beach or river, and were constructed of a framework covered with boughs, earth, and moss. Sweathouses were recorded on the beach west of First Avenue in downtown Seattle (Bagley 1916).

Stockaded villages have been reported throughout Puget Sound, although in King County, there are only a few references to "fortifications," mainly on the Duwamish River (Waterman ca. 1920; see also Thrush 2007). In addition, Tribal Claims Court testimony describes a fortified Puyallup settlement at the mouth

Figure 3-2. Salmon Bay Charlie's house at Shilshole with canoe anchored offshore, ca. 1903.

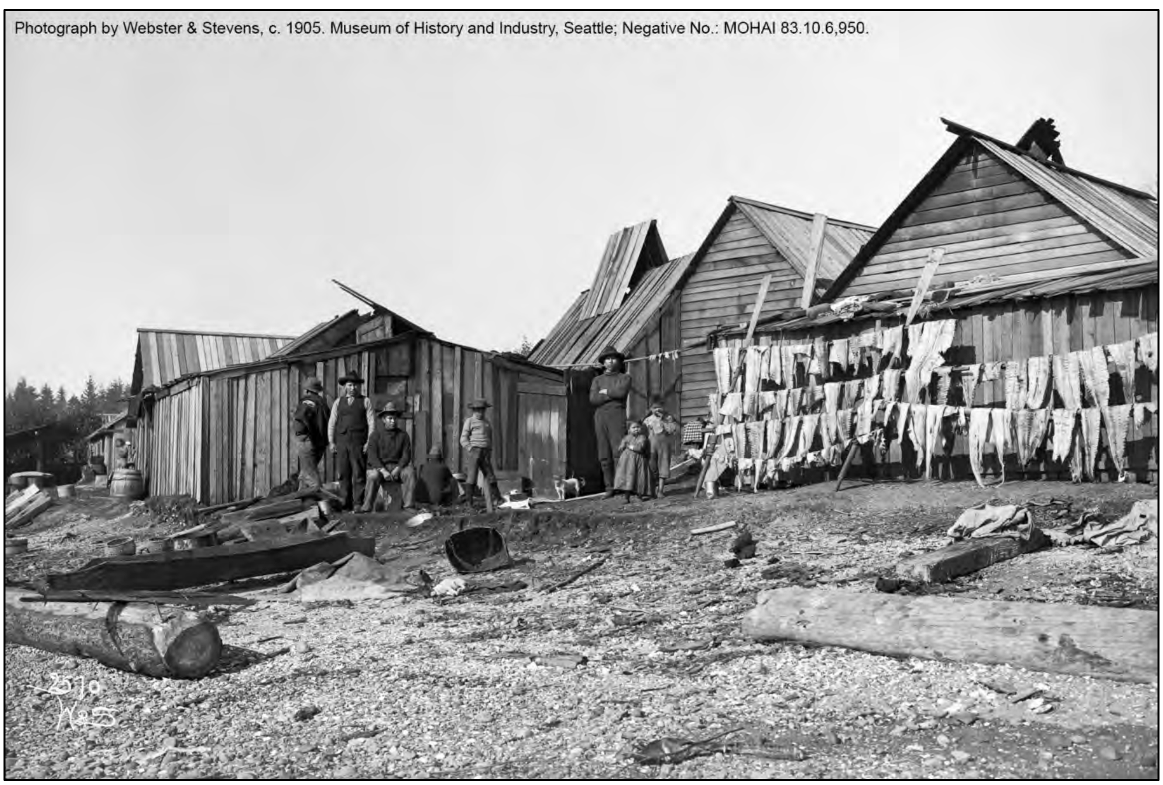


Figure 3-3. Fishing camp at Wing Point on Bainbridge Island, ca. 1905.

of Quartermaster Harbor on Maury Island, which may correspond with archaeological site 45KI843 (Gurand 1927; Minichillo 2009).

Cemeteries were most likely located at a distance from the village. In King County, all burial forms common to Puget Sound were present, including inhumation (Haeberlin and Gunther 1930:53; Smith 1940a:202), surface burial (Gibbs 1877:202; Haeberlin and Gunther 1930:53), and elevated burials placed in canoes or sheds on platforms and/or in trees (Ballard 1951:1:220; Smith 1940a:201; Waterman 1922:192). Certain types of burials may have been class linked. Watt (1931:59) suggests that personal items were buried with the deceased and her vivid description of a cemetery on Elliott Bay includes a description of grave goods that consisted of clothing, tinware, Hudson's Bay Company beads, and stone implements.

Temporary Houses

Temporary shelters were used at fishing stations and other locations where resources were acquired. They ranged in sophistication from brush lean-tos for overnight use to structures with frameworks comparable to winter houses, depending on how long the shelter was used and whether it was reoccupied seasonally.

The semipermanent houses at fishing camps consisted of a pole or post framework left standing from year to year and covered with planks and mats transported from the village house. Trowbridge (1942:394) described what appears to have been a fishing camp in 1853, at Alki Point:

> *We found here seven or eight lodges of Indians…their lodges are built in quite a substantial manner; a frame is first made consisting of a ridge and four corner posts; thick slabs of pine are then placed upright for the sides and ends and mats cover the roof. An opening is left along the ridge for the smoke to escape. The interior is fitted up in a peculiar manner: bunks and shelves are arranged around the wall for sleeping and for containing baskets, skins, etc. A pit about a foot deep and six feet square dug in the center of the lodge is a fireplace and above this on poles their meat, fish, and clams is* [sic] *hung to dry.*

Mat houses were also built at fishing stations and other resource gathering locations. Figure 3-4 shows an example of a mat house on the Tulalip Reservation around 1904. Materials were lighter and could be transported, erected, and deconstructed more easily. Watt (1931:59) described a Native American camp in the 1850s in a way that reflects her bias as a non–Native American, but the impression is one of industriousness on the part of the house's inhabitants. Watt (1931:59) says the camps were, "not so sweet as clover beds. The hundreds of drying fish that were hung on poles over small fires and inside the mat houses, and the strings of clams were very offensive in odor."

Fire hearths, cooking pits for baking and steaming, and pavements or platforms composed of shell and rock may be expected at temporary campsites. Fish racks, sweathouses, and burials may also be associated with temporary campsites. Figure 3-5 shows these features associated with a temporary Snohomish fish camp around 1905.

Muckleshoot informants commented that a campsite was left the way it had been found, i.e., rocks and ashes from fire hearths were scattered and poles from fish racks were cached above the high water mark (Lewarch, Larson, et al. 1996). Others who came upon the campsite location then understood that the campsite was not occupied.

Figure 3-4. Tulalip woman known as Annie's Katie and another woman weaving baskets, Tulalip Indian Reservation, Washington, 1904.

Canoes

Haeberlin and Gunther (1930), Smith (1940a), Tweddell (1953), and Waterman and Coffin (1920) all address regional traditional canoe technology. Ballard (1951:2:441) and Waterman and Coffin (1920) describe six types of canoes that were used in Elliott Bay and on the Green River, including the war canoe, freight canoe, trolling canoe, shovel-nose canoe, one man canoe, and the children's canoe. Figure 3-6 shows a canoe plying the waters of Lake Union around 1885. Archaeological remains of two canoes have been documented in King County, a dugout canoe exposed in a clay riverbank deposit along the Green River (45KI41) and a mostly complete cedar dugout canoe found in Angle Lake near present-day Sea-Tac.

Fishing Technology

Ballard (1957), Haeberlin and Gunther (1930), Lane (1973a, 1973b, 1975b, 1975c, 1983, 1987), Smith (1940a), Swindell (1942), and Tweddell (1953) offer comprehensive data on fishing technology and fish preparation for the Native Americans of King County. Fish were taken throughout King County with a variety of fishing gear and strategies that maximized this resource. While the vast bulk of the anadromous runs were trapped in weirs built to span streams (Figure 3-7), many other devices were used to catch considerable numbers of fish. Spears, gaffs, gillnets, set nets, funnel snares, dip net seines, and trolling with hook and line were all used by Native Americans, based on the watercourse and the fish they sought.

Herring was caught using different methods depending upon whether or not the fish were spawning. A herring rake, a wooden paddle with small, sharp bone points inserted into drill holes on one side, was used to catch herring in deep water when they were not spawning. During spawning season, when herring schools crowded nearshore waters, the fish were dipped with a loosely twined piece of matting (Smith 1940a:256).

Figure 3-5. Snohomish couple in temporary summer house, Puget Sound, Washington, 1905.

Salmon and herring were dried, and smoked or cured for storage by King County Native American groups (Figure 3-8). Methods of drying and curing salmon could be adjusted depending on desired firmness, flavor, or anticipated storage needs. Haeberlin and Gunther (1930:22) report the Native Americans of Puget Sound dried or smoked salmon in "little outsheds…some of these huts had a gabled roof and others were a simple lean-to…salmon was smoked over a fire in the house or shed." Fish were preserved in winter villages and in temporary fish camps (Lane 1975a:33). For the Snoqualmie, Corliss (1972:14) states that salmon was dried on racks "near the houses along the river" and then piled inside "like cordwood" for winter. The drying racks were about 10 feet square, on posts set across with poles to dry the fish and to keep it from the dogs (Kennedy and Larson 1984:52). A fire hearth built under the racks aided the drying process.

Clams were eaten fresh or processed for storage or trade, especially with groups east of the Cascade crest. Horse clams, cockles, and butter clams were the most likely to be preserved for winter use and trade. Clams and cockles were gathered in open-weave baskets and taken to the processing area while horse clams were shelled at the tide line by smashing the clam against a rock (Larson and Lewarch 1995:13–20). In general, clams were either steamed in a rock-lined pit or on a rock pavement for immediate consumption. Butter clams and cockles that were cured for winter storage or trade were steam-baked, removed from their shells, skewered on sticks and leaned against a rack over a fire built on a rock pavement until dried. Fires could also be built in trenches or against logs and the sticks of clams leaned over the fire or against the log (Larson and Lewarch 1995:13–21). Horse clams were not steamed first, but were skewered raw on sticks for drying. Native littleneck clams were steamed and laid on mats in the sun to dry (Smith 1940a:243).

Photographer unknown, c. 1885. Museum of History and Industry, Seattle; Negative No.: SHS 2228.

Figure 3-6. Chudups John and others in a canoe on Lake Union, Seattle, ca. 1885.

Photograph by William F. Boyd, c. 1893. University of Washington Libraries, Special Collections Division; Negative No.: NA4183.

Figure 3-7. Puget Sound area men fishing from wooden platform, Washington, ca. 1890–1895.

Figure 3-8. Salishan man named William We-ah-lup smoking salmon, Tulalip Indian Reservation, Washington, 1906.

Hunting Technology

Hunting strategies and paraphernalia for Native Americans in King County have been documented by Larson and Forsman (2001), Smith (1940a), Tollefson (1993), Turner (1976) and Tweddell (1953). Hunting was conducted with bow and arrow, animal drives, surrounds, jumps, dead falls, traps, snares, nets, and slingshots (Hedlund et al. 1978:64; Smith 1940a; Turner 1976). The shift to firearms begun with the fur trade in the early nineteenth century, was well underway by 1855, and probably completed shortly thereafter. Hunting methods were determined by the animals sought, the size of the hunting party, and the area and distance to be traversed:

> *The type of game, topography, structure of hunting party, and general hunting conditions influenced the nature of procurement. Hunting tools and technology often were specific to certain species as were the many methods of decoying and tracking in hunting* (Hedlund et al. 1978:64).

Deer and elk meat, if not cooked for immediate consumption, was cut in pieces, hung on a frame, and dried. Hunters often dried their meat in the mountains, wrapped it in mats, covered it with boughs and cached it in trees for their return trip or for other hunters (Haeberlin and Gunther 1930:21). Mountain goat meat was cooked, at least partially, in the hunter's overnight camp or the base camp, to remove moisture, and thus weight and bulk, before packing it to the village.

Smith (1940a:246) says of the meat preparation process:

> *The meat to be dried was cut into strips one half inch thick and about eight inches wide and laid on pole racks built about three and a half feet above the fires. The fires used for drying meat were made of limbs which charred and furnished sufficient heat to cook the meat thoroughly but which gave off little or no smoke. As the strips cooked the fat and juice dripped into the fires. When cooked, they were transferred to drying racks or the fire was allowed to get low enough so that the pole racks could be used to finish the process of drying.*

Louis Starr told Ken Tollefson (1993:15) that the hunters built a table rack 20 to 30 feet long by 6 feet wide constructed of sticks 2 inches thick over an alder fire. Bear was steamed in a pit, or baked above ground (Turner 1976:82). The details of cooking in a pit, according to Louis Starr were:

> *It was prepared in a pit 3 or 4 feet in diameter. Hot rocks were rolled in to form a sort of floor. Chokecherry or other branches were placed across the pit and then additional branches at right angles to those to form a rack arrangement. This was covered with red fir branches and leaves. On these the meat was placed. Over it was spread more branches and leaves and finally a cover of earth three or four inches deep...Eating berries, bears at that time of year were fat; in the cooking process, the fat dripped onto the rocks and created steam, making the addition of water unnecessary*... (Smith 1964:217; see also Smith 2006:144-145).

If dried bear meat was desired, Tollefson (1993:16) adds that the hunters constructed windbreaks near a fire to hold the heat and to dry the meat until it was "hard as leather." After the meat was dried, it was stored in deer hides or in baskets (Haeberlin and Gunther 1930:21-22; Smith 1940a:246; Lewarch et al. 1996a), to protect it from dampness.

Beavers were baked or steamed in pits, muskrats were roasted on a stick, and birds were caught with a bow and arrow, loop snares, or nets, and roasted on a spit or boiled in a basket (Turner 1976). Figure 3-9 is an engraving from 1792 showing a pole alignment for netting ducks built along the water passages near Port Townsend.

Plant Gathering Technology

Ballard (1951), Gunther (1981), Haeberlin and Gunther (1930), Larson and Forsman (2001), Smith (1940a), and Waterman (1973) have documented plants and plant gathering techniques and tools of King County Native American groups.

A digging stick about 2.5 feet long "…usually made of wood of some conifer" (Haeberlin and Gunther 1930:20) was used to dig camas and roots. Waterman (1973:53) reports for the Indians of Puget Sound that the digging stick was "…equipped with a cross-piece of elk antler." Preparation of camas could have occurred at the camp or near the edge of the prairie where the camas was collected. Camas ovens were often quite large, and according to Gibbs (1877:194), the hole was heated with stones, and the roots "covered with twigs and earth." Haeberlin and Gunther (1930:23) expanded upon Gibbs' description for the camas ovens for Puget Sound Indians:

> *The pits for cooking were always outdoors and often as much as four or five feet deep. After the food (camas) was placed in a pit in which there had been a fire, it was covered with boughs and earth and a fire again started on top…It took from two to four days, according to the quantity of bulbs.*

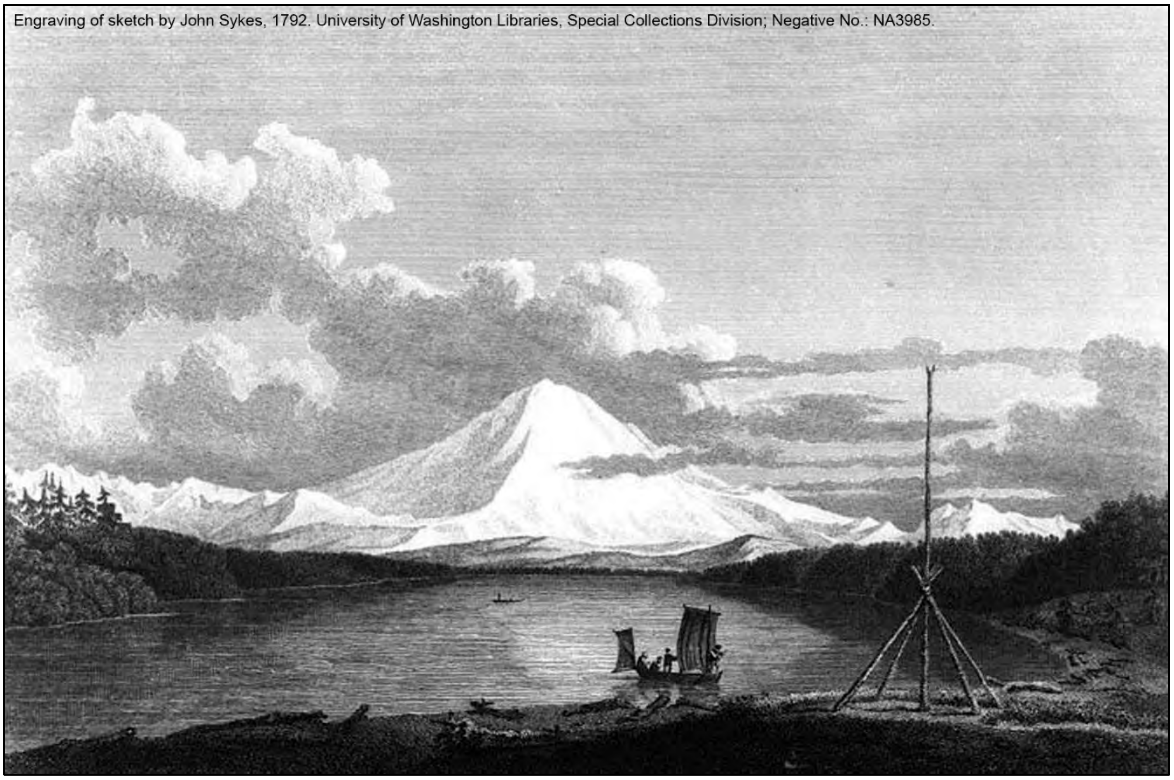


Figure 3-9. Engraving showing Clallam pole for netting ducks in front of Mt. Rainier, 1792.

A wide variety of berries were either collected in folded cedar bark baskets made on-site (Kennedy and Larson 1984:57) or gathered into hard, coiled-root baskets carrying two to four gallons (Smith 1964:176). Some people used berry picking implements. Prior to storage, berries were dried or smoked on cattail mats laid on drying racks over a fire. Smith's informants told him (1964:177–178) that berries were dried on racks covered with mats:

> *Those of the Muckleshoot were four feet wide, fashioned of split cedar woven with inner cedar bark; since cedar is so resistant to rot, they were rolled up on a large roll at the close of berrying season and hidden for use the following year. Under these racks, two small fires were built, one close to each end of the structure.*

Native Americans routinely burned huckleberry fields to encourage the return of bigger, fatter berries and more lush bushes, usually at a wet time of year so that the fires did not damage the large trees (Duwamish et al. 1933:997). Landes (1925:1) states that huckleberries "are at their best in the open burns, as...[they] grow best in these regions." Smith (1964:163) comments that "selected areas were burned at the end of a season to stimulate the spread of berry bushes. This practice tended to remove dense undergrowth, making game more easily distinguishable, as well as to increase browse, thereby enhancing the area's dual use qualities."

Tools and Utensils

Haeberlin and Gunther (1930), Smith (1940a), Tweddell (1953), and Waterman (1973) offer the most comprehensive discussions of tools and utensils used by King County Native American groups. Tools and utensils were fashioned from many types of wood, grasses, animal bone and antler, bird bone, feathers, fur, pelts, stone, and shell.

SOCIAL ORGANIZATION AND INTERACTION

The social fabric of traditional Native Northwest Coast communities was organized around a well-defined class system that differentiated upper- and lower-class village members as well as a slave class consisting of war captives and their descendants (Suttles and Lane 1990). Exogamous marriage requirements for upper class people, intermarriage with groups inside and outside present-day King County, and kin relationships conditioned the movement of people to particular locations. Status may have determined the location of villages and delineation of space within houses (Chatters 1981a). For example, the Snohomish village at the mouth of the Snohomish River was a fortified upper-class village with the lower-class people living outside the fortifications of the upper-class people. Some high- and low-class villages on the Duwamish River were in close proximity to one another (Waterman ca. 1920).

Over time, certain temporary resource procurement camps became seasonal gathering places for large groups of people. These were occasions for social interaction, the formation of economic and political alliances, and the arrangement of marriages. Joint summer camps were at Redondo Beach and on Vashon Island (Smith 1940a:26), while a late summer–early fall gathering place was Government Meadow, near the crest of the Cascade Range (Larson and Forsman 2001:22).

Aspects of past social organization amongst Northwest Coast Native Americans have been the focus of much ethnographic research for over a century, but archaeological signatures of social complexity remain elusive in places such as King County where the archaeological record has yet to yield substantial remains from which such a fabric can be readily inferred. Despite this difficulty, it is important to understand the basic structure of these communities in order to explain patterns that are apparent in the archaeological record of King County. Additionally, as our knowledge of the record of King County improves with more and larger archaeological samples, some research domains currently considered difficult to address, such as social organization, may become more approachable by archaeologists.

The concept of exchange networks is an example of an aspect of social organization that helped shape Native American land use and is directly relevant to interpretations of the pre-contact archaeological record of King County. Trade between local groups and more distant communities was conducted along two major routes. One came from the south, from the Columbia River, north through the Cowlitz, Chehalis, and Black River Valleys, to the Puget Lowlands. The second major trade route went in both directions across the Cascade Range on trails through several mountain passes, including Stevens Pass, Snoqualmie Pass, Yakima Pass, Stampede Pass, Meadow Pass, Naches Pass, and Cowlitz Pass (Anastasio 1985; Gibbs 1855:408; Haeberlin and Gunther 1930:11; Hedlund et al. 1978:39; Smith 1964:232; Teit 1928:121). Trade goods were carried over the trails through the mountain passes to overland trails or along the waterways of the Cedar River and the White and Green Rivers to Elliott Bay. The waters of Puget Sound between the shoreline of King County and many destinations to the north, south, and west, also hosted a web of trade routes plied by canoe.

Trade goods consisted primarily of food items, and changed through time with the introduction of the horse. Teit (1928:121) has the most complete list of trade items and compares the pre- and post-horse diversity of goods:

> *A great impetus was given to trading by the introduction of the horse. Root-cakes, dried berries, buffalo robes, and many other heavy or bulky packs, which in former days it did not pay to carry, were now transported across the mountains. Before the introduction of the horse, the trading with Coast tribes was chiefly in light and valuable articles. Pipes, tobacco, ornaments of certain kinds, Indian hemp, dressed skins, bows, and some other things, were sold to the Coast tribes,*

the chief articles received in return being shells of various kinds. Some horses were also sold to the Coast people.

ETHNOGRAPHIC LOCATIONS IN KING COUNTY

Ethnographic cultural resources documented in King County, ranging from large winter villages to isolated acquisition sites that focused on a single resource, are a useful data set for this context statement and for understanding the recent pre-contact archaeological record. Although settlement and subsistence changed drastically after Euroamerican contact, this period still represents the most recent portion of the continuum of traditional Native American lifeways. Persistence in land use from pre-contact times may be expected, and the kinds and distributions of known ethnographic cultural resources may therefore allow some inferences to be made regarding analogous resource types and distributions farther back in time.

The distribution of known ethnographic locations documented for King County is presented in Figure 3-10, most clustered on waterways. The King County database of almost 500 mapped ethnographic places is compiled from ethnographic and historical sources dating back over a period of at least 100 years, the earliest from maps and ethnohistorical accounts and latest from anthropological research. General Land Office (GLO) cadastral survey maps drafted for much of King County in the mid-nineteenth century provide some of the earliest historical, non-anthropological observations of ethnographic resources (Figure 3-11). Between roughly 1910 and 1940, several anthropologists, including J.P. Harrington, T.T. Waterman, Marian Smith, and Arthur Ballard, collected ethnographic data on groups in Central Puget Sound. Waterman (ca. 1920, 1922) and Smith (1940a) were highly dependent on Arthur Ballard, not only for the ethnographic data that he had collected from Puyallup, Duwamish, and Green River and White River (Muckleshoot) people, but also for access to his informants. Although Ballard, and by extension, Waterman and Smith, documented ethnographic use of prairies, rivers, and trails, his documentation of mountain use was not as complete. Larson (1995a, 1996), Forsman and Larson (1999), and Tollefson (1993) collected ethnographic information in the 1990s, not documented by Ballard, for high elevations in the Cascade Range.

Ethnographic locations in the King County database are placed into four broad categories shown in Figure 3-10, to control for a record compiled incrementally over a much longer period than the span of time archaeologists have been documenting the archaeological record of the County, and classified in a more unsystematic manner. Habitation locations correspond to villages, camps, and other occupations that may have served different purposes over time. Most are near the shorelines of large bodies of water and along the lower reaches of large rivers, however a few ethnographic habitations were documented on Huckleberry Mountain and the upper reaches of the Green River. Resource acquisition sites represent a variety of hunting, fishing, and gathering sites and range widely in area from specific productive spots to much larger geographic areas traditionally used for wide-ranging pursuits such as elk hunting. A third category of other cultural features includes such mapped places as trails, forts, burials, and other ceremonial locations. A final category includes named natural places on the landscape, often prominent landmarks; these named natural landmarks are distributed much more widely across the county than specific cultural features.

Archaeological sites that may correspond with ethnographic period villages in King County include *Sbabadid* (45KI51) on the old Black River (Chatters 1981a), one in Fall City at 45KI263 (Nelson 1998, 2000a; Schumacher and Burns 2005), several on the Snoqualmie River, and one at Tokul Creek (45KI19) (Onat and Bennett 1968). Land claims testimony from 1927 noted a Puyallup settlement of seven

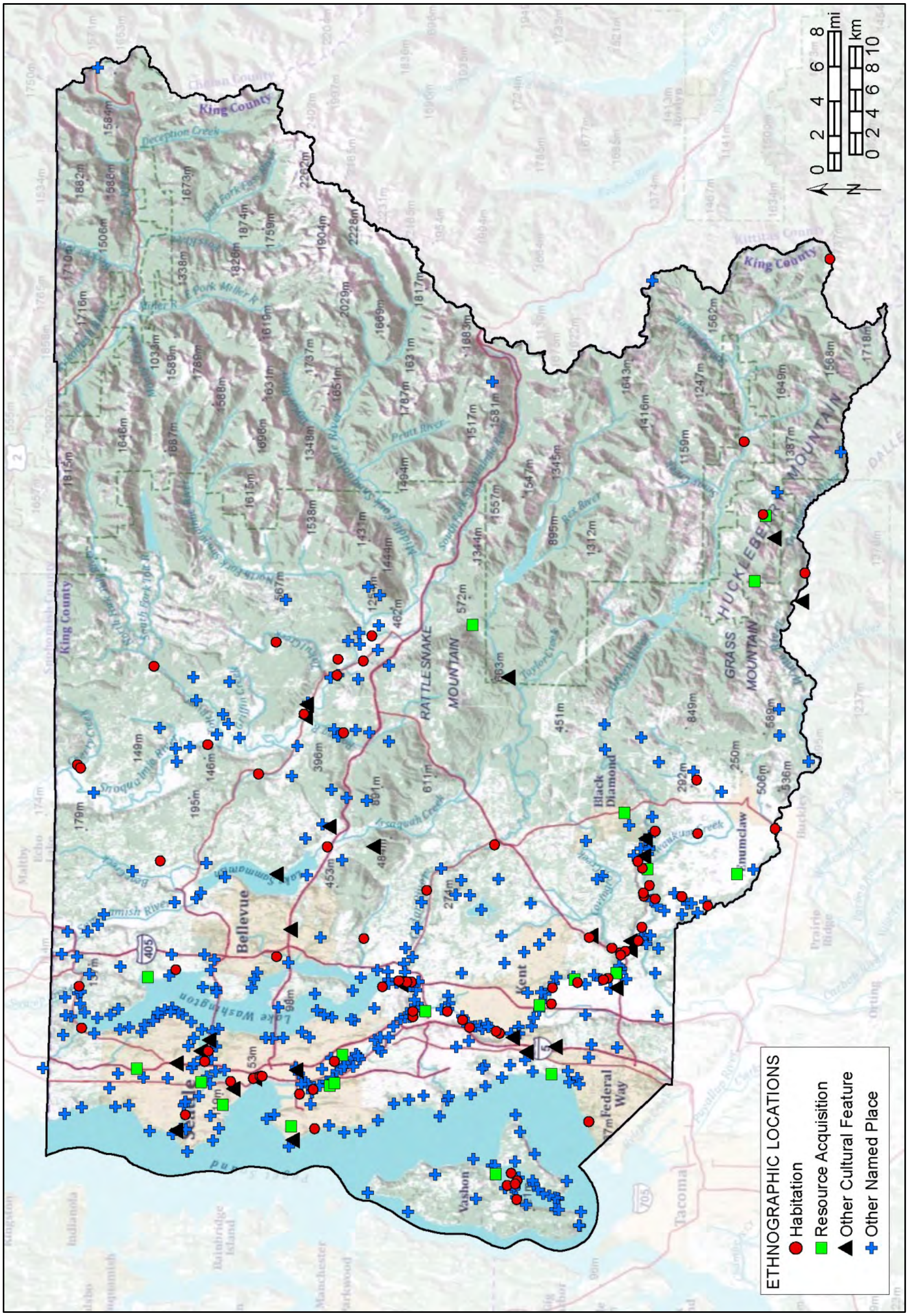


Figure 3-10. King County ethnographic location map.

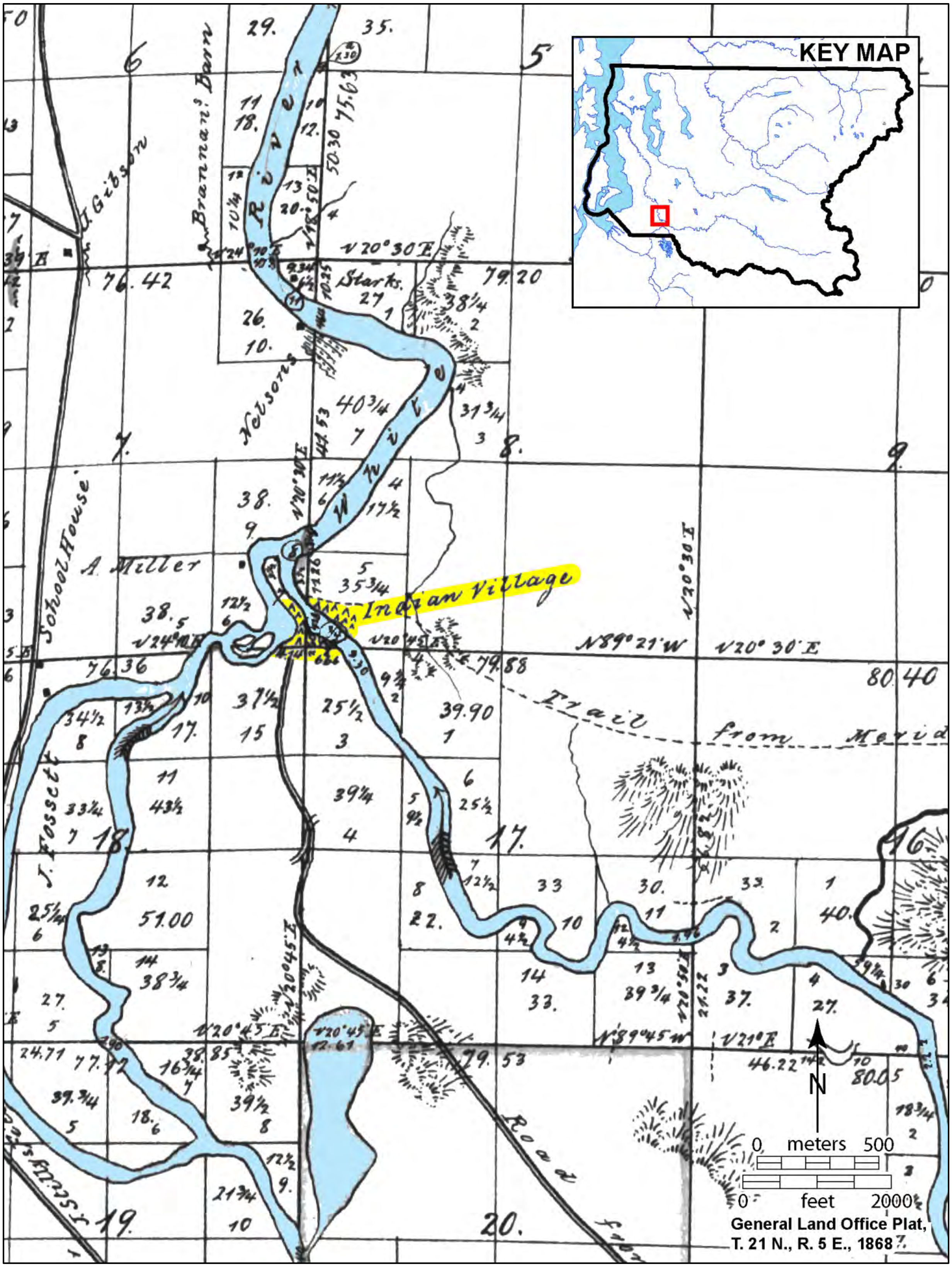


Figure 3-11. GLO map, 1868, showing Native American features.

buildings at the portage between Vashon Island and Maury Island which may correspond with archaeological site 45KI784 (Taylor et al. 2009).

Ethnographic site types reflecting acquisition of food, water, and other important materials include specific areas where resources were harvested and processed, e.g., a place for setting an aerial duck net, a fish weir, or a plant gathering area. Ethnographic resource types that represent fishing and fish processing are often at the confluences of rivers and streams, the mouths of rivers, lake and saltwater shorelines, adjacent to fishing holes, and other places along rivers where fish rested or could be funneled into fish traps. Hunting occurred throughout the river valleys, prairies, meadows, foothills, and mountains of King County. Hunting locations, like plant gathering areas, may be a difficult ethnographic resource type to associate with specific archaeological sites. A burned prairie or huckleberry meadow may be an indicator of huckleberry gathering and processing. Site 45KI55 is an archaeological village site in the Snoqualmie River Valley also identified as an anthropogenic prairie based on the character of soil horizons observed in subsurface exposures (S. Williams 2006). Other ethnographic resource acquisition sites include springs and quarries, although they may or may not be readily visible, accessible, or even extant today. Springs can often be identified by wetland areas, especially if in proximity to a trail, e.g., such as the one associated with the Mule Spring Site (45KI435) (Miss and Nelson 1995). Resources such as ochre or lithic resources were associated with specific areas (e.g., Ballard 1951).

Trails are relatively common and may be considered discrete ethnographic site types that conveyed a person from Point A to Point B, often connecting other different ethnographic site types such as campsites or areas of resource acquisition. Trails may be associated with ridges or follow watercourses, although observations made in the nineteenth century suggested that trail routes often favored ridges over valley floors (McClellan 1855:191). Trails often led through forested areas away from streams and rivers to more open areas. Overnight camps may be strung along the trails to the larger base camps, but trails may also connect landforms like prairies or “meadowlands,” known for their resources. Trails, as well as routes to specific hunting grounds, provided an opening in the forest that allowed hunting and gathering while people traveled (Hedlund et al. 1978:41).

The co-occurrence of a trail and a spring is a strong indicator for the location of a campsite. At least three recorded sites in King County include a historically and/or ethnographically documented trail near a spring. The Sawmill Ridge Lithic Scatter (45KI465) was identified in and adjacent to the Sawmill Ridge Lithic Scatter Trail. The well-defined trail connected the site to a spring, a seep, and an elk wallow (Lewarch 1999:2). The Mule Spring Site (45KI435), a huckleberry camp, is adjacent to Mule Spring and the Slippery Creek Trail (Miss and Nelson 1995). Several springs on Muckleshoot Prairie are near seven archaeological sites and a trail/wagon road (Murphy et al. 2002). Cedar trees peeled for their bark for use in clothing and basket manufacture were commonly located “along travel routes to the berry fields, and adjacent to known Indian trails” (Hollenbeck 1987:12).

Burials in Puget Sound have been documented by Gibbs (1877:202), Haeberlin and Gunther (1930:53) and Smith (1940a, 1989 based on Arthur Ballard’s data). The dead were interred in the ground, on raised platforms, or in canoes suspended in trees. Documented burial places have been recorded on sand spits, islands, and in groves of trees, on bluffs, and with a view of a river. Ballard (1951:1:220) reported that burials were sometimes accomplished through placing the body at the base of a hill or bluff, and caving the dirt from the bluff edge on top of the body. Burials in downtown Seattle were reported by settlers and early historians on the edge of bluffs above the Elliott Bay shoreline (Costello 1974 [1895]:122; Denny 1909:140-141; Watt 1931:58-59). Recent discovery of a contact-period Native American burial (45KI505) on a bluff overlooking the Snoqualmie River Valley is a documented example of riverine burials and a notable instance of early contact-era Native American human remains preserved in a non–shell midden context (Schalk and Schwarzmiller 2002).

Ethnographically recorded place names for natural geographic features may refer to the shape of a bit of topography that looks like an object, but more often, “Indian geographical names bear directly on his food supply” (Waterman 1922:183), and may be on or near locations associated with villages, camps, or places of resource acquisition. Place names with mythological significance were numerous, and were associated with “spots sacred to supernatural beings – spots particularly where various taboos are to be observed” (Waterman 1922:184). Some places may be in the vicinity of known archaeological sites, such as *Swa wa tiu tud* or North Wind’s Fish Weir on the Duwamish River above the archaeological site 45KI267. Conversely, some names with mythological significance pertain to a part of the landscape at such a scale that they cannot feasibly be associated with particular archaeological remains, such as Snoqualmie Falls.

CHAPTER 4. Regional Archaeology and Pre-Contact Culture History

This section provides a synopsis of archaeological chronologies and schematic outlines of archaeological data that have been proposed for the greater Puget Sound and Straits region. A five-period culture historical sequence is then defined that will be used throughout the remainder of the document. The discussion of chronologies also reviews the explanatory frameworks used by archaeologists to interpret the regional archaeological record.

To create the culture historical sequence presented for King County at the end of this chapter, archaeological chronologies and schematic outlines proposed for hunter-gatherer archaeological systems in Western Washington were examined (in light of calibrated radiocarbon dates if possible), and temporal changes in economic organization, social organization, or subsistence-settlement patterns were identified. Schematic outlines of archaeological data were then compared with outlines of environmental regimes through time in Western Washington. Periods when paleobotanists identified changes in environmental variables and when archaeologists suggested changes in the archaeological record were correlated. The 14,000-year record of hunter-gatherer occupation in Western Washington was divided into the five analytical time periods used in the rest of this document based on these correlations.

REGIONAL ARCHAEOLOGY IN A CULTURE HISTORICAL FRAMEWORK

Most chronologies and regional summaries are composed of sequential spatio-temporal units developed using terms from the culture history approach in Americanist archaeology (Lyman et al. 1997). Figure 4-1 compares previously developed culture historical sequences for the region as well as the sequence derived for this context document. The term “phase” is a cornerstone unit of culture historical research, describing occupations or aggregates of artifacts and features that have a specific temporal and spatial distribution (Dunnell 1971; Lyman et al. 1997). Despite this basic practice of grouping temporally and spatially similar archaeological components and artifact assemblages together to form the building blocks of chronological sequences, few synthetic archaeological investigations in the Puget Sound region actually attempt to create and refine formal phases. Instead, these spatio-temporal units have been variously termed components, assemblages, periods, stages, systems, complexes, and other names. This hesitance is in contrast to the Gulf of Georgia region to the north, where sequence-building has followed a pattern similar to other areas of North America (e.g., King 1950; Matson and Coupland 1995).

One main goal of the culture historical approach is to interpret parameters of the archaeological record by constructing units of time and space. This approach is more descriptive than explanatory, and has resulted in considerable debate through the decades about the epistemology of culture historical units of analysis (e.g., Lyman et al. 1997; O’Brien and Lyman 2002). Despite some philosophical controversy, the basic parameters of age and spatial distribution explored in detail by culture historical research are fundamental to any further explanatory endeavors in archaeology, especially in King County where investigations have been limited and biased toward particular landforms and portions of the county (see below and Chapters 5 and 6).

Although not explored in detail in this document, it should be noted that the sequences developed for the Puget Sound region since the 1960s use, either explicitly or implicitly, a culture historical foundation established in the 1940s and 1950s for the Gulf of Georgia area where some of the first major archaeological excavations in the central Northwest Coast took place. Arden King’s excavations in the late 1940s on San Juan Island and Charles Borden’s excavations at several sites along the lower Fraser River in British Columbia laid this early foundation (Borden 1950, 1970; King 1950). King divided the pre-

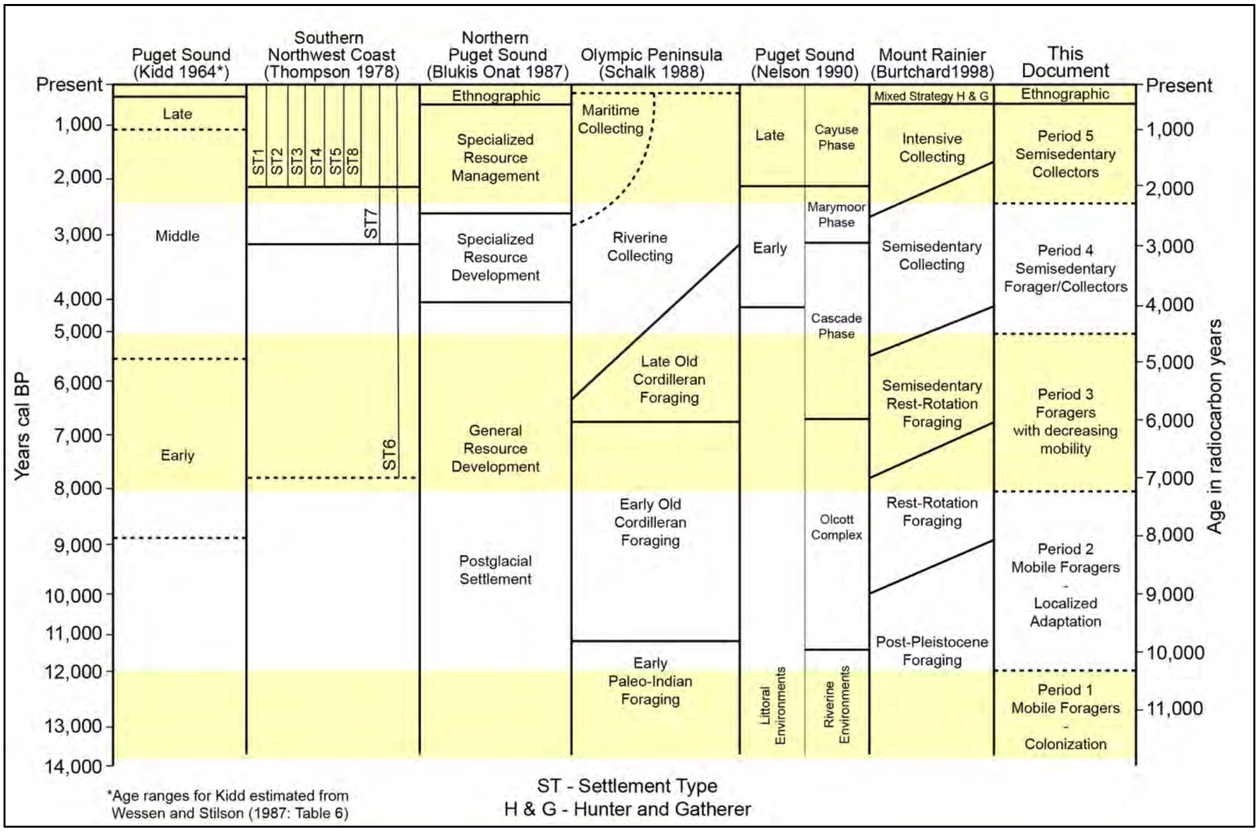


Figure 4-1. Comparative culture historical sequences for Western Washington.

contact culture history of the San Juan Islands into four phases: the Island phase representing an early- to mid-Holocene focus on terrestrial mammal hunting reflected in chipped stone hunting tools and a lack of shellfish deposits; a Developmental phase marked in the archaeological record by the first appearance of shell midden strata and a diversity of terrestrial and marine animal remains; a Maritime phase characterized by much denser shell midden deposits and a greater diversity of artifact types indicating a greater reliance on shellfish and other marine resources, including an increase in ground stone tools; and a Late phase marked by a wholesale shift from chipped stone to ground slate implements and a decrease in the diversity of the tool assemblage.

In the nearby lower Fraser River and delta of British Columbia, Charles Borden and subsequent archaeologists created a similar, parallel sequence for the region that defined phases still in use today throughout much of coastal Washington and British Columbia. More recent syntheses divide the Gulf of Georgia sequence into the Charles/Mayne/St. Mungo, Locarno Beach, Marpole, and Strait of Georgia/San Juan/Stselax “culture types” (Matson and Coupland 1995; Mitchell 1990). All generally hypothesize a shift from an early- to mid-Holocene terrestrial mammal–oriented land use pattern to one of increasing reliance on marine and anadromous fish during the last 5,000 years. The evolutionary trajectory implicit in these sequences is toward the “developed Northwest Coast pattern” and characteristics of ethnographic Northwest Coast Native American groups documented by ethnographers. This framework has produced descriptive and normative research orientations throughout the region, including Western Washington. Beyond the descriptive approach, attempts to explain the ways in which culture historical units differ across sub-regions within the broader Northwest Coast and between the Coast and interior Plateau have generated research questions that tie together culture historical studies with those of social inequality, household/domestic structure, environmental processes, and detailed subsistence studies. The Gulf of Georgia sequence was defined locally but became the most influential of the region as a combination of modern development on both sides of the international border, combined with cultural resource statutes and the NPS' research program on San Juan Island, created the one of the richest archaeological databases anywhere on the Northwest Coast. Many students of the most influential archaeology programs of the mid-twentieth century, most notably at the University of Washington and University of British Columbia, continued the focus on the Gulf of Georgia (e.g., Carlson 1960; Matson 1976; Mitchell 1971). Some, however, expanded survey coverage to the south into the Puget Lowlands (e.g., Bryan 1963; Kidd 1964) and consequently set the stage for the research described below.

Robert Kidd's (1964) Synthesis

Robert S. Kidd was one of the first archaeologists to synthesize archaeological data from Puget Sound and compare attributes of artifacts from sites in Puget Sound to artifact assemblages throughout the continental United States, Canada, and Alaska. Most culture historians accepted Kidd's descriptions of four general stages of development in Western Washington archaeology. This four-stage system was not critically evaluated or refined until the 1980s. Later investigators addressed the system's problems of chronology, but still have not established a firm culture historical framework based on scientific excavations and a large corpus of radiocarbon dates (Campbell 1981:11). Kidd's model continued to be a focus of archaeological inquiry several decades after its formulation (e.g., Wessen and Stilson 1987).

Kidd's four-stage synthesis of the archaeological record of Western Washington is based on "obvious differences" in excavated artifact and feature assemblages (Kidd 1964:2). Four stages or time-space units comprised the system: **Early**, **Middle**, **Late**, and **Historic**, although Kidd did not discuss the historic period in his thesis. The time-space units were classificatory periods described as "...segments of the time continuum through which a distinguishable configuration of forms, or coherent sequence of events, was discernable within a given area or subarea," (Kidd 1964:15). He summarized artifact classes, radiocarbon dates, and site types associated with the periods, but did not assign precise temporal boundaries, which reduced the utility of the system for estimating age ranges to new artifact assemblages. Wessen and Stilson (1987:Table 6) later assigned dates to the classificatory periods proposed by Kidd, and these date ranges are frequently cited by archaeologists working in Western Washington.

Seven criteria defined Kidd's **Early Period**, including: site location on elevations above 30 m (100 feet) and away from contemporary shorelines and major river valleys; absence of shell and organic deposits; absence of house features or hearths; absence of grinding stones; presence of large choppers and scrapers; presence of large stemmed and willow leaf–shaped projectile points and knives; and use of coarse lithic materials, such as basalt, for stone tools. Kidd also noted an absence of bone and antler tools in sites from the Early Period, but attributed lack of such materials to factors of preservation. The Olcott Site (45SN14), on a terrace above the Stillaguamish River east of Arlington, was the site whose content and location typified the Early Period (Kidd 1964:27). Artifacts, primarily from surface collections, were described from a number of sites in Western Washington and compared to artifact assemblages from archaeological sites throughout the United States and Canada. Uncorrected radiocarbon ages from the extra-regional comparative materials referenced by Kidd (1964:71–91) ranged between approximately 10,000 and 5,000 years ago. Using calibrated dates, the Early Period dated between approximately 11,500 cal BP to approximately 5700 cal BP.

Kidd's **Middle Period** had eight distinguishing criteria, including: site location on or near the marine littoral or major rivers; the appearance of shell middens; settlement on offshore islands; the appearance of stone grinding technology; an increase in projectile point styles; addition of cryptocrystalline silica rock to basalt in the suite of materials used for stone tools; the virtual disappearance of choppers, chopping tools, and core scrapers; and the appearance of sculptures manufactured from stone, bone, and antler. Kidd also noted the enormous expansion in the variety of bone and antler tools, but surmised that the increased variety was probably a function of preservation. The Fossil Bay Component of the Fossil Bay Site (45SJ105) serves as the type site for the Middle Period. Comparative radiocarbon ages, age estimates from sites throughout the Western United States and Alaska, and environmental reconstructions discussed by Kidd for the Middle Period generally were between 5,000 and 1,000 years ago, and the calibrated dates between 5700 cal BP and 900 cal BP.

The **Late Period** was restricted to northwestern Washington and southwestern British Columbia and was characterized by archaeological materials that were most similar to the material culture of ethnographically described people, although "no convenient, if artificial, dividing line is discernable between Middle and Late Periods" (Kidd 1964:159). Six criteria demarcated the Late Period, including: the disappearance or curtailment of stone chipping technology in northwestern Washington; the disappearance of some ground stone artifact styles; an increase in the number of thin ground slate points; continued increase in the variety of bone and antler artifact classes; an increase in the number of barbed points of bone rather than antler; and an increase in the diversity of burial styles (Kidd 1964:160). The Fox Cove Component of the Fossil Bay Site (45SJ105) is the type site for the Late Period. Comparative materials from the Late Period date within the past 1,000 years, or since approximately 900 cal BP.

Kidd's system was typical of the culture history genre and demonstrated some flaws. First, the diagnostic characteristics for each time period were mixtures of different kinds of artifact classes. Second, diagnostic characteristics were not comparable among periods and were based on impressions of similarities among sites, rather than quantitative comparisons. And third, all sites within a given time period were assumed to share attributes common to that time period.

Charles Nelson's (1990) Summary

Charles Nelson summarized archaeological data for Puget Sound, highlighting a dichotomy between riverine and littoral archaeological sequences based on differences in midden characteristics and factors conditioning preservation of bone, antler, and shell in each environmental zone. He explained the dichotomy between assemblages from sites in littoral environments and sites in riverine settings based on smaller sample sizes from riverine settings (Nelson 1990:481). Most of his interpretations of the littoral sequence are based on data from the Skagit River delta region and nearby islands. Nelson (1990:482) suggested that the earliest evidence, about 4,000 years ago, of the littoral adaptation in the Puget Sound basin was found in the Deception Pass vicinity at the north end of Whidbey Island and at Old Man House on Agate Passage. The **Early Littoral** adaptation dated between 4,000 and 2,000 radiocarbon years ago, or approximately 4500 cal BP to 1900 cal BP. The **Late Littoral** adaptation, dating after 2,000 radiocarbon years ago (1900 cal BP), was demarcated by stylistic changes in stone, bone, and antler technologies rather than any change in adaptation.

Four archaeological phases comprise Nelson's riverine sequence. The **Olcott Complex** is based on the artifact assemblages described by Kidd and others from the high river terraces in the Snohomish River basin and other drainages in Puget Sound (Nelson 1990:483). Ages for the Olcott Complex in this sequence are between 10,000 and 6,000 radiocarbon years ago (11,400 cal BP to 6800 cal BP), based on similarities with radiocarbon-dated materials in British Columbia and Eastern Washington. The **Cascade Phase** component is identified in materials excavated from the Marymoor Site, on the Sammamish River floodplain, and estimated ages range between 6,000 and 3,000 radiocarbon years ago (6800 cal BP to 3200 cal BP) through comparisons with excavated materials in Eastern Washington. The subsequent **Marymoor Phase** is based on distribution of radiocarbon-dated projectile point styles throughout Washington State and radiocarbon dates from the Marymoor Site. The Marymoor Phase dates between 3,000 and 2,000 radiocarbon years ago (3200 cal BP to 1900 cal BP). **Cayuse Phase** materials (the nomenclature borrowed from Eastern Washington) date to within the past 2,000 radiocarbon years (1900 cal BP). The riverine and littoral sequences are not "correlated in detail" in this framework, and little information was available at the time of his research to characterize the subsistence activities of riverine adaptations (Nelson 1990:483).

Astrida Blukis Onat's Northern Puget Sound Study Unit

Astrida Blukis Onat (1987) summarized broad "developmental stages" in the culture history of Northern Puget Sound and drew extensively on patterns noted by Kidd (1964) and archaeologists working in British Columbia. She inferred developmental relationships from earlier to later periods and refined Kidd's broad four-stage chronological scheme by assigning more precise age ranges. Many of the patterns in artifact assemblages and site characteristics cited by Blukis Onat rephrased Kidd's criteria for defining stages. Blukis Onat noted that most archaeological investigations in Western Washington through the 1970s focused on coastal environments, with only recent interest in foothill and mountain adaptations.

Five developmental stages were postulated (Blukis Onat 1987:17–19). Colonization of the region and initial adaptations to the Puget Lowland occurred between approximately 13,000 and 6,000 radiocarbon years ago (15,000 cal BP and 6800 cal BP) during the **Generalized Resource Development Post-Glacial Settlement** stage (Blukis Onat 1987:17). Coastal inundation and wave erosion probably destroyed many of the archaeological sites dating to this time period, particularly considering the large number of recorded archaeological sites inland from contemporary marine littoral habitats and river deltas, at elevations greater than 100 feet above contemporary sea level. Sites from this time period were typically characterized by low density distributions of artifacts, and were generally identified on the surface of cultivated fields or in settings with shallow soils that were in direct contact with underlying glacial deposits. Site functions included food procurement and food processing, with a focus on terrestrial and littoral resources. Artifact assemblages had diagnostic leaf-shaped projectile points, leaf-shaped knives, pebble tools, and cobble tools. Basalt was the most common lithic material in artifact assemblages. In this developmental sequence, hunter-gatherers may have begun exploiting anadromous fish runs during this time period.

A second developmental stage, **Specialized Resource Development-Developmental Salish**, dated between 6,000 and 2,500 radiocarbon years ago (6800 cal BP and 2600 cal BP). Blukis Onat noted differences in tool inventories between coastal and inland sites, which suggested different kinds of activities that were conditioned, in part, by variation in terrestrial, littoral, and marine habitats. Coastal sites had artifact assemblages with ground stone tools, basalt projectile points, microblades, bone tools, and shell tools. Many coastal sites with favorable conditions for preservation of bone, wood, and shell had specialized bone tools. Inland sites had artifact assemblages with ground stone tools similar to coastal sites, and a variety of chipped stone artifacts manufactured from a wide range of lithic materials. Some sites may have been villages with permanent structures, but most recorded sites were temporary camps focused on food procurement. Shell middens generally developed within this stage after 4,000 radiocarbon years ago (approximately 4500 cal BP) in Northern Puget Sound.

Archaeological systems identical to ethnographic cultures appeared during the third developmental stage, **Specialized Resource Management-Established Coast Salish**, between 2,500 and 250 radiocarbon years ago (2600 cal BP and 250 BP). Maritime adaptations were manifested in artifact assemblages from coastal sites, while artifacts from inland sites demonstrated land mammal hunting and upriver fishing activities. Local and regional variations in artifact assemblages were due to differences in available resources and different culture histories unique to particular areas.

The final developmental stage was defined as **Cultural Conflict-Euroamerican Contact**, a short period between 250 BP and 150 BP. This period is characterized by sites with a small number of Euroamerican trade goods in artifact assemblages that were mainly composed of artifacts typical of the pre-contact period. A drastic decrease in population occurred during this stage due to disease and concomitant change in traditional lifeways.

General patterns regarding settlement location are noted, but areas with high probability for archaeological sites are not specifically identified beyond the general statement that "...permanent residence can only occur at specific locations with relatively long-term topographic stability" (Blukis Onat 1987:19). Virtually all marine shorelines have been eroded in Northern Puget Sound, with the exception of shorelines with bedrock substrates. Thus, most older sites that may have been on the marine littoral have been destroyed. Landforms with some probability for intact archaeological deposits in the Northern Puget Sound area ranged from uneroded river terraces, shores of lakes, and sites in and along peat deposits, to areas in depositional environments on alluvial floodplains (Blukis Onat 1987:20).

Following creation of the Northern Puget Sound Study Unit, Blukis Onat et al. (2001) continued to contribute to regional culture history by incorporating archaeological materials at *Stuwe'yuqw* (45KI464) into a phase system, and listing definitive traits of the Tolt Phase. These traits include Large Side-Notched projectile points, Stemmed or Shouldered projectile points, Cascade projectile points in association with Large Side-Notched points or with Stemmed or Shouldered points, presence of microblade cores and microblades, evidence of long distance trade for lithic materials, and association with Mid-Holocene landforms. The Tolt Phase was defined as the period between 7100 cal BP and 3600 cal BP and was limited to the Cascade Mountain foothills and montane environments east of Puget Sound. Investigations at *Stuwe'yuqw* incorporated new analytical techniques to assess the origin of lithic materials used for stone tools, to classify lithic technology, and to evaluate stratigraphy. Tolt Archaeologists also conducted extensive analysis of the regional distribution and dating of Large Side-notched, Stemmed or Shouldered, and Cascade projectile point styles to evaluate the utility of the projectile point styles for typological cross-dating.

REGIONAL ARCHAEOLOGY IN EXPLANATORY FRAMEWORKS

Some archaeological research within Western Washington has been driven not so much by questions of chronology but by attempts to explain past human behavior in the region using general principles grounded in anthropological and archaeological theory, over the very broad periods of time that are represented in the archaeological record. Most notably in models developed to explain pre-contact Native American settlement and subsistence in upland and montane settings, the archaeological and paleoenvironmental records of these landscapes are used to test hypotheses drawn from broad principles and assumptions derived from evolutionary ecology. The Darwinian selectionist approach has been used in the region as well, explaining changes in the forms of artifacts and composition of artifact and feature assemblages and site settlement patterns over time.

The differences between selectionism and evolutionary ecology in the theory and practice of archaeology have been the subject of vigorous ongoing debate since the 1990s (e.g., Boone and Smith 1998; Lyman and O'Brien 1998, 2001; Neff 2000; see also Schiffer 1996). Thorough review of the debate is beyond the scope of this document. The selectionist framework provides a basis for explaining functional change versus stylistic change, and creates histories that recognize temporal scales on a continuum. The evolutionary ecological framework provides models of settlement and subsistence that can be readily tested using King County archaeological data, and provides explanatory mechanisms that can be readily linked to other research in the region. Incorporation of aspects of these two schools of thought in the explanatory model presented in subsequent chapters does not diminish the value of other models, it was only that these approaches seem most useful for the model proposed.

Selectionist Framework in Western Washington

Gail Thompson (1978) produced the most detailed regional-scale selectionist study for Western Washington in her analysis of archaeological assemblages from hunter-gatherer sites in Northern Puget Sound. Thompson quantified change in the distribution of hunter-gatherer settlement types through time and documented increased use of a wider variety of subsistence resources in Northern Puget Sound over the past 6,000 years. Patterns in the archaeological record of Northern Puget Sound were similar to changes that had been documented in the early archaeological record of the Midwest and Eastern North America. Early generalized hunting-and-gathering systems initially had few site types, and sites were occupied throughout the year to access subsistence resources. The early subsistence systems were characterized as diffuse or extensive economies, because the systems accessed a variety of food resources. Through time, hunter-gatherers in the Midwest and Eastern North America added new resources to the subsistence base through changes in settlement patterns. People used short-term camps to take advantage of seasonal variation in resource productivity. The settlement pattern changed from a system where a few sites were occupied for much of a year to a system where many sites were used for shorter periods of time as seasons changed. Thus, generalized hunter-gatherer economic systems incorporated a wider range of food sources through time, by increasing subsistence diversity. The increase in diversity was reflected in an increase in the range of site types and development of a wider range of tool types that were designed for specific tasks.

Thompson demonstrated that the number of settlement types increased through time as hunter-gatherers acquired a wider variety of seasonally available resources through use of special-purpose sites. Thompson analyzed artifact assemblages using an explicitly functional classification that differentiated between stylistic attributes, or general shape characteristics, and functional attributes, or factors that contributed to the use of an artifact as a tool. Instead of dividing time into a series of discrete units, Thompson focused on delineating the persistence of different settlement types through a temporal continuum.

Sites classified as Settlement Type 6, Thompson's oldest settlement type, were most common from approximately 5000 cal BP to 2000 cal BP, although some Settlement Type 6 sites continued through the early historic period. Settlement Type 6 represented residential base camps that were reoccupied throughout a single year and had access to multiple microenvironments. Hunter-gatherers changed the subsistence-settlement pattern by adding settlement types to the existing system. Around approximately 3,000 to 2,500 years ago, Settlement Type 7 was added to the settlement system. Between approximately 2,000 and 1,500 years ago the number of settlement types increased with the addition of Settlement Types 1, 2, 3, 4, 5, and 8. Thompson suggested that the fully developed subsistence-settlement pattern represented a complex seasonal round, with numerous short-term special purpose sites in a variety of microenvironments and fewer base camps occupied for longer periods throughout a year. Thompson's research later served as the basis for several substantial quantitative functional analyses of artifact assemblages in Southern Puget Sound (e.g., Campbell 1981; Larson and Lewarch 1995; URS Corporation and BOAS 1987).

Evolutionary Ecological Framework in Western Washington

Schalk (1988) and Burtchard (1998) have provided the most extensive applications of the evolutionary ecological approach originating from Lewis Binford (e.g., 1983a, 1983b, 1989) to explain patterns in the archaeological record of Western Washington. Burtchard's (1998) outline of hunter-gatherer adaptations through time in Western Washington in particular contributes elements to this archaeological sensitivity model for King County.

Olympic Peninsula

Schalk's (1988) characterization of hunter-gatherer land use in the Olympic National Park and the Olympic Peninsula evolved from previous research in montane settings in the inland Northwest (e.g., Schalk 1984; Thoms and Burtchard 1987). In the process, he modified the concept of an Old Cordilleran culture, a culture history description of early adaptations on the west slopes of mountain ranges along the west coast of the New World (Butler 1961). Schalk proposed five kinds of land use systems through time on the Olympic Peninsula, representing different adaptations. **Paleo-Indian** land use represents initial colonization of the area following retreat of the Cordilleran Ice Sheet. Large lanceolate and fluted projectile points recovered as isolated finds, often associated with bogs and prairies, provided the evidence of this adaptation. Initial hunter-gatherer colonists are characterized as small groups of foragers who probably hunted large animals that went extinct at the end of the Pleistocene. Paleo-Indian foragers predated the beginning of the Holocene, but probably did not enter Western Washington before 11,000 or 12,000 radiocarbon years ago (13,000 cal BP to 14,000 cal BP) (Schalk 1988:88-90).

The **Old Cordilleran** foraging adaptation spans the period from the beginning of the Holocene to about 3,000 years ago. The Old Cordilleran foraging system was divided into an Early foraging pattern, ca. 10,000 to 6,000 years ago, and a Late pattern, ca. 6,000 to 3,000 years ago. Early Old Cordilleran foraging groups were highly mobile, had small group sizes, and primarily hunted using a "rest rotation foraging" pattern based on the acquisition of abundant elk and deer resources. The ungulates aggregated in foothill and intermontane valley settings in the winter and higher elevation grasslands in the summer (Schalk 1988:90–91). Density of elk and deer was relatively high because of the grass-parkland vegetation that covered much of the region during the dry climatic regime of the time period. Late Old Cordilleran foraging groups faced a dual problem of reduced density of elk and deer, caused by climate change, and increasing group sizes, as human populations expanded after initial colonization of the region (Schalk 1988:102–103).

After about 6,000 years ago, the basic foraging adaptation persisted despite the development of a closed canopy forest. Fish and littoral food resources were incorporated into the economic system in the non-winter months, and group mobility increased. Hunter-gatherers began burning forests and grasslands to provide a more complex mosaic of immature vegetation, which improved forage for elk and deer and increased the array of plant resources. Hunter-gatherers in areas with especially productive riverine resources and/or areas with stress on food resources would have become more sedentary, utilized winter storage of food, and reorganized the subsistence-settlement pattern to move small task groups to food resources (Schalk 1988:116).

Both **Late Old Cordilleran** foraging systems and **Riverine** collecting systems operated on the Olympic Peninsula within this sequence until approximately 3,000 years ago. By this time, the Riverine collecting system encompassed the entire region, with populations aggregated in villages, sedentary to semisedentary communities, and an emphasis on lowland food resources and large-scale processing and storage of salmon (Schalk 1988:119–120). A specialized **Marine** collecting adaptation developed around 1,500 to 1,000 years ago in areas with especially abundant marine resources. The temporal and spatial relationships among land use strategies in this sequence do not represent linear, evolutionary progressions, as shown by the co-occurrence of the Riverine collecting and Late Old Cordilleran foraging land use systems.

Schalk (1988:119) summarizes the major aspects of changing hunter-gatherer land use systems on the Olympic Peninsula:

> *Climatic changes in this model are reduced to a catalytic role in cultural change that is driven primarily by demographic conditions. This model maintains that the major land use changes represented in the archaeological record of the Northwest Coast involved (1) a seasonal shift from hunting as the major year round economic pursuit to use of fish and some marine resources during spring, summer, and fall, (2) a seasonal shift from hunting to stored food as the primary winter subsistence activity, (3) and emergence in some areas of the Peninsula of fully maritime adaptations based upon highly logistic land use strategies.*

It has been noted elsewhere (Lewarch and Larson 2003; Wessen 1990, 1993) that this model hypothesizes several broad-scale cultural changes over the course of 12,000 years that rely on population growth as an explanatory mechanism, without a fuller exploration of the parameters of early- to mid-Holocene population growth. Additionally, Wessen (1993:22–25) views it as a theory-oriented model developed from little early period empirical evidence except the negative findings that are typical of that age range within the existing archaeological database. This lack of data creates the appearance of a long period of stability and low population density until the mid-Holocene. Wessen (1990) also contends that in the process of promoting a particular evolutionary ecological slant within a management document, this model emphasizes terrestrial resources at the expense of shellfish and other coastal resources whose importance have been demonstrated at the Hoko and Ozette Sites. Despite these criticisms, Schalk's Olympic Peninsula model was the first comprehensive attempt in Western Washington to explain the entire time-scale of human land use from mountain crest to marine shoreline.

Mount Rainier

Burtchard (1998) elaborated on the ideas developed for the Olympic National Park for a land use model for Mount Rainier National Park. Hunter-gatherer population density, technological and economic organization, and changes in the kinds and locations of food resources played significant roles in Burtchard's model. Environmental and archaeological data for Mount Rainier National Park and nearby areas were synthesized to delineate six temporal stages that characterized hunter-gatherer land use through time in Western Washington. In this sequence, initial colonization of Western Washington occurred by approximately 12,000 years ago (see Figure 4-1). The **Post-Pleistocene Foraging** groups, ca. 12,000 to 8,000 years ago, utilized elk and other terrestrial mammals, as well as soon-to-be-extinct megafauna (Burtchard 1998:137). People may have used mountain passes in the Cascades and montane and foothill landforms at elevations below the passes, however hunter-gatherer use of montane environments at elevations above 1800 m (5,900 feet) would have been restricted by alpine glaciation, snow cover, and limited economic resources. Because of these constraints, regular use of the montane environment probably dated after approximately 9,000 years ago (Burtchard 1998:138).

According to this study, people focused on plant and animal resources in lowland and foothill habitats during the **Rest-Rotation Foraging** period, between approximately 9,000 and 6,000 years ago. Small populations of foragers moved short distances between camps in the lowlands and camps in the foothills to hunt elk and deer and acquire plant resources. Seasonally variable aggregations of elk and deer conditioned the location and size of short-term residential camps. Periodically, groups moved to other, less intensively utilized areas, allowing elk and deer populations to regenerate, hence the term "rest-rotation." This strategy was predicated on low hunter-gatherer population densities, because each hunter-gatherer group required access to relatively large hunting territories and minimal competition from other groups (Burtchard 1998:140). Hunter-gatherer use of higher-elevation montane habitats would have been rare during this period due to a relatively low density of food resources.

The period between 7,000 and 4,000 years ago was characterized by continued rest-rotation foraging land use, but hunter-gatherer group mobility changed as a consequence of increased population density and reduced availability and density of elk and deer (Burtchard 1998:141). This adaptation is characterized as **Semisedentary Rest-Rotation Foraging**. Regional climate change caused a shift in vegetation patterns from relatively open forest-parkland habitats in lowland and foothill settings to a closed canopy forest. Lowlands and foothills had fewer areas of abundant forage for elk populations, while montane tundra and parklands increased in importance as sources of seasonal forage. Foraging groups throughout most of the region retained small group sizes, continued to move between camps frequently, and did not extensively use bulk processing and storage. Increased population density, coupled with a decrease in available biomass from elk and deer, resulted in some hunter-gatherer groups utilizing less optimal habitats than had been used previously. Some groups in marginal environments modified foraging strategies to include longer stays at some base camps and incorporated storage technology to provide resources during the winter. People developed a wider range of foraging strategies that incorporated bulk processing and seasonal storage. Montane habitats were used more frequently than in previous periods (Burtchard 1998:141).

The period between 5,000 and 1,500 years ago is characterized as **Semisedentary Collecting**, marked by a shift in mobility patterns and technological and economic organization. By approximately 4,000 years ago, Burtchard (1998:142) suggested that a combination of increased population density and decreased abundance of terrestrial mammal resources, due to habitat changes associated with development of closed canopy forests, stimulated several changes:

1) increased use of fire to expand ungulate habitat, particularly in lowland and foothill settings;
2) loss of rest-rotation options;
3) more intensive reliance on mass harvested and stored anadromous fish and other storable commodities;
4) loss of residential mobility; and
5) logistical reorganization consistent with intensive land use requirements.

Hunter-gatherers continued to utilize montane habitats throughout the period, but apparently at lower levels of intensity and in different ways within the reorganized collector system (Burtchard 1998:145).

The fifth period of this sequence was designated **Intensive Collecting**, between 2,000 and 400 years ago, and is characterized by a continued increase in hunter-gatherer population density and low food resource productivity of closed canopy forests. Hunter-gatherers expanded strategies to increase food productivity, such as burning areas in lowlands and foothills to increase forage for elk and deer; using salmon more intensively; using plant resources suitable for mass harvesting and storage more intensively, such as huckleberries, camas, and wapato; and collecting littoral resources more intensively. People are hypothesized to have increasingly incorporated low return mass harvestable food resources into the economic system, utilized marginal environments more intensively, expanded trade and exchange networks, defined and defended territory on a more regular basis, and had conflicts and competition with adjoining groups. In this model, littoral habitats and less productive salmon streams were used more intensively than during previous periods. Hunter-gatherers continued to use montane habitats, and may have increased intensity of their use as a means of establishing and defending territories.

Burtchard's model of hunter-gatherer land use through time had overlapping starting and ending dates between time periods to emphasize different adaptations as coeval. Expanding on earlier management recommendations for Olympic National Park, Burtchard described the kinds of sites that would be expected, activities and groups that produced the sites, artifact and feature classes, probable site locations relative to environmental variables, and probable ages of site types in Mount Rainier National Park. Burtchard provided explicit definitions of environmental characteristics, site types, and rationale for site locations throughout Mount Rainier National Park. His analyses are useful to estimate hunter-gatherer archaeological resource types, densities, and locations in foothill and montane landforms of King County.

Other Frameworks

This context document is not intended to be a comprehensive review of all culture historical sequences for the Northwest Coast or the models that attempt to explain cultural changes and archaeological manifestations within them. The specific chronological sequences developed for the Puget Lowlands and surrounding mountain environments were reviewed here, along with local broad-scale diachronic explanatory models. At the end of this chapter and in several subsequent chapters a chronological sequence and explanatory model are created, derived from what are considered appropriate aspects of some of these models. Other explanatory frameworks have been developed for the south and central Northwest Coast, however, that will undoubtedly be useful for future archaeological research in King County and the rest of western Washington. Many of these focus on economic changes postulated over time within a particular sub-region (e.g., Croes and Hackenberger 1988), or the interplay between economic development and institutionalized social inequality that has seen a stronger research interest in British Columbia (e.g, Archer 2001; Coupland 1988; Coupland et al. 2001; Grier 2006). The theoretical and explanatory aspects of some of these frameworks are discussed again in Chapter 7.

ARCHAEOLOGICAL CHRONOLOGIES FOR PUGET SOUND AND WESTERN WASHINGTON

The review of culture history studies earlier in this document noted that culture historians provided a general chronological framework to interpret the archaeological record of Western Washington. To expand that earlier discussion of archaeological chronologies, this section includes a comparison of several chronological sequences, to identify periods when hunter-gatherer land use appears to have changed. By establishing critical time periods common to most archaeological outlines, situated within a consistent calibrated timeline, the archaeological record can be partitioned into meaningful temporal units. Ideas and interpretations from the different approaches previously discussed above are used here to develop a comprehensive summary of hunter-gatherer adaptations in Western Washington. The previous sections included summaries of interpretations and chronologies developed using several of the most common theoretical approaches used by professional archaeologists working in Western Washington. The multiple chronologies and inferences regarding land use share some common archaeological ideas summarized in the following paragraphs. Convergence points among these chronologies support a five-period chronological sequence. Each period represents distinct hypothesized land use patterns by the occupants of this region. Those patterns have implications for expected manifestations of the archaeological record, and if this explanatory model holds, the sequence has related implications for estimated archaeological sensitivity across the landscape of King County.

Most archaeologists working in the Pacific Northwest agree that archaeological evidence supports the solid presence of hunter-gatherers in Western Washington by approximately 14,000 cal BP (Ames and Maschner 1999; Burtchard 1998; Schalk 1988). Recent reviews of regional archaeology discount the purported association of hunter-gatherer artifacts and an extinct mastodon at the Manis Site near Sequim (Ames and Maschner 1999; Schalk 1988). The best evidence comes from the Richey-Roberts Clovis Site in East Wenatchee, which has fluted Clovis projectile points associated with a volcanic ash that erupted from Glacier Peak ca. 11,250 radiocarbon years ago (ca. 13,000 cal BP) (Mehringer 1989:52). Isolated fluted projectile points have been recorded in bogs and on the surface of prairies in Western Washington and on the shoreline of a lake east of Snoqualmie Pass (Ames and Maschner 1999; Burtchard 1998; Meltzer and Dunnell 1987; Osborne 1956). Unfluted concave-based projectile points and stemmed points are part of a larger stone tool assemblage found in situ below peat dating to the terminal Pleistocene along Bear Creek in the City of Redmond (Kopperl et al. 2015). Artifacts assigned to the Western or Intermountain Stemmed Tradition have contemporaneous or even earlier dates than Clovis assemblages in the Great Basin and Plateau region (Beck and Jones 2010), and have been found in Eastern and Central Washington and as close as Packwood, south of Mount Rainier (Mack et al. 2010). Based on comparisons of this meager data set with Paleoindian and Paleoarchaic sites elsewhere in the United States, the hunter-gatherers who first colonized Western Washington after the retreat of the Cordilleran Ice Sheet probably were mobile foragers moving throughout the region in small groups to fish, hunt, and collect plant foods.

Archaeological studies in analogous deglaciated coastal environments in the northeastern United States and eastern Canada indicate generalized foraging adaptations with sites on the marine littoral. Coastal sites have evidence of fishing and hunting sea mammals and terrestrial fauna. The general pattern of Clovis people in North America was to utilize a wide range of food resources available in a particular region. In Puget Sound, coastal, riverine, and grassland habitats extant by about 14,000 years ago would likely have hosted small, seasonally restricted occupation and resource processing sites. Archaeologists have conceptualized the initial foraging adaptation in the Olympic Peninsula as lasting until about 11,000 cal BP, in the Central and Southern Cascade Range until 10,000 cal BP, and in the North Cascade Range until 9000 cal BP. Nelson (1990) suggested a hunting adaptation focused in river valleys between 11,000 cal BP and 6800 cal BP.

Blukis Onat (1987), Burtchard (1998), Kidd (1964), and Mierendorf (1986) hypothesize changes in the subsistence-settlement pattern of the Cascade Range, Northern Puget Sound, and Southern Puget Sound by around 9000 cal BP. Burtchard's model includes a shift from initial Post-Pleistocene foraging to more systematic Rest-Rotation Foraging systems, which was roughly equivalent to the changes noted by Mierendorf in the North Cascades.

Burtchard, Kidd, Mierendorf, Nelson, and Schalk propose changes in hunter-gatherer subsistence-settlement patterns around 7000 cal BP to 6000 cal BP. Burtchard, Mierendorf, and Schalk suggest the shift in mobility and resource utilization occurred in concert with a major climate change, increasing hunter-gatherer population density, and changes in the abundance and location of elk and deer. In Thompson's study area, multi-season base camps appeared in the archaeological record by 6000 BP. Nelson also noted changes associated with the Cascade Phase in river basins.

The period between approximately 6000 cal BP and 5000 cal BP included increased sedentary occupations in the North Cascade Range, Olympic Peninsula, and Central and Southern Cascade Range. Burtchard and Schalk suggest that this time period marked the beginning of economic and technological systems that utilized mass processing and storage of salmon and storable plants. The structure of the settlement pattern changed from residential groups moving seasonally as a single unit, to long-term use of some areas by residential groups and movement of smaller task-groups from long-term base camps. Blukis Onat, Burtchard, and Nelson identify organizational shifts in the archaeological record around 4000 cal BP, primarily due to increased utilization of marine littoral resources.

The period around 3000 cal BP is identified by Mierendorf, Nelson, Schalk, and Thompson as a time of change in subsistence organization and settlement patterns. Thompson notes the addition of a new settlement type in Central and Northern Puget Sound. Schalk suggests that virtually all hunter-gatherer subsistence-settlement systems on the Olympic Peninsula were part of a regional pattern that focused on salmon fishing. A specialized maritime collecting adaptation developed in especially productive marine littoral habitats on the Olympic Peninsula coast around 2800 cal BP. Mierendorf posits a semisedentary foraging subsistence-settlement pattern in the North Cascades that was similar to ethnographically described patterns.

Between 3000 cal BP and 2000 cal BP, the ethnographically documented subsistence-settlement pattern may have appeared throughout the Puget Sound region (Blukis Onat 1987; Burtchard 1998). Thompson and Nelson suggest that this pattern probably developed between 2000 and 1500 cal BP. Kidd suggests patterns similar to ethnographic patterns developed within the past 1,000 years.

Each of the seven schematic outlines described above uses slightly different temporal periods to organize hunter-gatherer subsistence-settlement patterns and to account for patterns in the archaeological record of Western Washington (see **Figure 4-1**). In spite of the differences among the schematic outlines, several dates are consistently identified as important points that demarcated possible changes in hunter-gatherer land use. The period between 11,000 cal BP and 10,000 cal BP was identified as one of "settling in" by the hunter-gatherer groups who initially colonized Western Washington at some earlier point following deglaciation. Shifts in foraging patterns occurred between 9000 cal BP and 8000 cal BP. Changes in mobility patterns and economic and technological organization occurred around 6000 cal BP. By 1500 cal BP, hunter-gatherer land use patterns were similar to those described during the ethnographic period. Burtchard (1998) and Schalk (1988) demonstrate overlap between different adaptations in their definitions of time periods and schematic diagrams that showed changes in land use through time. Thompson (1978) provides a parsimonious account of changes in land use by plotting the distribution of settlement types in time and space. Quantitative patterns in the data demonstrate changes in land use through time, without dividing the temporal continuum into periods. Discussion of diachronic changes in the archaeological record of neighboring regions, including the Gulf of Georgia, northwestern Oregon, and the Columbia Plateau is beyond the purview of this document, but the changes described above for Western Washington did not happen in isolation, especially those correlating with broad-scale environmental changes such as fluctuations in relative sea level and changes in regional climate regime at the end of the Pleistocene through the mid-Holocene. Useful overviews of the pre-contact cultural and environmental sequences of these areas include those of Ames (1994a), Ames and Maschner (1999), Chatters (1995), Lyman (1991), and Moss and Erlandson (1995), among others.

A CHRONOLOGICAL SEQUENCE FOR KING COUNTY

This context statement provides the basis for developing an archaeological sensitivity model of King County. Several approaches to archaeological analysis have been discussed, with particular emphasis on the schematic outlines of hunter-gatherer land use in Western Washington associated with each approach. Culture history provides a general chronological framework and documents some of the kinds of artifacts, features, and site types that occur here. Selectionist studies quantify the range of functional and stylistic variation in archaeological assemblages from hunter-gatherer sites. Practitioners of the evolutionary ecological approach expanded on the results produced by culture historians to estimate locations and kinds of hunter-gatherer archaeological materials through analysis of environmental data.

Five broad analytic time periods are established to analyze archaeological and environmental data in King County. The time periods are based on analysis of geological and paleobotanical data, combined with pertinent archaeological chronologies for Western Washington. The beginning and end points of each analytic period have been demarcated by patterns in the geological, paleobotanical, and archaeological records identified as important markers of change by both geologists and archaeologists. The prevailing hypotheses of most geologists and archaeologists working in Southern Puget Sound have been compiled through this historic context study, to identify periods that encompass important patterns in environmental and archaeological data.

The first analytic time period between 14,000 cal BP and 12,000 cal BP was one of relative postglacial environmental stability in Western Washington and colonization of Western Washington by hunter-gatherers after the retreat of the Cordilleran Ice Sheet. Boundaries of the analytic time period represent regional climate and vegetation patterns and estimated entry dates of the first hunter-gatherers into Western Washington. The second analytic time period encompasses a period of postglacial environmental change in Western Washington between 12,000 cal BP and 8000 cal BP, and is characterized by increasingly sophisticated land use strategies adapted to local environments and their shifts in regional climate and vegetation patterns. The third analytical time period between 8000 cal BP and 5000 cal BP encompasses a change from a warm, dry climate to a cool, moist climate. Archaeologists have proposed important reorganization of hunter-gatherer subsistence and technology within this analytic time period.

The fourth analytical time period, between 5000 cal BP and 2500 cal BP, includes the appearance of shell middens in the archaeological record of Puget Sound, and the development of old growth Douglas-fir and western hemlock forests in the Puget Lowland. Much of the contemporary Duwamish River–Green River Valley was filled with alluvial sediments during this time period. Most archaeologists infer shifts in hunter-gatherer economic and technological organization in the analytic time period between 5000 cal BP and 2500 cal BP. The fifth analytic time period brackets the time between 2500 cal BP and the commencement of settlement in the area by Euroamericans about 200 years ago, encompassing developments in hunter-gatherer economic and social patterns and ending with initiation of Euroamerican contact. The archaeological record for this portion of the Puget Sound shows an increase in the number of shell midden sites after 2500 cal BP. The period also includes adaptations to localized environmental changes caused by the 1100 cal BP earthquake on the Seattle Fault and possible changes in economic and social organization as a result of Euroamerican contact.

CHAPTER 5. Classification of Archaeological Resources of the Puget Sound Region

In the late 1940s and 1950s, ethnographer and archaeologist Marian Smith observed differences in the land use patterns of Puget Sound hunter-gatherers that were linked to environmental and ecological variables. Smith (1956:Figure 1) proposed a foothill or interior province of hunter-gatherer artifact styles and adaptations to the Cascade Range and foothills distinct from those developed along the marine shoreline. She noted unique attributes of ethnographic peoples and archaeological cultures in Puget Sound and suggested “Puget Sound probably owes its basic orientation to the old culture of the foothill province” (Smith 1956:291). Though criticized by some anthropologists at the time (e.g., Suttles 1957), Smith’s observations presaged the interest of contemporary archaeologists in documenting variation and persistence in technology, settlement patterns, and subsistence organization by environmental zones in Western Washington. Burtchard (1998; Burtchard and Miss 1998), Lewarch and Benson (1991), Mierendorf (1986; Mierendorf et al. 1998), and Schalk (Schalk and Taylor 1988) identify variation among hunter-gatherer archaeological sites in the Cascade Range and Schalk (1988) does so for the Olympic Mountains. Campbell (1981), Larson and Lewarch (1995), Schalk (1988), and Thompson (1978) document variation among sites on the marine littoral, alluvial floodplains, and glacial drift plains of the lowlands.

Some more recent archaeological syntheses suggest that hunter-gatherer archaeological sites in the Central and Southern Puget Sound were part of a stylistic and adaptation sphere different than that of the Northern Puget Sound and Gulf of Georgia regions (Lewarch et al. 1995; Lewarch and Bangs 1995a, 1995b). Stylistic elements, seasonal availability of resources, topography, and interactions with adjacent peoples combined to produce patterns in the archaeological record that vary from areas to the north and east, much as described by Smith (1950, 1956) for the Central and Southern Puget Sound.

Despite the hypothetical differences between the Central and Southern Puget Sound and the rest of Western Washington in terms of pre-contact settlement, subsistence, and their archaeological manifestations, the archaeological record from the broader region is a useful and necessary starting point to create a classification of archaeological resource types used in the sensitivity model. Characteristics of selected archaeological assemblages from the Puget Sound region are summarized in this chapter, including, when possible, artifact and feature assemblages from the entire time span of hunter-gatherer settlement in Western Washington and from a variety of specific environments and landforms. Assemblages are from relatively well-dated contexts that are representative of archaeological materials from different time periods, occurring on various landforms and representing different kinds of activities. Not all sites recorded in Western Washington are included in the summary. Instead, the focus is on site assemblages from environmental settings that provide useful analogs for understanding the archaeological record of King County, including some assemblages from farther afield associated with time periods or landforms underrepresented in the known archaeological record of King County and the Central and Southern Puget Sound.

This chapter begins with a brief discussion of methodological issues that persistently shape the way we view the archaeological record in King County, as well as much of the rest of the Northwest Coast. The sample sizes attained by archaeological fieldwork are conditioned by research designs, practical logistical and budgetary constraints, and the particular depositional contexts of specific sites. The inferences we draw from those samples are in turn limited by such factors. Some of these issues are also incorporated into discussions in subsequent sections of this document, but warrant a brief summary here.

The remainder of this chapter provides a classification of Native American archaeological resources for King County based on the known regional archaeological and ethnographic record, and generalizes changes in settlement and subsistence on the King County landscape based on changes in the known distribution of particular site types among the Analytic Periods defined in Chapter 4. Greg Burtchard's (1998) detailed site classification for the Cascade Range provides a useful framework for incorporating ethnographic data into a regional settlement typology. A primary goal of the typology is to produce mutually exclusive classes of archaeological resources that can be distinguished in a relatively straightforward manner by basic archaeological site parameters, content and proportion of general categories of archaeological material, and location on the landscape. Reliability of this regional summary is dependent upon consistent assignment of artifact assemblages to time periods using calibrated radiocarbon dates, stratigraphic temporal markers such as peat and volcanic ash or tephra layers, and artifact styles and technology that have been assigned age ranges in other areas. A crucial step in the development of regional archaeological summaries is consistent use of analytic units to compare site data. Most archaeologists use assemblages of artifacts and features from a single stratum, or a group of strata, in an archaeological site as units to compare artifact classes within and among sites. A group of roughly contemporaneous artifacts and features from a site generally is termed a component.

METHODOLOGICAL FACTORS SHAPING THE ARCHAEOLOGICAL RECORD

Given the diversity of local and regional Native American settlements, subsistence resources, and material culture noted in the ethnographic and ethnohistoric records, a similar diversity may be presumed in the archaeological record. This is a basic assumption of most archaeological site typologies in the region, along with the assumption that we may confidently divide variability in the archaeological record into meaningful categories. The past several decades have seen archaeologists in King County identify archaeological deposits and classify them into a variety of site types with different inferred functions. By far the majority have been surmised to reflect areas used briefly for a limited range of activities, such as stone tool manufacture and maintenance, or plant or shellfish processing—represented by low-density lithic scatters, isolated concentrations of fire-modified rock, or thin shell midden lenses. In much rarer instances, archaeologists have found more spatially complex deposits, usually exhibiting greater numbers of categories within artifact, faunal, and feature assemblages, and interpreted them as more intensively used residential encampments. Recorded archaeological deposits inferred to be larger communities or village sites are extraordinarily limited in King County.

One of the most frequently used means of quantifying the differences among archaeological site assemblages is comparison of diversity indices to differentiate site types within a functional site classification. Measures of diversity include *richness*, which is the number of categories observed in a particular sample (e.g., the number of tool types or raw material types in a lithic artifact assemblage, or the number of animal taxa represented in a faunal assemblage), or *evenness*, which is how those categories are proportioned throughout a sample—both of these measures, to differing degrees within particular samples, characterize diversity (Jones and Leonard 1989).

Binford (e.g., 1980, 2001) conceptualized hunter-gatherer settlement patterns as a spectrum between *foragers* who maintain group residential mobility by shifting settlements to resources, and *collectors* who maintain logistical mobility by dividing communities into task groups that establish more specialized encampments and extraction sites near resources and transport those resources back to more centralized settlements. Binford's influence can be seen in many, if not most, archaeological models of hunter-gatherer settlement and subsistence in North America, which often incorporate contrasting modes of mobility and settlement depending upon the distribution and patchiness of resources across a landscape and various population and social parameters of hunter-gatherer communities. This approach has been the target of many criticisms within the ongoing debate of archaeological and anthropological theory, from perspectives as divergent as post-processual (e.g., Preucel 1995) and Darwinian selectionist frameworks (e.g., Jones et al. 1995; Lyman 2007; Lyman and O'Brien 2004). Despite such criticism, the basic premise that small archaeological sites with few functional artifact types or subsistence taxa represent limited-use loci or temporary encampments, those with greater assemblage diversity represent logistical settlements, and those with greater stratigraphic complexity and assemblage diversity represent more permanent settlements, is an aspect of Binford's legacy that persists.

Thomas (1989) reviews the use of diversity measures in hunter-gatherer archaeology and how they applied to his research in the Great Basin, where the forager-collector framework has generally proven to be a useful dichotomy. Despite the well-reasoned theoretical expectation that the archaeological remnants of long-term residential sites should exhibit greater artifact assemblage diversity than those of resource extraction sites or short-term logistical camps, measures of diversity in archaeological assemblages by and large reflect the sample size of that assemblage. Holding sample size constant, however, the inferences drawn by comparison of diversity measures among multiple sites appear to maintain their utility. The relationship between sample size and taxonomic or assemblage richness has been a subject of more intensive exploration for some time now by certain specialized subdisciplines, most notably zooarchaeology (e.g., Grayson 1984; Lyman and Ames 2004) and paleoethnobotany (e.g., Lepofsky and Lertzman 2005). For example, species-area curves can be used to determine the point during an analysis in which an increase in sample size provides redundant information (sampling to redundancy) (Lyman and Ames 2007).

A study of the archaeological record of the Portland Basin using data from excavations at 11 sites demonstrates the way sample size and assemblage structure are related (Ames 1994a). Linear relationships were calculated between the excavated volume of site sediments and such parameters as artifact and faunal assemblage sample size (a strong relationship), and between assemblage size and assemblage richness (a direct, but weaker, relationship). Ames (1994a:80) succinctly concluded that, "the more you dig, the more you find, the more you find, the more kinds of things you will find."

The lack of statistically significant relationships between volume excavated and density of artifacts per cubic meter, and between volume excavated and assemblage richness, however, implies that excavation volume is not a reliable factor to predict artifact richness despite the general conclusion that greater volumes provide greater absolute sample size and increased sample richness. These relationships seem to be characteristic of spatially complex coastal and riverine sites in this region. Rare categories of archaeological data, most notably features such as postmolds, hearths, and earth ovens, may require excavation of considerable volumes of site sediment to be found.

An examination of data from several coastal sites in Oregon attempted to answer the question, How much site volume must be excavated to provide an assemblage that adequately characterizes the site? The straightforward observation that small-volume excavations found sites interpreted to be small occupations while more extensive excavations found relatively larger occupations was followed by the general caution that the relationship between perceived abundance and the proportion of site space investigated must be known at some level before functional inferences can be made (Lyman 1991:57). Given the breadth of research questions, many of which focus on classes of data that are rare in coastal environments (e.g., structural features of dwellings), Lyman (1991:62) estimated minimum excavated volumes of upwards of 100 cubic meters were necessary to draw meaningful conclusions.

The data that comprise the archaeological record of Western Washington have been derived from a variety of excavation techniques, under a variety of research designs, and subjected to varying levels of post-excavation laboratory analyses. A more detailed description of the kinds of investigations that have occurred in King County is given in Chapter 6, but it should be mentioned here that the pattern holds true: there are many small-volume excavations usually associated with survey or reconnaissance efforts, fewer intermediate-scale test excavations, and very few data recovery excavations that would meet the 100-cubic-meter threshold described above. This exponential pattern corresponds with inferred widespread distribution of specialized activity loci throughout much of the County, and much more restricted distributions of larger residential settlements, but the pattern may also be influenced by sampling levels. Although some archaeological sites in King County have been putatively considered residential sites, the archaeological remains of features such as hearths and drying rack postmolds are quite rare, and strong archaeological evidence of a Native American dwelling in King County has only been found at the Tualdad Altu Site, 45KI59 (Chatters 1988). One of the most fundamental reasons for a paucity of house and feature data in King County is the small volume of excavation prevalent in archaeological investigations, even for those data recovery investigations attempting to recover samples of adequate size to make statistically strong inferences.

Archaeological investigation of a complex pattern of house remains along the Fraser River below its canyon dating to as early as 5500 cal BP has allowed inferences to be drawn about households and the history of *Stó:lō* communities (e.g., Lepofsky et al. 2009). The rich archaeological record in the lower Fraser River Valley is in stark contrast with the record in the Puget Sound lowlands and the reasons for this contrast have yet to be adequately explained. Issues of field methodology and sampling are a good place to start, coupled with an understanding of local geological history and processes that may constrain or destroy portions of the archaeological record. We can only surmise the effects of excavated volume and sample size on the ways in which we classify and make sense of the archaeological record of King County without the availability of more large-volume excavations and focused examination of the relationships between assemblage sizes and basic diversity measures for King County sites (e.g., Lyman and Ames 2007).

In a similar vein, the effects of screen-mesh size may have a significant effect on functional classification of sites, especially in cases where the number of taxa identified in faunal assemblages is the sole or primary determinant used to infer occupational intensity and activities that occurred at a site. Butler and Campbell (2004:359–360) demonstrate how use of different screen-mesh sizes makes comparisons of zooarchaeological data sets and subsequent inferences drawn from the data difficult to reconcile. Faunal assemblages recovered through relatively fine-mesh screen, especially from shell midden contexts near productive marine habitats, almost always contain greater taxonomic diversities than those recovered through larger-mesh screened fractions (e.g., Kopperl 2001). A site might be classified as a temporary salmon-fishing encampment, for example, if its assemblage was recovered from ¼-inch-mesh screens, while another assemblage from the same site recovered through finer-mesh screen may yield substantially greater taxonomic richness and therefore be classified as a less-specialized, longer-term occupation. Unlike faunal taxonomic richness, fine-mesh screens do not tend to increase the number of lithic artifact data classes in an assemblage despite raising overall sample sizes in a given volume of excavated and screened sediment. Finer-grained lithic raw material such as cryptocrystalline silicates (CCS) and obsidian are often better represented in finer-screened fractions (e.g., Gall 2007; Schalk et al. 2000). Use of finer-mesh screen does not guarantee scientific rigor, especially when excavation volume must be reduced to accommodate the greater time commitment of fine-mesh screening within typical budgetary constraints of most archaeological research, thereby reducing the ability to examine larger-scale classes such as features that often require greater excavation volume

(Schalk et al. 2000:155–158). In weighing the goals of a particular research design against time and budget limitations, the use of larger-mesh to screen most sediments and finer-mesh to screen a carefully controlled subsample of site deposits may be an ideal strategy to sufficiently characterize artifact and faunal data classes at a site.

Issues of sample size, variation in analytic methods, variability inherent in the depositional and taphonomic history of particular sites can only be briefly explored in this document. Differences between excavators and analysts during the various stages of archaeological investigation are demonstrated sources of variation between data sets (e.g., Graesch 2009; Lyman and VanPool 2009). These issues cannot be resolved without a combination of further comparative analyses and assessment of existing data as well as careful consideration of and standardization of excavation and analytical sampling strategies. Construction of the archaeological resource classification in this context document acknowledges these limitations. Relative differences among archaeological data sets are used to categorize particular sites, instead of specific quantitative measures and thresholds.

DEFINITION OF ARCHAEOLOGICAL RESOURCE TYPES

Archaeologists in Western Washington use a variety of terms to describe archaeological resource types. Some classifications provide insights into mobility patterns and site function within the regional settlement system by describing the kinds of activities that were associated with each site type (Burtchard 1998; Burtchard and Miss 1998; Mierendorf et al. 1998). The most detailed site typologies correlate archaeological resource types with group size and composition; with kinds, duration and location of activities; and with archaeological signatures of the site type. Many archaeologists describe sites in terms of physical attributes, such as the density and distribution of archaeological material classes, and some investigators use a combination of functional and descriptive terminology (e.g., Boreson 1999). Greg Burtchard's (1998) classification system for archaeological sites in the Cascade Range is the most detailed regional settlement typology available, listing social, behavioral, locational, and artifact attributes of site classes. His classification is a useful starting point to integrate ethnographic data with archaeological information from the entire array of landforms in Western Washington and King County, both montane and lowland. The typology used for this document expands the geographic scope of Burtchard's typology to include site types that occur in lowland and marine littoral settings (Table 5-1).

Table 5-1. Archaeological Resource Classification

Activity Association	Task Intensity	Site Type
Residential Activity Site	Multi-Task	Village
		Base Camp
		Multiple-Resource Field Camp
	Limited-Task	Specific-Resource Field Camp
Non-Residential Activity Site	Limited-Task	Specific-Resource Procurement/Processing Site
Other	No Task Associated	Cairn/Earthworks
		CMT
		Trail
		Burial
		Isolated Artifact
		Rock Art

The site typology conceived here includes 11 basic categories. They are grouped first by their association with residential activities (villages and camps), non-residential activities (resource procurement and processing areas), or other types (not associated with particular on-going activities by a group during their annual settlement round). Residential sites are divided into specialized-task and multiple-task occupation sites. The former are encampments associated with the acquisition of one particular resource, while the latter subsumes centralized villages, residential base camps, and field camps—all of which are characterized by having hosted multiple recurrent economic pursuits. Non-residential activity sites are places where a particular resource was obtained and/or processed away from a residential camp or village, and are as varied as the kinds of subsistence and non-subsistence resources available in King County. The other, non-activity sites are features on the landscape outside of specific areas of economic or residential activity. Burials are known ethnographically to have been separate from residential locations. Trails were blazed among camps, villages, and resource areas, sometimes marked by stacked rock cairns. Other more substantial earthworks and culturally-modified trees (CMTs) survive in the archaeological record but may not be associated with specific activities. Also, because some CMTs are the remnants of harvesting activity, they may be considered a subset of the specific-resource procurement site type. Isolated artifacts usually lack a clear context that allows an inference of a particular activity. Finally, rock art is often found some distance from any sort of residential or resource procurement sites. This typology highlights 1) the mobility of the site occupants, 2) whether or not the site type represents residential activity in addition to economic pursuits, and 3) the variability in the number of tasks undertaken at the site itself, instead of focusing on specific kinds of resources and activities.

The classification admittedly combines aspects of functional and descriptive classifications. The non-activity site types include an array of archaeological materials and features, while the types subsumed under the activity site categories are differentiated by inferred function of the site within a broader settlement and subsistence system. A classification based purely on functional categories that are mutually exclusive and exhaustive may be ideal, but the constraints of the existing King County archaeological database preclude such a framework at this time. The classification developed here works with these constraints to provide the basis of an explanatory model for the county that is testable given the existing data and the quality of data likely to be generated in the near future.

ARCHAEOLOGICAL RESOURCE TYPOLOGY

Attributes of site classes are summarized in very basic terms in Table 5-2, and discussed in greater detail in the following text. The kinds of archaeological data that may differentiate site types include the complexity of deposits, the diversity (measured in terms of richness and evenness) of features, artifacts, subsistence remains in the deposits, the physical size of the deposits, and evidence of their seasonality within the annual cycle and repeated use between cycles. Instead of providing quantitative thresholds of particular artifact categories, most site types are differentiated from others in terms of relative scales of complexity. Richness and evenness are used in the same relative manner when comparing categories of features, artifact assemblages, and subsistence remains of the different site types. Relatively high richness of certain data classes of villages and base camps are relative to those found in archaeological deposits of field camps and non-residential procurement sites. The high evenness of certain data classes expected at more long-term residential sites implies a greater number of activities that would result in more even abundances of feature, artifact, and subsistence remains classes. In contrast, field camps and resource procurement sites used for more specialized activities would result in one or a few dominant data categories (moderate or low evenness) as well as fewer overall numbers of categories (moderate or low richness). Given their use as relative terms, these two ways of viewing assemblage diversity are kept separate in this scheme instead of being combined into composite diversity indices (e.g., Jones and Leonard 1989).

Table 5-2. Site Typology and Archaeological Attributes of Site Classes

Site Class	Deposit Complexity	Features		Artifacts		Subsistence Remains		Area	Seasonality (Number of Seasons)	Repeated Occupation
		Rich	Even	Rich	Even	Rich	Even			
Village (2+ Houses)	Complex	High	High	High	High	High	High	Large	All	Intensive
Base Camp	Complex	High	Med	High	High	High	High	Large	1–3	Intensive
Multi-Resource Field Camp	Simple	Med	Med	Med	Med	Med	Med	Med	1–2	Frequent
Specific-Resource Field Camp	Simple	Low	Low	Med	Med	Med	Med	Small	1	Infrequent
Procurement/ Processing	Simple	Low	Low	Low	Low	Low	Low	Small	1	Very Infrequent
Other	Simple	N/A		N/A		N/A		Varies	N/A	N/A

Three caveats should be reiterated. The classification system is fairly exhaustive, but is not a quantitative summary of the entire range of features, artifact classes, or food remains that occur at recorded sites in Western Washington. The classification system is a first step to go beyond, for example, simply calling a large site with evidence of structures a “village” by including expectations based on differences in archaeological and environmental parameters. Second, confidence in classifying sites into these types is dependent upon the quality and quantity of samples obtained from the sites. As discussed above, small-scale sampling often leads to classification of sites as resource procurement or temporary camps, while larger excavations are often the only means of classifying sites as larger base camps or villages. Third, the attributes are intended to help archaeologists characterize variation in the archaeological record of Western Washington using a common terminology. In the future, as archaeologists expand the database for Western Washington, attributes of the site classes can be quantified. Ideally, site types can be created based on quantitative variation in artifact assemblages, feature classes, deposit characteristics, and food resources (e.g., Thompson 1978).

Village – Multi-Task Residential Activity Site

This residential site type is best characterized as the classic winter village described in Northwest Coast ethnographic literature (e.g., Elmendorf 1960; Gunther 1972; Haeberlin and Gunther 1930). When Euroamericans arrived in the region, village sites were on the marine littoral and in lacustrine and riverine habitats, near the mouths of major rivers, or upstream near the confluence of streams and rivers. The multi-task, mixed group, residential site was the center of a seasonal settlement round of a group of families. Village sites had one or more houses, had extramural processing features such as drying racks, and were occupied by one or more families through the winter.

The archaeological characteristics that differentiate village sites from other residential sites in this typology revolve around the presence of a large number of house structures; large and complex site deposits; diverse assemblages of features, artifacts, and subsistence remains; evidence of the entire seasonal round of economic pursuits brought to the site; and intensive reoccupation of the site (see Table 5-2). Specific archaeological signatures include a diverse array of processing and storage features; postmolds from buildings and other structures such as processing facilities; and complex cultural stratigraphy of midden deposits, including organic midden of charcoal, fire-modified rock, and food refuse and/or shell midden with charcoal, food refuse, layers of whole and fragmented shell, and fire-modified rock. Artifact assemblages have a high diversity of lithic tools, bone and antler tools, debris from manufacturing these tools, and perishable artifact classes such as wood, basketry, cordage, mats, and other objects made from fibers. Food remains represent all or most of the annual cycle of subsistence, including both fresh and stored foods. Features of other site types may be incorporated into a village, most notably procurement and processing loci of resources accessible in the immediate vicinity of the village (e.g., good fishing spots and shellfish beds). Certain non-activity site types described below may also be found within the boundaries of village sites, such as earthworks, trails and trail intersections, burials, and rock art. The recent investigations at *Tse-whit-zen* (45CA523), a very large Lower Elwah village on the Olympic Peninsula along the Strait of Juan de Fuca, encountered archaeological deposits extending several thousand years into the past and showcase the potential size and diversity of features and artifacts at village sites (Larson 2006). The size of these kinds of residential sites is the characteristic that most distinguishes them in the archaeological record, usually entailing multiple concurrently occupied dwellings.

Base Camp – Multi-Task Residential Activity Site

The residential base camp is the center of subsistence and other activities for large groups composed of multiple generations and both males and females (e.g., Burtchard 1998:112–113; Burtchard and Miss 1998:126–127). The residential base camp is an element of two different kinds of subsistence-settlement systems. Prior to approximately 5,000 years ago, residential base camps served as the hub of settlement for most hunter-gatherers throughout the year, including the winter season. Residential base camps were established near productive habitats and were occupied for multiple seasons by multiple family groups (Burtchard 1998; Larson and Lewarch 1995; Schalk 1988; Thompson 1978). All members of a social group would relocate seasonally or more often, to another base camp that served as the central locality to obtain nearby resources.

Within the past 5,000 years, residential base camps were one element of a more complex settlement pattern. Base camps were occupied for shorter time periods, usually in the spring, summer, or fall, by a subset of the members of a winter residential village. Base camps were situated near productive resources as in earlier time periods, but by this time a wider array of smaller task groups traveled from base camps to access specific resources or groups of resources, often at some distance from the camp. Base camps would most likely be located in settings some distance from village residential sites on the marine littoral or in riverine or lacustrine settings.

In terms of site typology, base camps differ from villages in terms of relatively lower evenness of feature classes and material reflecting less than an entire annual round of economic pursuits, and from field camps in terms of deposit complexity and diversity of classes of feature, artifact, and subsistence remains (Table 5-2). Specific signatures of base camps include hearth features, shelter depressions, postmolds for shelters and processing facilities, storage pits, processing pits, and other features used to preserve or prepare plant and animal foods. Artifact assemblages have a diverse array of tool types, evidence of tool production, and a range of non-subsistence artifacts. Artifact density is high in base camps and a diverse range of lithic and other material types may be represented in the tool and manufacturing debris assemblage. Base camps were often reoccupied, either in a single yearly settlement round or multiple times over the centuries, producing multiple archaeological strata. In most well-developed regional settlement models (Burtchard 1998; Schalk 1988; Thompson 1978), the base camp is replaced by the village as the residential "anchor" during the annual round and becomes a major secondary residential locus during more mobile times of the cycle. Because of this overlap in site function, many aspects of both site types such as the character of artifact assemblages and feature composition may be quite similar between base camps and villages in similar environmental settings. Unlike villages, food retained from seasons other than those of occupation at a base camp would not be as crucial for survival during that period, and therefore, if present, food remains that represent a more limited portion of the annual subsistence round may be a useful trait to distinguish these site types.

Multiple-Resource Field Camp – Multi-Task, Residential Activity Site

The residential field camp is a seasonal hub of activities performed by some members of a winter residential village or base camp. Residential field camps were situated near productive resources, as were the residential base camps, but hosted smaller task groups. Field camps were in prairie, foothill, and mountain settings, away from village residential sites on the marine littoral or in riverine settings, and away from larger and more frequently occupied residential base camps. Field camps were established in places with access to either multiple resources or particularly important single resources. Multiple resource field camps would represent domestic activities of a seasonal or shorter-term campsite along with processing and possibly acquisition of several different kinds of resources, depending on the proximity of their procurement locations.

Field camps that primarily focused on plants often hosted tasks geared towards procurement of other resources as well. The Mule Springs Site (45KI435) on Huckleberry Mountain is a good example of plant processing tasks associated with hunting and other activities in a residential field camp (Miss and Nelson 1995). Huckleberry processing was so important ethnographically to Southern Puget Sound basin groups that berrying tasks were almost always included in multi-task field camps in the mountains.

Archaeological signatures of residential field camps are similar to the signatures of residential base camps, but are smaller in horizontal extent and stratigraphically less complex, have lower artifact densities, and have lower diversity of features, artifact types, and subsistence remains (see Table 5-2). Hearth features, shelter depressions, postmolds for shelters and processing facilities, storage pits, processing pits, and other features may be present. Artifact assemblages have a moderately diverse array of tool types and somewhat limited evidence of tool production and maintenance. Artifact density is moderate, as may be diversity of lithic material types. Some residential field camps were reoccupied multiple times over centuries or millennia, and may have multiple archaeological strata. Characteristics of the archaeological deposits that distinguish multiple resource field camps from specific resource field camps are the presence of the several different kinds of resource remains that would require forays to several different areas for acquisition. For example, campsites near the mouths of streams at the marine shoreline are situated to access shellfish beds, salmon runs, and terrestrial and marine mammals and birds. Interior campsites along the ecotonal margins of woodlands and prairies would provide easy access to several different plant and animal habitats. The residential features and artifacts of such small-scale (but possibly long-term) camps would be consistent between physiographic zones and targeted resource areas, but would differ in terms of food remains, lithic raw material composition if such a resource was targeted by the occupants of the camp, and associated resource processing features.

Specific-Resource Field Camp – Limited-Task, Residential Activity Site

Limited-task field camps were used by small groups for short-duration occupations, such as a single family on a hunting and gathering excursion, or a group of adult males on a hunting foray. The groups were subsets of a larger population aggregate who occupied residential base camps. Field camps have evidence of overnight stays, such as hearth features or fire-modified rock. Some field camps along travel corridors, such as ridge crests or stream terraces, may have been an overnight camp for groups traveling along a trail rather than a focus on procurement of a particular resource. An exception to the association of this site type with small numbers of occupants at any one time would be a campsite whose occupants were tasked with one primary labor-intensive procurement strategy, such as campsites near very productive salmon fishing locales.

Archaeological materials associated with limited-task field camps include hearths, depressions from small temporary shelters, small diameter postmolds from temporary shelters, and processing features such as cobble pavements, pits, or charcoal filled trenches (from drying huckleberries). Lithic artifact assemblages include evidence of tool maintenance, tool repair, and debris from the later stages of tool manufacture (see Table 5-2). The tool assemblage will reflect economic pursuits limited to a single type of resource, and heavy task tools such as grinding stones may occur only if the resource requires such tools given the investment in labor to make them and energy to transport them away from centralized camps and villages. Field camps near sources of lithic material may have cores, relatively large amounts of shatter, and manufacturing debris from the initial stages of stone tool manufacture. Some field camps in exposed areas may have stacked rock or wood palisades that served as windbreaks (Haeberlin and Gunther 1930:15). In suitable steep-walled settings, rock overhangs would provide shelter and therefore may have been a preferred for field camp sites.

Given their focus on procurement and processing of a single resource, this site type will co-vary with resource distribution on the landscape, and will reflect the labor and technology requirements for its procurement and processing. Although the exact locations of most specific resource field camps will only infrequently be reoccupied in succeeding years (see Table 5-2), certain aggregated resources and stable landforms may host camps established to harvest specific resources that are reoccupied year after year. Descriptions of various single-resource task groups and their camps given in the ethnographic literature provide a reasonable data source to develop specific site types and archaeological expectations (e.g., Haeberlin and Gunther 1930; Smith 1940a; Stern 1934; Tweddell 1953). Examples of the kinds of specific-resource field camps that may be found are as follows.

Hunting Camp

Burtchard (1998:113) describes limited-task hunting camps as localities used by small groups of adult males. Hunting camps would have been used for overnight stays, and many camps had hearths. Hunting camps may also have had sweat lodges that were used by hunters. Camps established to hunt terrestrial mammals such as deer, elk, and bear are included in this sub-type, as are camps established to hunt sea mammals. Given the co-location of several kinds of littoral and marine resources, however, identification of a campsite specifically as a sea-mammal hunting camp may prove difficult. Hunting camps are specific resource procurement camp sites that are expected to be reoccupied relatively infrequently, given the extensive range of most terrestrial mammal populations.

Archaeological materials associated with hunting camps may include hearth features and fire-modified rock. Lithic assemblages have evidence of tool maintenance, tool repair, and debris from late stages in tool manufacture and tool resharpening. Lithic assemblages may have a moderate light tool to debitage ratio and moderate diversity of lithic material sources. Bone hunting implements may be found, depending upon the type of animal being hunted. Favored hunting areas may have been reused, and were often rock shelters or rock overhangs. Stacked rock features that were constructed as windbreaks or hunting blinds may be present. Small diameter postmolds, hearth features, and concentrations of fire-modified cobbles may demarcate sweat lodges.

Fishing and Fish Processing Camp

The limited-task fishing and fish processing location is an analog to the hunting camp, but situated in riverine, lacustrine, or marine littoral settings. Fishing and fish processing locations were usually utilized by small groups, often of mixed age and often including males and females (e.g., Haeberlin and Gunther 1930; Stern 1934). Archaeological signatures include hearths, cobble pavements, and small diameter posts or poles to support drying racks. Fish bone is often incorporated in midden deposits, along with charcoal, fire-modified rock, and/or other food remains, from consumption of shellfish or terrestrial mammals.

Specific-Resource Procurement/Processing Site

This site type is defined by activities that focus on procurement and processing of one resource, without a residence (temporary or otherwise) established at the same location. Similar to the Specific-resource Field Camp, which includes residential evidence of dwelling remains, this site type may be further subdivided by the kind of resource being targeted by occupants of the site. Because a large proportion of previously recorded sites in King County likely fall into this broad category without a clear reflection of the particular resource, further sub-divisions and the archaeological characteristics that may set them apart are discussed here without formally expanding the typology.

Butchering Location

Butchering locations functioned in a similar manner in the hunter-gatherer settlement pattern as limited-task hunting camps, with evidence of initial processing of game (e.g., Burtchard 1998:114). They represent a single-use butchering event or a few use episodes, and would not include evidence of overnight stays such as a hearth or fire-modified rock.

Butchering locations have low densities of manufacturing debris and low diversity of lithic materials. Early stage manufacturing debris may be present if the locality is near a source of lithic material. Formed lithic artifacts include cutting, piercing, and scraping tools or expedient minimally-modified or unmodified flakes. Discarded material may be limited to faunal remains left at the site, in which case lack of organic preservation will substantially curtail archaeological visibility.

Butchering sites from the late Pleistocene and early Holocene represent a noteworthy sub-type of specific resource procurement/processing sites. Although few have been identified in Western Washington, most are associated with peat bogs on Late Pleistocene-aged surfaces. The Manis Mastodon Site (45CA218) near Sequim includes bog deposits on an old glacial drift plain (Gustafson et al. 1979), and one of several late Pleistocene-aged bison finds in peat bogs on Orcas Island has compelling evidence of human butchering (Kenady et al. 2007). Other sites are isolated artifacts that may be indicative of early butchering activity as well. All fluted point finds in the Puget Lowlands are categorized as isolated finds, sometimes in general association with peat bogs and geologically old landforms. The Hamilton Bog Site (45KI215), on a glacial drift plain above the Cedar River (Meltzer and Dunnell 1983), reflects early hunter-gatherer activity in King County. An extinct three-toed sloth found in a peat bog on the Des Moines Drift Plain near the north end of Sea-Tac International Airport suggests that other bogs in the vicinity may have archaeological materials associated with extinct megafauna (Mattson 1985:25; McDonald 1998). Based on what little we know from early sites inferred to be hunting camps and butchering sites, peat bogs, small kettle lakes, and former wetland margins of interior lakes on the glacial drift plains may retain the best archaeological evidence of the earliest hunter-gatherer groups to settle in King County. These landforms provided the most suitable habitat for mastodon and bison, which would have been a focus of the earliest hunters utilizing the Puget Lowlands (e.g., Schalk et al. 2007). The archaeological deposits of the Bear Creek Site (45KI839) found below a 10,000-year-old peat deposit in the Sammamish River valley consist primarily of lithic tools, some of which have blood protein residues of several classes of large terrestrial mammal, including bison and bear (Kopperl et al. 2010, 2015).

Shellfish Processing Location

The limited-task shellfish processing location is an analog to the fishing or hunting location, but situated on or adjacent to the marine littoral or near economically productive freshwater shellfish habitats. Task groups operating from base camps or residential sites consisted of mixed ages and may have had both males and females, and/or were small family groups. Archaeological signatures include hearths, cobble pavements for steaming shellfish, small diameter postmolds from posts and poles used to support skewers with shellfish, and pits with fire-modified rock inside or concentrations of charcoal and fire-modified rock nearby. The fire-modified rock and charcoal concentrations were often formed when a steaming pit was disassembled. Bone tools, stone tools, food remains, and shell deposits may be associated with features. Shellfish processing sites predating global sea-level stabilization about 5,000 years ago may be submerged below present-day sea level.

Plant Processing Location

Limited-task plant processing locations were used by small groups, often of mixed age and primarily composed of females, with a few males and children. Expectations for one type of plant processing location, the huckleberry processing site, are summarized for the southern Cascade Range in Washington (Mack 1992; Mack and McClure 2002) and the Mount Rainier vicinity (Burtchard 1998:117–118). Huckleberry processing sites have well documented features such as elongated trenches filled with charcoal or elongated fire pits filled with charcoal and fire-modified rock. Small diameter postmolds may be present as signatures of poles that were used to support drying frames. Huckleberry processing locations should be associated with nearby field camps, because such activities were important elements of higher-elevation components of the seasonal round but were also spatially discrete from residential areas.

Processing sites for camas or other edible roots are probably better examples of plant processing locations with a fairly restricted range of activities. Earth oven depressions filled with fire-modified rock fragments, charcoal, remnants of unburned fuel wood, charred bulb remnants, and burned lumps of starchy plant tissue and juices define camas processing locations in the archaeological record (e.g., Beckwith 2004; Punke et al. 2009; Thoms 1989).

Based on botanical analyses of midden samples and feature contents, a variety of feature types were used to process plant materials in lowland and marine littoral settings. Clusters of rock, forming well-defined surface hearths; shallow basins excavated into the ground surface; and pits used to store plant foods have been associated with processing elderberries and wapato. Large, circular pit features, filled with charcoal, charred starchy plant tissue, and cobbles, have been identified as camas processing features. Whittling and planing tools have been associated with plant processing locations, such as spokeshaves and other tools with concave edges and low edge angles that were used to shape digging sticks and branches to construct drying platforms. Most plant processing locations previously identified in King County are associated with multiple-task sites that include evidence of plant processing in addition to other activities, such as the George Nelson Allotment Site (45K1450) on the Enumclaw Plateau (Lewarch, Forsman, et al. 2000). Features indicative of plant processing may, however, be found in isolation from archaeological deposits of residential sites. Their distribution may instead be more closely correlated with elements of the landscape: suitable plant habitat, substrate and soil condition, and proximity to natural sources of cobbles to make ovens and other processing features as shown on southern Vancouver Island (Beckwith 2004), in the Calispell Valley in the interior Northwest (Thoms 1989), and in the Willamette River Valley in Oregon (e.g., Cheatham 1988; Connolly et al. 1998; Kramer 2000; Thoms 1989:309–310).

Lithic Procurement and Lithic Reduction Location

Most hunter-gatherers in the Central and Southern Puget Sound utilized lithic materials in cobble form that were available from alluvial floodplains, on coastal beaches, or exposed on glacial drift plains. The mountain and foothill environments may have bedrock exposures that contain silica rock and other toolstone. Archaeologists working in the North Cascades identified several hunter-gatherer quarries that were associated with outcrops of silica rock (Mierendorf et al. 1998). The structural geology of King County south of Snoqualmie Pass has fewer metamorphic rock formations than the North Cascades. Lithic procurement and lithic reduction locations have, however, been recorded on eroding ridges in the Cedar River drainage and on the ridge between the Green River Valley and the Greenwater drainage. The Naches Lithic Scatter Site (CR05-07-31) on the ridge trail near Naches Pass is one example of a lithic procurement and lithic manufacturing site situated at a localized toolstone exposure on an eroding mountain ridge south of Snoqualmie Pass (Blukis Onat et al. 1988).

Quarry or lithic procurement sites may be identified by four criteria: presence of worked stone identical to a nearby lithic material outcrop; abundant debitage with cortex indicative of the early stages of stone tool manufacturing; a low diversity of lithic material types relative to other nearby sites; and presence of cores, preforms, and hammerstones (Burtchard 1998:115; Burtchard and Miss 1998:130). Sources of lithic material can be expanded to include cobbles removed from glacial outwash sediments, cobbles and pebbles from beach deposits, and cobbles and pebbles recovered from stream and riverbeds. Some lithic procurement and lithic reduction locations are associated with other archaeological resource types, especially limited-task hunting camps.

Other Sites

The final major site category in this typology includes a diverse array of cultural features, most of which are not the remains of past residential and economic activities. These features are often associated with archaeological deposits indicative of site types described above, but when found in isolation may be categorized in the following classes.

Cairn/Earthworks

Cairns and other earthworks are characterized exclusively by culturally redeposited sediments, and include stacked rocks, berms, and talus pits of clear anthropogenic origin not associated with other features or artifacts. Stacked rock features may have served as vision quest enclosures, hunting blinds, defensive palisades, wind breaks, travel markers, or territory markers (e.g., Burtchard 1998:116; Haeberlin and Gunther 1930). Individual stacked rock features probably had multiple functions. Talus fields may have pits or shallow depressions with low, mounded alignments on the periphery and may have served as food caches or burials.

Culturally Modified Tree

Northwest Coast Native Americans traditionally removed bark from Douglas-fir and pine to line earth ovens, and peeled cedar bark to manufacture containers, clothing, matting, and cordage (Gunther 1981; Stewart 1984; Turner and Peacock 2005). Large, rectangular scars are places on the tree where bark was removed for manufacture of containers for transporting huckleberries from mountain and foothill regions. A grove of peeled cedars, 45KI430, has been recorded near a lake on Tiger Mountain (Robinson and Rice 1992). Other examples of CMTs have been recorded in the Green River valley, including a fir tree inscribed with a design partially covered with newer growth (45KI804) and a maple tree exhibiting modified branch growth (45KI805)—both modifications interpreted as Native American in origin based on discussions with local Tribal informants (Hoyt et al. 2008). At a higher elevation, cedar trees with stripped cambium were recorded at confluence of North and South Fork Cedar River on U.S. Forest Service (USFS) land (Hollenbeck 1987). CMTs that have clearly been used to harvest bark may also be considered specific-resource procurement sites.

Given the ages of some Douglas-firs and cedars can be measured in centuries, dating these resources is difficult and inferences about their origins may be limited unless specialized equipment such as an increment borer is used. Despite the limitations of evaluating these living archaeological resources, past research has defined patterns in bark peeling scars among geographic areas of the Cascade Range and inferred different utilization patterns. Such studies, as well as those conducted farther afield in the Pacific Northwest, inform us of the signatures that identify and differentiate such resources from each other (e.g., Bergland 1992; Burtchard and Miss 1998:33; Green 1994; Hicks 1985; Hollenbeck and Carter 1986:180; Mack and Hollenbeck 1985; Merrell and Clark 2001).

Trail

Pre-contact trails are difficult to identify with certainty in the field. Faint, erosional scars in vegetated areas and trail treads on ridges and river and stream terraces are the usual direct lines of evidence to identify hunter-gatherer trails. Trails may be most readily identifiable, albeit indirectly, near topographic constrictions such as saddles and passes, in areas that have not undergone historic logging and development, in conjunction with alignments of cairns, and from historic records such as GLO survey maps.

Burial

Archaeological deposits with human remains have been identified in a variety of depositional contexts in Western Washington. Most have been found in association with shell midden sites (e.g., Larson 2006), but finds of human remains in non-shell contexts have been made as well (e.g., Schalk and Schwarzmiller 2002; Shong, Miss, et al. 2007). Human remains have also been identified within historic-period fill, especially on or adjacent to bluff tops, above the marine littoral, that were modified in the early historic period (e.g., Lewarch, Larson, et al. 2002). Burials not associated with other site types and deposits, most notably shell midden strata, however, are unlikely to be preserved.

Rock Art

This category refers to any sort of design or marking made on a rock surface. Although recorded rock art sites are rare in Western Washington north of the Columbia River Valley, suitable rock faces that may preserve such archaeological resources are present within King County, especially in the more mountainous and rugged interior.

Isolated Artifact

Isolated artifacts include such objects as individual projectile points, individual tools, isolated exotic materials considered manuports, and broken and discarded tools. This archaeological resource type subsumes isolated artifact finds in any setting within King County in which no additional material or features are identified. Primary deposition of isolated artifacts would likely be greatest close to most other archaeological resource types.

Site Classification, Time, and Differential Preservation of the Archaeological Record

The archaeological resource typology created for this context document, the explanatory model developed within it, and the site sensitivity model derived from it, attempt to capture important aspects of variation in the archaeological record of King County. In doing so, the resources are categorized into general functional types irrespective of their age. Therefore, some categories such as the village are not expected in the King County archaeological record from a theoretical perspective in the early periods of the culture historical sequence, nor are early-period CMTs expected from a biogeographical perspective (such forest resources were not widely available until the mid-Holocene). Additionally, some associations between site types and particular landforms may be expected during particular periods but post-depositional processes may create a preservation bias. For example, short-term field camps and resource processing sites are expected in many alluvial floodplains throughout much of the Holocene. Their survival during subsequent river channel avulsion or migration, however, and the depth below natural or artificial surfaces of those that do survive to the present day are conditional based upon geological and historical factors.

The distribution of site classes throughout the five Analytic Periods suggests a preservation bias in the archaeological record of the Puget Sound basin that may be a function of sea-level rise and alluvial processes. Landforms with multiple, productive resources would have included areas on the marine littoral where streams and rivers formed deltas, and on alluvial floodplains, especially at localities where tributary streams entered the main stems of rivers. Base camps were probably situated at localities where multiple, productive environments converged. Many landforms near those productive environments during the first three Analytic Periods (pre-5000 cal BP) have been inundated by Puget Sound, covered with recent alluvium, or were eroded when river channels migrated across alluvial floodplains. This inference is supported by arguments made by other investigators. Blukis Onat (1987), Dancey (1969), and Wessen and Stilson (1987) all suggested that early residential base camps were probably eroded or inundated. The base camps most likely preserved were associated with quarry sites and hunting camps that have been recorded on river terraces and glacial drift plains above contemporary shorelines and floodplains. Thompson (1978) also noted a paucity of base camps prior to 3,000 years ago in the southern half of the Northern Puget Sound basin. Because landscape history is difficult to model at the scale of the entire county, especially for the early Analytic Periods, reconstruction of a particular landform should be undertaken prior to assessment of its sensitivity for sites of particular functions and ages.

ARCHAEOLOGICAL RESOURCE DISTRIBUTION PATTERNS

A sample of sites from throughout Puget Sound (Figure 5-1) is examined here to identify patterns in the distribution of archaeological components in the region by assigning them to particular Analytic Periods and site classes. The sites listed in Appendix D, Table D-1 were chosen to characterize the range of variability in content, inferred function, and landform association within each Analytic Period. A smaller, more selective sample comes from the much larger data sets from the last two Analytic Periods, while

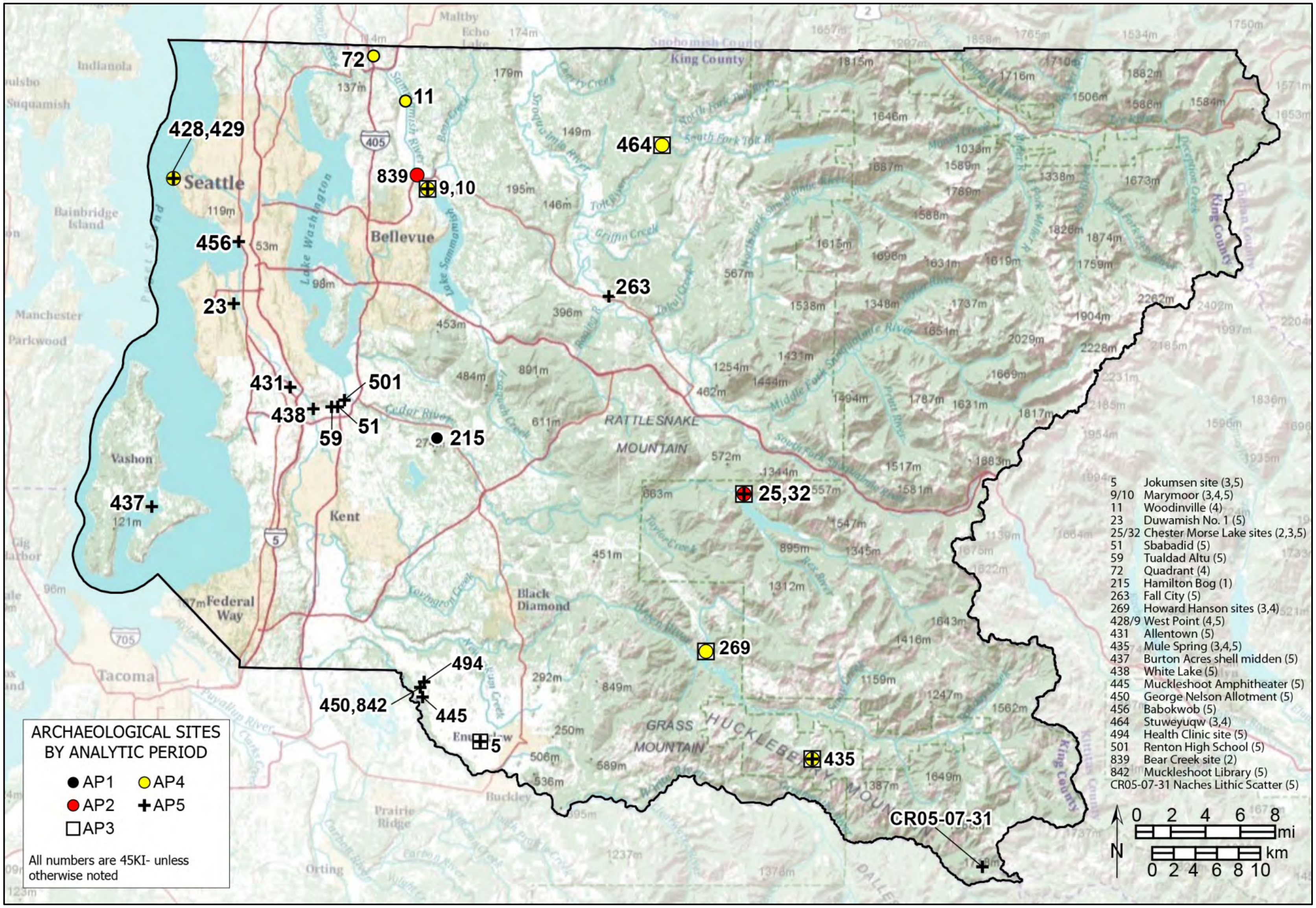


Figure 5-1. Archaeological site types.

almost all known dated components from the earlier periods were considered. The first table of Appendix D assigns site classes to selected sites, as well as Analytic Periods based on estimated age ranges of each component, and also includes information about the landform type for each site as it was described by the archaeologists who conducted the analyses. Associations among archaeological resource types defined in this chapter, Analytic Periods defined in Chapter 4, and landforms defined in Chapter 3 inform the GIS sensitivity model in terms of weighting particular landforms for certain kinds of resources from different chronological periods.

Analytic Period 1: 14000 cal BP to 12000 cal BP

AP 1 encompasses initial post-glacial hunter-gatherer occupation of the Puget Sound basin. Although archaeologists still debate evidence for the timing and routes used by hunter-gatherers who entered North and South America in general, and the Pacific Northwest in particular, at the end of the Pleistocene (e.g., Beck and Jones 2010; Meltzer 2009), in the Southern Puget Sound basin the timing of hunter-gatherer entry was constrained by the presence of the Cordilleran Ice Sheet. If hunter-gatherers were in the Southern Puget Sound basin prior to 18,000 years ago, any evidence would have been destroyed when the Puget Lobe of the Cordilleran Ice Sheet advanced south from Canada.

The Southern Puget Sound basin was free of glacial ice by 15,000 years ago, but some surfaces of glacial drift plains above embayments may have been inundated by water from proglacial lakes. All glacial drift plains, foothills, and the Cascade Range were exposed and available for hunter-gatherer settlement by 14,000 years ago. Evidence of human occupation found to date is limited to a few isolated projectile points with diagnostic Paleoindian characteristics and two archaeological sites with materials that can be assigned to the time period based on radiocarbon dates. Most of the evidence from the time period has been found on glacial outwash drift plains that would have had patchy forest parkland vegetation during this time. Sites are associated with mountain lakes near the Cascade Range crest (Hollenbeck and Carter 1986) and the vicinity of bogs on glacial outwash drift plains (Gustafson et al. 1979; Meltzer and Dunnell 1983).

Anaerobic and substrate conditions have helped preserve many site deposits dating to AP 1. The most notable feature of the Manis Mastodon Site (45CA218), near Sequim on the Olympic Peninsula, was a mastodon that had been mired in a bog (Gustafson et al. 1979; Peterson et al. 1983), although Mierendorf et al. (1998:34) and Schalk (1988:88–89) have questioned the direct association between the mastodon remains and human activity. Others also noted the lack of evidence indicating that hunter-gatherers killed the mastodon (Morgan 1999:3.1). Based on unpublished data, however, Morgan (1999:3.1–3.3) concluded that hunter-gatherers did, in fact, butcher the animal. Cobble flake tools, modified bone and tusk tools, and modified caribou antler tines also may have been associated with the mastodon. In spite of questions regarding provenience and the direct association of purported artifacts with the early radiocarbon date, other radiocarbon data and recognizable stone tools from strata near the mastodon indicate the archaeological materials probably date to AP 1. Across the Strait of Juan de Fuca from the Manis Mastodon Site on Orcas Island, the remains of an Ice-Age bison with evidence of human butchering were found in a peat bog and date to about 13,500 cal BP to 13,700 cal BP (Kenady et al. 2007). This find, along with other contemporaneous paleontological finds that have preserved well in the drift uplands of Orcas and Vancouver Islands, suggest a parkland environment was established quickly following glacial retreat that was well suited for large herbivores and an ideal hunting ground (Schalk et al. 2007).

Isolated finds of fluted points and others stylistically associated with the earliest human inhabitants of western North America are more common than archaeological material found in situ from this period.

Three examples highlight the variable contexts in which such isolates are found. A fluted projectile point from the Hamilton Bog Site (45KI215) on a glacial outwash drift plain south of the Cedar River Valley is the only documented late Pleistocene–early Holocene site in King County (Meltzer and Dunnell 1983). The peat bog is in a kettle depression on the glacial outwash drift plain within an area that was mapped as Orcas peat by the U.S. Soil Conservation Survey (Snyder et al. 1973). The point was recovered during peat mining operations in 1983, and the recipient of peat from the bog contacted archaeologists at the University of Washington (Meltzer and Dunnell 1983). Large, stemmed projectile points and leaf-shaped projectile points have been reported in private collections made on Whidbey Island. Wessen (1988:68) also noted a large, fluted lanceolate projectile point among stemmed points collected near Penn Cove. Whidbey Island is composed of glacial outwash drift plains with undulating topography. Osborne (1956:Plate 1, 42) identified a “Plainview-style” point from a private collection, found in the Chehalis River Valley on a river terrace cut through glacial outwash plains that had formed south of the south edge of the Puget Lobe of the Cordilleran Ice Sheet. The point was manufactured of light brown jasper with evidence of basal thinning, a common attribute of large lanceolate projectile point styles that date prior to approximately 10,000 years ago.

The archaeological record of early hunter-gatherer adaptations in the Puget Sound basin is generally similar to much of the rest of the United States, consisting of widespread distribution of isolated Clovis and other fluted projectile point forms found without any record of their archaeological context. The Lake Cle Elum projectile point indicates early hunter-gatherer groups were in montane habitats and presumably familiar with relatively low elevation natural travel corridors across the Cascade Range. The distribution of fluted points concentrated on glacial outwash plains demonstrates that early hunter-gatherer groups used forest parkland and bog habitats and that modern landforms of early postglacial age may have evidence of the initial hunter-gatherer colonization of the Puget Lowland. Stemmed points similar in form to Windust points widespread in the Intermountain West were found at the Beech Creek Site (45LE415) within the Cascade Range south of Mount Rainier (Mack et al. 2010). Although luminescence analysis of site sediments yielded dates as early as 9200 cal BP, stylistic attributes of the lithic assemblage are similar to others of the Western, or Intermountain, Stemmed Tradition that may actually pre-date Clovis assemblages in parts of western North America (Beck and Jones 2010).

As in many areas of the United States, the archaeological record of Puget Sound Clovis adaptations does not retain features or large sample sizes of artifacts that allow formulation of hypotheses regarding subsistence-settlement patterns. Initial hunter-gatherer group sizes must have been small, based on the paucity of archaeological evidence. Preservation of bone and antler at the Manis Mastodon Site (45CA218) and the Ayer Pond bison is a positive aspect of the limited archaeological record dating to AP 1. The fluted point recovered from the Hamilton Bog Site (45KI215) demonstrates that some peat bogs in King County have archaeological evidence of early hunter-gatherer occupations; perhaps other peat bogs have preserved bone, antler, and archaeological features that will provide insights into the subsistence-settlement patterns of AP 1.

One of the most notable features of the limited data for AP 1 is the absence of recorded residential sites. Even taking into account the hypothesized small population size of the first hunter-gatherer groups who colonized the region, the archaeological record should have examples of residential base camps manifested in features, some form of midden deposit, and possibly dense concentrations of artifacts. Fluted projectile point preforms, finished points, and reworked points should be present in the artifact assemblage to assign the archaeological material to AP 1. A persistent research goal in King County is the exploration of factors that may account for the absence of recorded residential sites dating to AP 1, and hypothesizing (and testing) where such sites may be expected.

All recorded sites from AP 1 that were evaluated for this study are on old land surfaces that have been exposed over the past 14,000 years. With the exception of the Lake Cle Elum fluted point, all the old land surfaces are composed of glacial drift that has had minimal deposition since the Pleistocene. Residential base camps would have been identified by archaeologists if they were present on the glacial drift plains and readily visible. Residential base camps dating to AP 1 may have been in productive habitats on the alluvial floodplains of rivers or on the marine littoral of Puget Sound. Alluvial floodplains have been extensively reworked by alluvial erosion and channel migration processes over the past 14,000 years, which probably destroyed sediments that dated to the initial hunter-gatherer occupation. The surface elevation of Puget Sound was several meters lower than today and marine littoral landforms on old shorelines from the time period have been inundated.

Analytic Period 2: 12000 cal BP to 8000 cal BP

Notable assemblages that characterize AP 2 in Western Washington are from the Ross Lake area of the North Cascades, Slab Camp (USFS6092-1) in the Olympic Mountains, the Cedar River Outlet Site (45KI25) at Chester Morse Lake, Lake Cushman in the upper Skokomish River drainage, the Manis Mastodon Site (45CA218) near Sequim, and the Bear Creek Site (45KI839) in the Sammamish River Valley. Three of the assemblages have been found in mountain environments as well as foothill or lowland contexts.

Archaeological sites dating to AP 2 have a wide, albeit sparse, distribution throughout the Cascade and Olympic Mountains, and age estimates for these sites are generally based on stylistic attributes of artifact assemblages rather than absolute dates. A portion of the Cedar River Outlet Site along Chester Morse Lake has evidence of a limited-task hunting camp, including a feature, tools, and debitage from local mudstone cobbles (Samuels 1993:13.2). The artifact assemblage was composed primarily of locally available mudstone, rather than CCS typical of later components recorded near Chester Morse Lake, and a midden-filled pit feature was quite distinct from the clusters of cobbles on shoreline surfaces recorded elsewhere nearby (Samuels 1993:13.3–13.4). To the north, another montane component is a butchering location in the Ross Lake area of the upper Skagit River (Mierendorf et al. 1998). On the Olympic Peninsula, Slab Camp (USFS6092-1) is a hunting site in a mountain valley at the headwaters of the Elwha River. The deposit consisted of a low density of stone tool manufacturing debris, lanceolate projectile points, and cores beneath a layer of Mazama ash, and represents early use of a mountain valley habitat (Gallison 1994). One site, 45MS100, is in the Lake Cushman vicinity, an upland environment but only 8 km (5 miles) from the marine shoreline of Hood Canal. The site was inferred to be a field camp based on descriptions of features, debitage, and tool classes (Wessen 1993). Other archaeological sites recorded in the Lake Cushman valley have yielded projectile point types, stone tool manufacturing debris, and lithic raw material that are similar to Slab Camp to the north.

Only a few components in the Western Washington lowlands have been dated to AP 2. A stratum of the Manis Mastodon Site with radiocarbon dates calibrated to the end of AP 2 yielded stone tools, faunal remains, and a feature that are within the age range of AP 2 (Morgan 1999; Peterson et al. 1983). Morgan (1999:3.6) discussed unpublished data from the Manis Mastodon Site that indicated use of wood artifacts and a large lanceolate projectile point associated with a hearth feature. The wood artifacts are the first non-stone implements found in the Puget Sound basin. The Bear Creek Site is one of the oldest chronometrically dated sites in the Puget Lowlands and is situated in what would have been a lower-elevation setting relative to other contemporaneous sites in the region. It is a relatively low-density but horizontally expansive component containing lithic artifacts found in a thin sandy stratum between underlying glacial outwash sediments and an overlying peat deposit with radiocarbon and luminescence dates spanning approximately 12,500 cal BP to 10,000 cal BP (Hodges et al. 2009; Kopperl et al. 2010, Kopperl et al. 2015). Despite a lack of fire-modified rock in this component, the extent of residential occupation is not clear and it may represent a base camp or more limited procurement or processing activities.

Site classes dating to AP 2 include specific-resource field camps and several sites that may be camps or non-residential resource procurement/processing sites. As was the case for AP 1, AP 2 does not have recorded base camp sites. Base camps, if part of the AP2 settlement pattern, would be relatively accessible to archaeological investigation, since they would be situated on old land surfaces that have not been deeply buried under Holocene-aged deposits. Base camps dating to the early time period may have been in productive habitats on alluvial floodplains of rivers or on the marine littoral of Puget Sound, especially near confluences of streams and rivers. The Bear Creek Site is such a deposit, buried under alluvium and lacustrine sediments, but its use as a base camp, field camp, or non-residential procurement site is not clear. It does, however, demonstrate the potential for early archaeological deposits buried in complex fluvial systems. As noted for AP 1, alluvial floodplains of the larger rivers in Southern and Central Puget Sound have been extensively reworked by alluvial erosion and channel migration processes. The surface elevation of Puget Sound was much lower than today and marine littoral landforms on old shorelines from the time period have been inundated. The climate between 12,000 cal BP and 8000 cal BP was much warmer and drier than the contemporary climate, which conditioned rainfall and vegetation patterns. Recorded sites occur on old landforms in montane, foothill, and glacial drift plain settings, and recorded sites near major rivers are above the active river floodplain (e.g., Chatters et al. 2011).

Hunter-gatherer subsistence-settlement models for Western Washington suggest relatively few site types should be present during the period between 12,000 and 8,000 years ago, with base camps situated in or near the intersection of productive habitats (Burtchard 1998; Schalk 1988). On the upper Skagit River and upper Skokomish River, the most productive habitats would have been the riparian zone on the floodplain. In the vicinity of the Manis Mastodon Site (45CA218), the nearby floodplain of the Dungeness River would have been the optimal location for a base camp, and the Sammamish River would likewise have provided access to several different habitats and subsistence resources for the occupants of the Bear Creek Site.

Analytic Period 3: 8000 cal BP to 5000 cal BP

A much larger sample of sites is available from AP 3 than from earlier periods (Appendix D, Table D-1). As would be expected for a larger sample of components, artifact assemblages represent a greater diversity of site classes and occur on a wider range of landforms than during those previous Analytic Periods. Four kinds of sites dating to AP 3 have been identified, including one base camp, several multiple-resource field camps, and numerous single-resource field camps and resource procurement/processing sites. The range of functional site types is similar to the diversity noted by Thompson (1978) for later time periods in the Northern Puget Sound basin, when multi-season base camps had associated special activity locations.

Hunting localities, quarries, field camps, and a base camp occur on old landforms in montane settings. Notable sites include several above the outlet of Chester Morse Lake in the Cedar River drainage (Samuels 1993), the Mule Springs Site (45KI435) on Huckleberry Mountain (Miss and Nelson 1995), pre-Mazama deposits along a small cirque lake near Mount Rainier (Burtchard personal communication 2009), and several sites in the Upper Skagit River Valley on Ross Lake (Mierendorf et al. 1998). These sites attest to hunting, plant gathering, and lithic material quarrying undertaken in the mountains during AP 3. Resource acquisition hunting sites and field camps have been identified on old river terraces in the Howard Hanson Reservoir in the upper Green River Valley (Benson 1986; Boreson 1999). Hunting sites also occur in the Lake Cushman Reservoir in the upper Skokomish River drainage (Wessen 1993). Many AP 3 sites found on older inland river terraces are notable for technological and stylistic attributes of Olcott or Old Cordilleran assemblages. Wessen (1993) proposed two kinds of Olcott stone tool assemblages, including one toolkit with a high percentage of large unifacial tools, and a second toolkit with a high percentage of flake cores. Both toolkits contained formed bifaces and projectile points. Assemblages with high percentages of large unifacial tools were inferred to be residential camps, while assemblages with flake cores represented locations where lithic procurement and processing activities were carried out.

The archaeological record of settlement on glacial outwash drift plains increased substantially after about 8,000 years ago. Site classes represented on this landform during AP 3 include resource acquisition and quarrying sites. Few radiocarbon dates are available, however, to corroborate temporal assignments that are largely made based on projectile point styles, stone tool chipping patterns, and lithic materials. Most stone artifacts from components assigned to AP 3 were made of basalt or dacite. The glacial outwash drift plains should have evidence of base camps that served as hubs for task groups traveling to hunting camps and lithic procurement locations. Sites dating prior to about 5,800 years ago may occur beneath Osceola Mudflow sediments on the glacial outwash plains of the Enumclaw Plateau (e.g., Hedlund 1976, 1983). Other base camps may be within kettle basins that have peat bogs and lakes that are larger today than in the dry period between 8,000 and 5,000 years ago.

The earliest sites confidently identified as field camps in lowland alluvial floodplain and marine littoral settings in the region date to AP 3. The Marymoor Site (45KI9), near the confluence of Bear Creek and the Sammamish River, has evidence of food processing, stone tool manufacturing, and other activities that are associated with field camps (Greengo 1966; Greengo and Houston 1970). Residential field and base camps may occur beneath recent alluvium on the lower reaches of other major river systems in King County as well. The Dupont Southwest Site (45PI72), with the oldest calibrated radiocarbon age between about 6180 cal BP and 5930 cal BP, is one of the earliest components in the Puget lowlands with inferred use of the marine littoral (Wessen 1989).

A wider variety of site types are represented in this period compared with earlier periods, a result of increasing diversity in the subsistence-settlement pattern and better preservation of archaeological deposits on landforms. The Dupont Southwest Site has shell lenses, the oldest identified in the region, and a limited range of tools and other food remains typical of shellfish processing locations (Wessen 1989). Two quarries occur at toolstone bedrock outcrops on a terrace and an alluvial fan in the upper Skagit River drainage (Mierendorf et al. 1998). The first well documented base camp dates to AP 3, on an alluvial fan adjacent to a stream in the upper Skagit River drainage (Mierendorf et al. 1998). Field camps are documented in a variety of environmental settings in the upper Green River drainage, on a mountain ridge, in the upper Skokomish River drainage, and on a lowland alluvial floodplain.

Most assemblages dating to AP 3 are on landforms exposed following the early postglacial period. Alluvial floodplains of larger rivers such as the Cedar, Snoqualmie, and middle Green Rivers would have been available for settlement but do not have sites dating to AP 3. The productive floodplain riparian environments would have been probable locations for multi-season base camps that should have been abundant during this time period, given the large number of recorded resource acquisition locations. Assemblages in the upper Green River are on old terraces above the active floodplain, which probably accounts for the preservation of the site material. A probable base camp in the upper Skagit River drainage is also on an old alluvial terrace above the active floodplain of the Skagit River. The marine littoral also was a probable location for base camps but was inundated in most places by rising sea level, leaving bluff-top sites that were probably peripheral to now-inundated occupation loci. The Dupont Southwest Site is such a remnant and documents early shellfish use in southern Puget Sound.

Rising sea level coupled with isostatic rebound of ground surfaces in Northern Puget Sound may partially account for the scarcity of residential base camps recorded south of the San Juan Islands dating to AP 3 or earlier. Thorson (1981:Figure 22) depicted marine shorelines that were exposed between Seattle and Camano Island when sea level was higher immediately after retreat of the Puget Lobe of the Cordilleran Ice Sheet, around 16,000 to 15,000 years ago. Thorson (1981:62) noted that isostatic rebound in Northern Puget Sound was greater than in Southern Puget Sound and that early postglacial shorelines south of Seattle are below the contemporary surface of Puget Sound. The inundation patterns and isostatic rebound estimates generally conform to the distribution patterns of early base camps in the Northern Puget Sound basin. Therefore, rising sea level as a cause for the paucity of early-mid Holocene residential base camps on the marine littoral may be a plausible hypothesis.

Analytic Period 4: 5000 cal BP to 2500 cal BP

Almost 30 components dating to AP 4 are used to characterize the extent of site variability in terms of type and landform association (Appendix D, Table D-1). Sites inferred to be base camps dating to AP 4 include three discrete components at the West Point Site Complex on the marine littoral, one in an alluvial fan setting near Sequim, and two in montane settings in North Cascades National Park. Other site classes that date to this period include resource acquisition sites from hunting, quarrying, and shellfish gathering, several of which are associated with field camp residences. The evidence for long-term, multi-season base camps below contemporary sea level at West Point in Seattle adds credence to the inundation hypothesis that posits effects of rising sea level on the archaeological record of the Southern Puget Sound basin (e.g., Wessen and Stilson 1987).

Hunting resource acquisition sites, quarries, and residential field camps are well represented in mountain environments during AP 4, above the outlet of Chester Morse Lake in the Cedar River drainage (Samuels 1993), in the Ross Lake area of the North Cascades (Mierendorf et al. 1998), at the Mule Springs Site (45KI435) on Huckleberry Mountain (Miss and Nelson 1995), at the Naches Lithic Scatter (CR05-07-31) near Naches Pass (Blukis Onat et al. 1988), adjacent to Buck Lake (45PI438) in Mount Rainier National Park (Burtchard 2007), in the upper Green River Valley (Benson 1986; Boreson 1999) and along ridges leading to Naches Pass (Burtchard and Miss 1998). Fragments of projectile points that may date to AP 4 have been found on ridges and near alpine lakes in the Alpine Lakes Wilderness Area of northeast King County (Huelsbeck and Ritchie 1994, 1995). This sample of components includes a greater diversity of site classes and larger number of components, and suggests accelerating intensity of use of the Cascade Range and foothills after about 5,000 years ago.

The complex mosaic of older glacial outwash surfaces, younger river valleys, and a marine littoral that was finally stabilizing by the mid-Holocene characterize the Puget Lowlands during AP 4. The dramatic increase in the number of AP 4 archaeological sites found in almost every kind of major lowland landform attests to an increase in population, a diversification of land use strategies, and an environment that became more amenable to preserving archaeological deposits. Hunting camps and lithic procurement localities on the glacial outwash drift plain continued after climate and vegetation changes occurred between 6,000 and 5,000 years ago that resulted in a closing of the forest canopy (e.g., Blukis Onat et al. 2001). Alluvial surfaces that date to AP 4 are preserved in some parts of the Puget Lowlands, and have retained archaeological remains of field camps and resource acquisition sites (e.g., Chatters 1981b; Greengo 1966; Greengo and Houston 1970), coinciding with increasing use of inland river terraces in other parts of Western Washington (e.g., Dancey 1969; Ellis et al. 1991; King 1991).

Archaeological sites on the marine littoral appear after about 5,000 years ago when relative sea level stabilized. The West Point Site Complex provides the most detailed and extensively quantified evidence of hunter-gatherer use of the marine littoral prior to 2,000 years ago (Larson and Lewarch 1995). The multiple base camps documented on the West Point sandspit below contemporary sea-level elevation had a diverse array of features, stone tools, bone tools, and food remains. Similar kinds of residential base camps or field camps were probably elsewhere on the marine littoral prior to 2,000 years ago, but were eroded by waves as sea level rose or were covered by tidal marsh sediments in protected embayments. Shell midden deposits dating to AP 4 were identified on the bluffs above Possession Sound near Edmonds at the Harbor Pointe Site (45SN93) and above the Nisqually Delta at later deposits of the Dupont Southwest Site, suggesting that archaeological materials associated with substantial gathering on the littoral may still be found at higher elevations nearby (Kopperl 2005; Wessen 1989).

AP 4 has evidence of an increasing diversity of site classes occurring in a wider range of environmental settings than the previous period, a trend predicted by some models (e.g., Thompson 1978). Residential base camps have been identified in the Puget Sound region dating prior to 3,000 years ago, and the base camps assigned to AP 4 in this study corroborate Thompson’s predictions. Base camps are underrepresented in the archaeological record given expectations in some models of population growth for the period (e.g., Burtchard 1998, Schalk 1988) and also given the number of special task sites that have been identified throughout the same region that would presumably entail base camp settlement as well. Most base camps in King County should be on the marine littoral and the lower reaches of larger rivers, although the evolution of the Duwamish Embayment complicates the pattern of site distribution in King County. Progradation of the ancestral Duwamish River–Green River delta and movement of river channels, however, probably eroded landforms that date to the end of AP 4. Also, the Duwamish River–Green River floodplain does not have higher, older river terraces that may contain archaeological deposits. Sea level gradually rose and the gradient of the ancestral Duwamish River–Green River was fairly stable over the past 5,000 years; thus, older sites may occur beneath more recent alluvium.

The ancestral Duwamish River–Green River extended to the Cedar River delta and south end of Lake Washington near the end of AP 4. Base camps and residential sites should occur in the Cedar River and Duwamish River–Green River drainages if there was a shift from foraging to collecting around 4,000 years ago as suggested by Schalk (1988). Village sites would be expected in marine littoral and riverine floodplain settings, the floodplain of the Duwamish River–Green River south of Tukwila to the Auburn vicinity, the middle Green River east of Auburn, and the White River south of Auburn if such villages were present during AP 4. Because of dynamic alluvial processes, however, sites dating to this time may not be preserved on the floodplains of the major river systems.

Analytic Period 5: 2500 cal BP to 200 cal BP

AP 5 is the most recent period of this culture historical sequence, represented throughout Western Washington by the greatest number of dated components for any period within the sequence. The sites from this period also reflect the most extensive use of the landscape and the most intensive use of particular resources, most notably anadromous runs of salmon and shellfish beds. The hypothesized shift away from a settlement pattern revolving around residentially mobile base camps and field camps to a winter village pattern is archaeologically manifested near the beginning of this period by the first appearance of village sites along the marine shoreline, followed later in the period by at least one inland riverine village site.

Almost 60 site components or component complexes dating to AP 5 are included in Appendix D, Table D-1, representing a diverse range of site classes. These components include four villages, three base camps, three multiple-resource field camps, 15 specific-resource field camps, 13 procurement/processing sites, and 20 sites identified without enough information to differentiate them as either a field camp or procurement/processing site. Non-activity sites such as CMTs are not included in the tabulation but have been documented in King County (see Chapter 6). All landform types with subsistence or raw material resources were utilized during this period in a settlement pattern generally analogous to the one observed by ethnographers and early Euroamerican settlers.

Field camps, base camps, quarries, and hunting camps indicate extensive use of mountain, foothill, and plateau environments during AP 5. Small, low artifact density distributions of debitage and tools occur on ridges and near lakes throughout the Cascade Range and foothills. The number and location of hunting and plant processing locations and field camps demonstrates intensive use of the mosaic of prairie and woodland habitats found on the Enumclaw Plateau. The archaeological record of the Enumclaw Plateau indicates a complex pattern of seasonal use by task groups who traveled from riverine villages to prairies above the White River and Green River, and farther east to the mountain foothills and the Cascade Range. Archaeological data from the Enumclaw Plateau corroborate the importance of prairie resources for hunter-gatherer groups that was noted by ethnographers (Hedlund 1973, 1976, 1983; Kopperl 2009; Lewarch, Robbins, et al. 2000a, 2000b; Willis 2008).

Preserved occupation surfaces in alluvial floodplains, sometimes buried under more recent flood sediments, indicate that hunter-gatherers undertook fishing activities, had base camps, and practiced other subsistence pursuits in this setting. At least one site, along the Snoqualmie River near Fall City (45KI263), indicates large village occupations were situated upstream from the marine littoral during the last 2,500 years (e.g., Nelson 2000a; Schumacher and Burns 2005). The numerous components dating to AP 5 found in lowland alluvial settings show a diverse range of activities and demonstrate the importance of fishing activities on the lower reaches of major river systems over the last few thousand years. Many riverine sites, especially with shell midden deposits that aided in organic preservation, contain food remains from hunting, plant collecting, and shellfish processing activities as well.

Village sites along the marine shoreline are documented in the archaeological record for the first time during AP 5. Old Man House (45KP2) is an example of a large residential occupation site that may have changed function from a seasonally important base camp to a central village by about 1,600 years ago (e.g., Schalk and Rhode 1985). Hunting and shellfish gathering sites, field camps, and base camps identified along marine shorelines also demonstrate the increasing and intensive use of the littoral. Many of these deposits are deep and well-stratified, reflecting long-term seasonal use of marine littoral landforms. Villages, residential camps, field camps, and a multitude of resource acquisition localities on the marine littoral mirror the pattern noted in the ethnographic literature for Southern Puget Sound.

The spatial distribution, landscape associations, and proportions of different site types during AP 5 are in marked contrast with earlier periods. This is due in part to better site preservation, but also by classification of a larger sample of site components assigned to particular functional categories based on (in most cases) limited investigation. In this context document, the site typology does not give specific quantitative thresholds to classify a site as, for example, a village as opposed to a base camp. Instead, it provides relative differences expected for site deposit and assemblage characteristics, and relies on investigators to use as much evidence as available from data collection to make an inference about site function. For example, site 45KI456 is a thin shell midden deposit that may be associated with the ethnohistoric village *Babak'wob* (Lewarch, Larson, et al. 2002) based on documentary evidence; otherwise it would likely be interpreted as a simple shellfish processing site or field camp based solely on archaeological remains. In this regard, AP 5 components benefit from their temporal proximity to ethnohistoric data sources. Also, organic material buried in non–shell midden contexts in any landform setting stand the greatest chance of being preserved from this most recent period (e.g., Schalk and Schwarzmiller 2002).

The more widely-applied culture historical sequences of the Gulf of Georgia and Fraser Delta region divide the time span encompassed by AP 5 into two phases: the earlier Marpole and later Gulf of Georgia phases. Some more locally derived culture historical sequences divide the last 2,500 calendar years into two periods as well, including Thompson (1978) and Lewarch and Larson (2003) in an earlier iteration of this document. While acknowledging that the absence of many site types from particular portions of her sequence is likely due in part to differential preservation and problems with assigning absolute dates to some archaeological components, Thompson (1978:120–130) maintains that the appearance by 1,500 years ago of very large coastal shell midden sites and a wide variety of sites apparently situated to focus on specific marine and riverine microenvironments in northern Puget Sound is indicative of new adaptations that also characterized northern Puget Sound communities at the time of early Euroamerican contact. Lewarch and Larson (2003:6-36–6-38) surmise that settlement and subsistence changes occurred between about 2,500 and 1,600 years ago, and that greater use of microenvironments after about 1100 cal BP corroborates division of this almost 2,500-year span into two separate periods. In doing so, they primarily cite data from Old Man House, from the West Point site complex, and from the tectonic event at 1100 cal BP that has only been well studied in relation to archaeological deposits at West Point, to justify such a division.

Montane-centered models assert that the broad changes from residentially mobile foraging to semisedentary winter village-based collecting occurred earlier than AP 5 (Burtchard 1998; Schalk 1988). The last two to three thousand years in those models are marked by changes in intensity of certain subsistence pursuits, instead of broad changes in mobility and the organization of those pursuits. Extending the ecological model of Burtchard to include lowland and littoral environments, the general distribution and character of sites throughout central and southern Puget Sound during the last 2,500 years is consistent with a semisedentary village–based collecting strategy incorporating small (and sometimes large) field camps and procurement/processing locations at or near resources being sought. A more complete elucidation of the intensification of the use of particular resources within this period and whether it noticeably increases in the last 1,500 years is precluded by the lack of well dated site components.

Summary

Table 5-3 summarizes the presence of recorded site types in the Puget Lowlands and northwestern Washington during the five Analytic Periods. AP 1 is primarily represented by isolated finds of diagnostic fluted points, although a few sites on the Olympic Peninsula and Orcas Island may represent Pleistocene-aged large mammal butchering sites. AP 2 marks an initial increase in site type diversity that still consists primarily of isolated diagnostic artifacts but also includes archaeological deposits inferred to be field camps and non-residential resource procurement sites. A wider range of site types are represented in AP 3, and better landform and organic preservation conditions during the last two Analytic Periods correspond with the full range of archaeological resources identified to the past 5,000 years in the region. Broad-scale shifts in seasonal settlement and mobility likely explain the appearance of villages during the last Analytic Period, although the reasons behind this shift are discussed in greater detail in Chapter 7. Certain archaeological features such as cairns, CMTs, trails, and rock art not associated with other archaeological deposits of activity areas are usually difficult or impossible to confidently date to a particular time period, as shown in Table 5-3.

Table 5-3. Known Representation of Site Types by Analytic Period

Analytic Period	Village	Base Camp	Multiple-Resource Field Camp	Specific-Resource Field Camp	Procurement/ Processing Site	Cairn/ Earthworks	CMT	Trail	Burial	Isolated Artifact	Rock Art
1					X					X	
2			X	X	X					X	
3		X	X	X	X					X	
4		X	X	X	X					X	
5	X	X	X	X	X					X	
Unknown					X	X	X	X	X	X	X

CHAPTER 6. Archaeological Investigations and Site Distributions in King County

Data from King County are synthesized in a more comprehensive manner in this chapter and are tabulated in Appendix D, Tables D-2 and D-3. Data from all Washington State Archaeological Inventory forms and USFS inventory forms with pre-contact archaeological components on file at the Washington State Department of Archaeology and Historic Preservation (DAHP) through October 2015 were included in these two tables, respectively. The GIS-based sensitivity model detailed in Chapter 8 weights spatially-scaled environmental variables in part by assumptions built into the explanatory model of settlement and subsistence and in part by known patterns in the broader regional archaeological record. The existing King County archaeological record summarized in this chapter is a body of data that tests the sensitivity model. Similarly, the results of previous archaeological investigations within the county provide some data that may verify parcel-specific estimations made by the sensitivity model, albeit heavily conditioned by the varying reliability of the results that have been generated in the past by professional archaeologists and information provided by the public.

A discussion of the kinds of professional archaeological investigations that have been undertaken in King County and the changes in their inherent reliability over the course of the past five decades is followed by a review of the existing archaeological record of King County. This record includes two main data sets: the archaeological site inventory archived at DAHP as site inventory forms and reporting documents, and informant accounts of archaeological resources that vary quite widely in content and locational specificity. Although quality of information in the site records archived in the state inventory still varies and does not contain all archaeological documentation that has been generated, the DAHP database and GIS layer of recorded sites offers the most consistent and rigorous mapping and recording standards and are therefore used during discussions of site types and distributions across the King County landscape. A second layer presenting information from informants and other sources augments the DAHP database.

With the exception of sites containing temporally diagnostic artifacts and/or organic remains subject to radiocarbon dating, most previously identified King County archaeological resources cannot be confidently assigned to a particular analytic time period. The record consists of numerous lithic scatters, fire-modified rock concentrations, and shell midden deposits that have not been dated or investigated to an extent that allows functional inference and classification to a particular archaeological resource class. The discussion of the known King County record is by necessity focused on broad patterns in abundance of general site types instead of a more detailed diachronic and functional analysis of site distributions. Future reports of research in King County should explicitly identify landforms and provide clear descriptions of surface and subsurface field methodology to facilitate incorporation into this county-wide model.

ARCHAEOLOGICAL INVESTIGATIONS IN KING COUNTY

Hundreds of professional archaeological investigations have been conducted within King County since the 1960s and resulted in descriptive reports or forms archived by King County and the State of Washington. The projects widely varied in purpose and field methods, and consequently the reliability of investigations has varied over time in terms of the inferences they draw about the kinds and distributions of archaeological resources within a particular area. Research is generally driven by state or federal heritage legislation with academic research only occasionally undertaken. Many projects in the past several decades in King County have found the means to accomplish important research within the context of regulatory compliance (e.g., Blukis Onat et al. 2001; Campbell 1981; Kopperl et al. 2010; Kopperl et al. 2015; Larson and Lewarch 1995; URS Corporation and BOAS 1987).

Beginning with the enactment of federal heritage legislation in the 1960s, the pace of archaeological research in King County and the rest of Western Washington increased. Prior to 1966, the only documented research in King County consisted of observations made by the Jesup North Pacific Expedition in 1899 of shell middens on Vashon Island (Smith 1907) and several seasons of the University of Washington archaeological field school at the Marymoor Site summarized in an unpublished report (Greengo 1966). The extent of research prior to 1966 was similar elsewhere in the Puget Lowlands south of the Gulf of Georgia, consisting of "expeditionary" work conducted before the turn of the century (Smith 1907) and various investigations, primarily surveys, undertaken by graduate students and faculty at local universities (e.g., Bryan 1963; Kidd 1964). The lack of fieldwork standards and reporting responsibilities that were stipulated by later legislation and professional societies resulted in data from these projects that are generally unavailable from DAHP. They are also difficult to meaningfully access at other institutions such as the Department of Anthropology at the University of Washington and the Burke Museum of Natural History and Culture, despite recent efforts to improve curation of such records.

The National Historic Preservation Act (NHPA) passed in 1966, the National Environmental Policy Act in 1969, and later amendments and executive orders over the following decades provide the impetus for almost all archaeological research conducted nationwide (e.g., King 2004; Neuman and Sanford 2001:17. Compliance with these laws has generated the vast majority of the King County archaeological database. The NHPA also mandated designation of a State Historic Preservation Officer (SHPO) in each state. In Washington State, the duties and responsibilities of this position developed into the Office of Archaeology and Historic Preservation (OAHP) and, later, DAHP under the supervision of the SHPO. The Washington State legislature has also enacted several laws pertaining to treatment of archaeological resources and the responsibilities of reporting archaeological finds. DAHP coordinates enforcement of these laws and professional accountability of archaeologists working within Washington State, and therefore has played an important role in shaping the existing archaeological record of King County as well.

Five broad categories of investigation (overviews, surveys, monitoring, test excavations, and data recovery excavations) have been conducted within King County. They are defined primarily by the goals they attempt to achieve, the field methods they use to collect data, and the state and federal regulations with which they must comply. *Archaeological Overviews* rely almost completely on previously collected data from a wide area to provide useful syntheses of environmental, archaeological, and historical information to government agencies and proponents of projects. *Archaeological Survey Projects* involve surveying a specified project area for archaeological resources using examination of the ground surface with pedestrian transects, subsurface excavation (ranging from auger probes to backhoe trenches) to provide representative exposures of buried sediments, or some combination thereof. *Archaeological Construction Monitoring* involves examination of ground and subsurface exposures created during construction projects for archaeological materials or deposits, usually conducted in places considered archaeologically sensitive yet inaccessible for archaeological reconnaissance prior to the start of construction. *Archaeological Test Excavation* is conducted after a site has been identified (most often during survey) in order to better define boundaries and characterize the deposit in terms of data potential and National Register of Historic Places (NRHP) eligibility. Field methods vary widely with the nature of the site and the context of the project. *Data Recovery Excavation* is most often conducted in King County as mitigation for damage anticipated (or already caused by) a construction project. Similar to archaeological testing, methods are dependent upon the nature of the archaeological site and the proposed project, however obtaining a representative sample of the archaeological deposit to address an explicit scientifically sound research design is usually emphasized.

Our knowledge of the King County archaeological record has been gathered in a piecemeal fashion since the 1960s, beginning with excavations at a few sites by university-based researchers and continuing today primarily within the context of cultural resource management projects. Broader regional studies discussed earlier provide us with culture historical sequences and explanatory frameworks, and also stand on a foundation of individual site investigations and smaller-scale studies examining intra- and inter-site patterns. The discussion in this section about the kinds of archaeological investigations that have taken place in King County ends with a brief review of the changing reliability of these studies as field methods, integration of other environmental studies, and reporting standards have improved.

Archaeological Overviews

A total of 119 overviews on file at DAHP provide archaeological, ethnographic, and environmental contexts for specific project areas in King County, 92 of them filed between 2001 and 2015. Most overviews compile basic information for a project area to allow resource managers to make decisions regarding the archaeological resource base or to allow project engineers and planners to select from among various project alternatives, for example for sewage conveyance pipelines or road alignments (e.g., Forsman et al. 1997; Shong, Gillis, et al. 2007). Managers often use overviews to decide if a project area requires more intensive investigation or if some alternatives have greater probability of intersecting archaeological materials than others.

Federal agencies, including the Mt. Baker-Snoqualmie National Forest (Hollenbeck 1987), the adjacent Wenatchee National Forest (Hollenbeck and Carter 1986) and Gifford Pinchot National Forest (Jermann and Mason 1976) and national parks (Mount Rainier [Burtchard 1998], North Cascades [Mierendorf 1986], Olympic [Schalk 1988]) produced important overviews and regional models for the large areas they manage. Overviews at a somewhat smaller scale can come from watersheds (Hedlund et al. 1978; Larson 1987a, 1987c; Larson et al. 1994) and provide useful syntheses of ethnographic, archaeological, and environmental information. Smaller-scale overviews for projects such as proposed pipeline alignments also contribute to our understanding of the archaeological record in King County by offering detailed information regarding environment, ethnographic patterns, and historic period ground modifications for projects in the Greater Seattle area. Archaeologists have also compiled information from a number of small-scale overviews to develop a compendium of environmental, archaeological, and ethnographic data for most areas in and adjacent to the City of Seattle hosting large mega-projects like construction of the sports stadiums, light rail, the State Route (SR) 520 bridge, the SR 99 downtown viaduct, and the sea wall replacement project.

Archaeological Survey Projects

Survey-level fieldwork is the most common form of archaeological investigation in King County. The frequency of government agencies requiring such documentation for construction projects has increased over the past several decades through a combination of increasing urban and suburban development, reconfiguration and strengthening of cultural resource regulations at the federal, state, and local level, and a few unanticipated discoveries during past construction projects outside of King County that have pushed the consequences of inadequate survey methods to the forefront of public and professional attention. Over 1,600 archaeological survey reports for King County were produced between 1963 and 2015 and are on file in the DAHP and King County HPP archaeological databases.

Survey projects have made important contributions to our understanding of pre-contact Native American adaptations in King County. In 1976, less than 20 hunter-gatherer archaeological sites were recorded in King County. Most of the 300 Native American archaeological sites or site components recorded in King County since 1976 were found during archaeological surveys. Surveys of foothill and mountain environments by USFS archaeologists have also identified sites in areas of King County where there was little prior information regarding the Native American archaeological record. Survey methodologies have evolved as well over the past several decades, along with other changes in professional standards. In a region where vegetation nearly always prevents examination of the ground surface, for example, shovel probes have become a standardized methodology (Figure 6-1).

Most survey projects completed in the late 1960s and early 1970s are documented in specific reports, or were included in summaries of larger regional-scale investigations such as annual summaries of archaeological surveys conducted for the Washington State Department of Highways (now Washington State Department of Transportation [WSDOT]) and the Washington State Parks and Recreation Commission. U.S. Army Corps of Engineers (USACE) archaeologists prepared Washington State Archaeological Inventory forms for sites, but often did not prepare formal project reports distributed outside the agency. Green River Community College began a long-term research program to identify and analyze archaeological sites on the Enumclaw Plateau in the 1970s, substantially expanding the record of sites in that area (Hedlund 1973, 1976, 1983). More than 15 hunter-gatherer archaeological sites were recorded, and survey results were later described in publications that included information on archaeological test excavations and surface collections.

By the late 1970s, the number of archaeological surveys with reports cataloged by Washington State increased exponentially, with the peak number of archaeological survey reports cataloged in 1980. Surveys conducted for the USFS, Mt. Baker-Snoqualmie National Forest timber sales, and utilities projects accounted for most of the increase in archaeological survey reports during the late 1970s. Most of the USFS archaeological reconnaissance projects were conducted by archaeological technicians who

Figure 6-1. Archaeological survey.

were supervised by professional archaeologists. The USFS appears to have been one of the few federal agencies to emphasize compliance with cultural resources laws and executive orders that were promulgated in the late 1960s and early 1970s. Other public agencies conducting survey projects included transportation agencies, such as WSDOT and KCRSD, USACE, local sewer districts, the Port of Seattle, METRO, the City of Seattle, and various other departments in King County.

Archaeological surveys for private developers, including housing construction and small hydroelectric power projects, were first reported in 1980 in small numbers. Many of the USFS projects were timber sale projects that included small areas as well as those with considerable acreage. Between 1982 and 1988, the total number of archaeological survey reports decreased from the previous high, ranging between 12 and 25 project reports per year for the 7-year period, while the number of surveys conducted shifted among agencies. For example, WSDOT and other public agencies surpassed the USFS in the number of survey projects undertaken. The number of survey projects conducted for private developers was relatively stable during the early and middle 1980s, ranging between one and four reported surveys per year. Between 1989 and 1993, reported surveys increased to a relatively stable pattern of between 21 and 25 reports per year. An increase in the number of USFS timber sale and land exchange projects accounted for more than half of the archaeological reconnaissance reports for that 4-year period. Archaeological surveys conducted for private clients and for the City of Seattle composed most of the remainder of the survey reports during the period between 1989 and 1993.

Between 1994 and 2001, the number of archaeological reconnaissance reports fluctuated between lows of 13 reports per year and a high of 42 reports in 1997. USFS archaeological surveys of large areas that were part of land exchanges contributed to a peak number in 1997 and 1998, but were greatly reduced after 1998 as timber sales dwindled. As the intensity of USFS archaeological surveys decreased, King County agencies such as Surface Water Management, Wastewater Treatment, and Road Services Division sponsored more archaeological surveys. Surveys conducted under the auspices of the City of Seattle and for private developers also composed a larger portion of archaeological reconnaissance projects than in previous years. An average of about 60 survey/reconnaissance reports was filed each year between 2001 and 2009, and an average of 90 reports each year between 2010 and 2015.

Archaeological Construction Monitoring

Highway survey archaeologists from the University of Washington Department of Anthropology first used the term “monitoring” to describe archaeological field investigations in the middle 1960s, although the first explicit construction monitoring projects were not conducted until the early 1980s. The University of Washington had a contract with the Washington State Department of Highways to conduct archaeological survey before and during highway construction projects. Highway archaeologists inspected the ground surfaces of project rights-of-way prior to construction as part of an initial archaeological reconnaissance of project areas. Highway archaeologists frequently examined project areas multiple times during construction as ground visibility improved with clearing and stratigraphic exposures were created during construction excavation.

The county and state databases list reports of the results of almost 300 monitoring projects in King County. Monitoring gained momentum after its start in the early 1980s. One of the first instances of monitoring in King County was during excavation of geotechnical borings and geotechnical trenches for the METRO Renton Effluent Transfer System on the Duwamish River floodplain and Elliott Bay in the middle 1980s (Kennedy 1985a). Monitoring protocols were frequently developed for sewage conveyance pipeline and other construction projects in the early 1990s. For example, archaeologists worked with engineers and construction personnel at the West Point Sewage Treatment Plant to develop monitoring procedures for the removal of fill and beach deposits in construction zones several months before construction was initiated (Larson and Lewarch 1995). More recent work related to construction of a replacement for the Alaskan Way Viaduct has involved archaeological monitoring of geotechnical boreholes and excavation for various construction components (Hodges et al. 2007; Miss et al. 2008). The scope of this work is immense and has required clear protocols with WSDOT, a substantial amount of geoarchaeological and historical research prior to excavation, and in-depth consideration of the geomorphology and historical development of much of the Seattle waterfront to guide both the archaeologists and the project proponent. In all, over 200 archaeological construction monitoring reports for projects varying widely in size and scope were prepared for projects between 2001 and 2015.

Sites and site types have been identified by monitors in environments where none had been previously recorded. Site boundaries were also expanded for some previously recorded properties. Monitoring is often the only means of obtaining information about the archaeological record and past environments in areas normally inaccessible using conventional survey methods, such as deeply buried deposits or those covered by impermeable surfaces (Figure 6-2). Archaeologists working in King County now routinely propose archaeological construction monitoring of deep excavation in areas with fill, because fill placement sometimes protects archaeological deposits in place.

Archaeological Test Excavation Projects

Archaeological test excavations use limited numbers of excavation units, often isolated 1-m- or 0.5-m-square units and additional shovel or auger probes dispersed throughout a portion of a site (Figure 6-3). Archaeological deposits (and often the surrounding landform) are examined to evaluate their

Figure 6-2. Archaeological monitoring.

Figure 6-3. Archaeological test excavations.

significance and integrity and to further define boundaries after initial identification. The county and state databases have almost 80 reports that focused specifically on archaeological test excavations in King County, over half of which were produced since 2001. Most recent data recovery excavation projects were preceded by an initial testing phase of field investigations to evaluate site significance. If subsequent mitigation is conducted, results of test excavations are often included in data recovery reports rather than reported separately. Investigations focused on assessing damage to archaeological sites are considered testing investigations as well (e.g., Kenmotsu 2014; Shong and Miss 2012). Archaeological test excavation projects were more numerous after about 1986 in King County. Table 6-1 lists the 46 reports associated with testing of King County archaeological sites or site complexes specifically with pre-contact components.

Table 6-1. Pre-Contact Archaeological Sites in King County with Reported Archaeological Test Excavations

Site	Site Name	Reference	Reference Title
45KI9	Marymoor Site	Norman 2000b	*Archaeological Testing for the Clise Mansion Sprinkler System*
45KI11	-	Shong and Hudson 2005	*Letter Report: Additional archaeological testing at site 45-KI-11 related to the Sammamish River Trail. Repair and Widening Project, King County, Washington*
45KI11	-	Earley 2006	*Letter Report: Woodinville Village 45KI11 Boundary Identification*
45KI11	-	Shong, Miss, et al. 2007	*Results of Archaeological Testing at 45-KI-11, for the Woodinville Village Development, King County, Washington*
45KI11	-	Shantry 2008	*Letter Report: Site 45-KI-11 Boundary Determination Within the Redmond Village Apartments Property, King County, Washington*
45KI11	-	Shantry et al. 2008	*Archaeological Resource Damage Assessment for Site 45KI11*

Table 6-1. Pre-Contact Archaeological Sites in King County with Reported Archaeological Test Excavations

Site	Site Name	Reference	Reference Title
45KI23	Duwamish No. 1 Site	Lorenz et al. 1976	*Archaeological Testing at the Duwamish No. 1 Site, King County, Washington*
45KI23	Duwamish No. 1 Site	Jermann et al. 1977	*Continued Archaeological Testing at the Duwamish No. 1 Site (45KI23)*
45KI12	Sammamish Slough Site	Thomas 1978	*Archaeological Evaluation of Pedestrian Bridge Site on Sammamish River Trail*
N/A	-	Hedlund 1979	*A Report on the Archaeological Resources in the Vicinity of the Icy Creek Rearing Pond No. 2*
45KI54	-	Wall 1980	*Determination of Eligibility Property Description Form, 45KI54*
45KI59	Tualdad Altu	Elmore and Chatters 1980	*Archaeological Test Excavations at the Proposed Earlington Industrial Park*
HMA, HMB	-	Hartmann 1980	*Archaeological Test Excavations on Huckleberry Mountain, White River Ranger District, Mount Baker-Snoqualmie National Forest, Washington*
N/A	-	Kennedy 1985b	*The METRO Renton Effluent Transfer System Archaeological Testing, Foster Golf Course, ETS-3D*
45KI64	Noble-Smith Site	Hoyt et al. 2009	*Big Spring Creek Relocation Phase I Cultural Resources Assessment, King County, Washington*
45KI267	Surge Tank Hill	Kennedy 1985a	*The METRO Renton Effluent Transfer System Archaeological Testing, Site 45KI267, ETS-3C*
45KI264, 45KI265	Hubers Site Brant Site	Larson 1986	*Report on Archaeological Testing on the Muckleshoot and Puyallup Reservations*
45KI33	Auburn Game Farm Site	Hedlund 1987	*Test Excavations of the Auburn Game Farm Site (45KI33)*
Multiple Sites	-	Samuels 1993	*The Archaeology of Chester Morse Lake: Long-Term Human Utilization of the Foothills in the Washington Cascade Range*
45KI431	Allentown Site	Lewarch et al. 1993	*METRO Alki Transfer/CSO Project Allentown Site (45KI431) Survey and Evaluation*
45KI432	Harbor Avenue Shell Midden	Solimano et al. 1993	*Cultural Resource Testing 45KI432 Alki Transfer/CSO Project, West Seattle Pump Station, King County, Washington*
45KI431	Allentown Site	Wilhelmsen 1993	*Results of a Sub-Surface Survey at the Allentown Pea Patch Property, Tukwila, Washington*
45KI431	Allentown Site	King 1995	*Results of Exploratory Backhoe Trenching for the City of Tukwila Community Recreation Center Project*
45KI436	Saltwater State Park Shell Midden	Smith 2009	*Cultural Resources Survey and Test Excavation Results for the Saltwater State Park Bio-Retention Systems Project, King County, Washington*
45KI437	Burton Acres Shell Midden	Norman 1997	*An Archaeological Investigation at the Site of the Proposed Burton Acres Park Boat Shed*
Multiple Sites	-	Boreson 1999	*Archaeological Investigations at Howard Hanson Reservoir, King County, Washington*
45KI445	Muckleshoot Amphitheatre Site	Lewarch, Robbins, et al. 2000	*White River Amphitheatre Project Archaeological Reconnaissance, Monitoring, and Testing Muckleshoot Indian Reservation Auburn, King County, Washington*
45KI455	Tollgate Farm	Lockwood and Hoyt 2013	*Tollgate Farm Park Project, City of North Bend, King County, Washington; Archaeological Survey and Testing at 45-KI-455*
45KI457	-	Nelson 1998b	*Interim Report on Phase I Excavations at 45-KI-457, King County, Washington*
N/A	-	LeTourneau 2001	*Results of Archaeological Field Inspection and Testing at Auburn Commuter Rail Station Garage*
45KI490	Phillip Starr Allotment	Murphy and Larson 2001	*Letter Report: Phillip Starr Allotment Site (45KI490) Testing, Muckleshoot Indian Reservation*
45KI490	Phillip Starr Allotment	Herbel and Schalk 2002	*Draft: Archaeological Test Excavations at Component 2 of the Phillip Starr Allotment Site (45KI490), Muckleshoot Indian Reservation, King County, Washington.*
45KI500	Red Barn Site	Crisson et al. 2001	*Washington State Department of Transportation's SR 18-180th Ave SE to Maple Valley Project: Results of Cultural Resources Survey and Test Excavations at 45KI500, King*

Table 6-1. Pre-Contact Archaeological Sites in King County with Reported Archaeological Test Excavations

Site	Site Name	Reference	Reference Title
			County, Washington
45KI501	Renton High School Indian Site	Kramer et al. 2001	*Renton High School Archaeological Resources and Traditional Cultural Places Assessment, King County, Washington*
45KI506/507	-	Norman 2002	*National Register of Historic Places Evaluation of Sites 45-KI-506 and 45-KI-507, King County, Washington*
45KI512	-	Crisson 2002	*Washington State Department of Transportation's SR 18: Maple Valley to Issaquah Hobart Road Project: Results of Cultural Resources Survey and Test Excavations at 45KI512, King County, Washington*
45KI694	Meridian Valley Flume Site	Kent 2005	*Cultural Resources Reconnaissance Survey, and Testing and Evaluation of Archaeological Site 45KI694 for the Meridian Valley Creek Realignment Project on Big Soos Creek City of Kent, King County, Washington*
45KI697	Auburn Narrows Hearth	Shong et al. 2011	*Cultural Resources Assessment, Monitoring and Testing at the Tacoma Second Supply Pipeline, Auburn Narrows Offsite Mitigation Project*
45KI703	-	LeTourneau and Blukis Onat 2004	*Supplemental Treatment Plan for Archaeological Data Recovery at Site 45KI703, Tukwila, Washington*
45KI703	-	Lockwood et al. 2013	*Duwamish Gardens Project, City of Tukwila, King County, Washington; Archaeological Delineation at 45-KI-703*
45KI717	-	Luttrell and Gough 2005	*Letter Report: SR 164, Site 45KI717 Preliminary Test Excavation Results Summary*
45KI724	Racing Stable Site	Kiers and LeTourneau 2007	*Results of Archaeological Testing Investigations for the Carnation Wastewater Treatment Facility Conveyance Line, Site 45KI724, Carnation, King County, Washington*
45KI732	Shimer Shell Midden	Shong and Miss 2012	*Report of Damage Assessment for Site 45KI732 at 2854 SW 300th Place, Federal Way, King County, Washington, Emergency Archaeological Excavation Permit No. 2012-08*
45KI733	-	Kopperl 2006a	*Results of Archaeological Testing at 45-KI-733, for the Muckleshoot Tribal School, King County, Washington*
45KI815	*Lwalb* Old Channel One	Silverman et al. 2010	*45KI815 Archaeological Testing, South Park Bridge Replacement Project, FHWA Federal Aid Number DBP 1491(001)*
45KI818	-	Hoyt and Johnson 2009	*Delineation of Archaeological Site 45-KI-818, King County, Washington*
45KI834	-	Kiers 2008	*Results of Archaeological Survey and Testing Investigations for the NE Novelty Hill Road Project, King County, Washington*
45KI839	Bear Creek Site	Kopperl et al. 2010	*Results of Testing at Bear Creek, Site 45-KI-839, Redmond*
45KI839	Bear Creek Site	Kenmotsu 2014	*Damage Assessment for the Bear Creek Site, 45KI839*
45KI1176	Maclean Site	Shantry et al. 2014	*Results of Archaeological Testing at 45KI1176 for the Cascadia Issaquah Memory Care Center*
45KI1224	-	Shantry et al. 2015	*Results of Archaeological Testing at 45KI1224 for the Pinnacle Peak Park Project, King County*

One factor contributing to the increase in archaeological test excavation projects was that archaeologists identified more sites during archaeological survey projects. The increase in site identification arose from the use of better field techniques and inspection of landforms in urban areas or areas that had been modified through agricultural tillage. With the increase in archaeological testing projects came more sophisticated excavation techniques and sampling designs. Archaeologists in the 1970s often excavated only one or two 1 × 1–m sample units in a site, usually in an area with the greatest artifact density. More recently, archaeologists have begun to use multi-phase sampling programs, distributing small sample units across all areas of an archaeological site to determine distributions of data classes and obtain representative samples of archaeological deposits (e.g., Kopperl

2006a; Kopperl et al. 2010; Lewarch et al. 1993; Lewarch, Larson, et al. 1996; Lewarch, Robbins, et al. 2000a; Solimano et al. 1993).

Data Recovery Excavation

Data recovery usually involves excavating a large enough sample of deposits to make statistically confident inferences about a site, guided by an explicit, scientifically sound research design that presents research questions and hypotheses that are testable using the data collected at the site. On some occasions, data recovery may involve excavation of the entire deposit within a project area in anticipation of future destruction. Methodology varies, but usually involves excavation units grouped to form contiguous excavation blocks to obtain archaeological data from the site, in most cases prior to construction or other ground modification activities (Figure 6-4). Project proponents frequently redesign to avoid sites following a survey so that data recovery is not required, or is limited in scale.

A total of 41 sites or site complexes (including those with pre-contact and post-contact historic-period components) have undergone reported data recovery excavations, over half of which were reported since 2001. Data recovery has been completed for research purposes at only a few sites in King County, including the Tokul Creek Site (45KI19) (Onat and Bennett 1968), the Marymoor Site (45KI9) (Greengo 1966; Greengo and Houston 1970), the Pedersen Site (45KI4) and the Jokumsen Site (45KI5) (Hedlund 1983), and the Burton Acres shell midden (45KI437) (Stein and Phillips 2002). These excavations were conducted at least in part as projects by academic institutions with a strong emphasis on training students or the volunteer public. Excavation of the Burton Acres shell midden was also conducted in part because the deposits were in danger of eroding into Quartermaster Harbor. Data recovery excavations in King County generated chronological information, samples of features, and samples of artifact classes that contributed important archaeological data for the Southern Puget Sound basin.

Figure 6-4. Archaeological data recovery excavations.

Table 6-2 summarizes reports for 31 sites or site complexes with Native American archaeological components for which data recovery was conducted within King County.

Table 6-2. Native American Archaeological Sites in King County with Reported Data Recovery Excavations

Site	Name	Author	Reference
45KI4	Pedersen Site	Hedlund 1973	*Background and Archaeology of Inland Cultural Sites at Connel's Prairie, Washington (45PI44 and 45PI45)*
45KI4	Pedersen Site	Hedlund 1983	*Location and Cultural Assessment of Archaeological Sites on the Enumclaw Plateau in the Southern Puget Lowland*
45KI5	Jokumsen Site	Hedlund 1973	*Background and Archaeology of Inland Cultural Sites at Connell's Prairie, Washington (45PI44 and 45PI45)*
45KI5	Jokumsen Site	Hedlund 1976	*Mudflow Disaster*
45KI5	Jokumsen Site	Hedlund 1983	*Location and Cultural Assessment of Archaeological Sites on the Enumclaw Plateau in the Southern Puget Lowland*
45KI9	Marymoor Site	Greengo 1966	*Archaeological Excavations at the Marymoor Site (45KI9): A Report to the National Park Service Region Four, Order Invoice Voucher 34-703 and 34-64-554 (Sammamish Flood Control Project)*
45KI9	Marymoor Site	Greengo and Houston 1970	*Excavations at the Marymoor Site*
45KI19	Tokul Creek Site	Onat and Bennett 1968	*Tokul Creek: A Report on Excavations on the Snoqualmie River by the Seattle Community College*
45KI23	Duwamish No. 1 Site	Campbell 1981	*The Duwamish No. 1 Site: A Lower Puget Sound Shell Midden*
45KI23	Duwamish No. 1 Site	URS Corporation and BOAS 1987	*The Duwamish No. 1 Site 1986 Data Recovery*
45KI25/45KI32	-	Schalk et al. 2004	*Archaeological Recovery for Chester Morse Lake Channel Excavation and Submerged Dam Modification Project*
45KI51	Sbabadid Site	Chatters 1981a	*Archaeology of the Sbabadid Site (45KI51), King County, Washington*
45KI59	Tualdad Altu Site	Chatters 1988	*Tualdad Altu (45KI59): A 4th Century Village on the Black River, King County, Washington*
45KI227	Naches Lithic Scatter Site	Blukis Onat et al. 1988	*Naches Lithic Scatter, CR05-07-31, Data Recovery Report*
45KI263	Fall City Riverfront Park Site	Nelson 1998a	*Cultural Resources Investigations at the Fall City Riverfront Park, King County, Washington*
45KI263	Fall City Riverfront Park Site	Nelson 2000a	*Results of Surface Mapping at the Proposed Fall City Riverfront Park Soccer Field*
45KI263	Fall City Riverfront Park Site	Schumacher and Burns 2005	*YUETSWABIC (45KI263): Preliminary Analysis of the Archaeological Collection*
45KI280/281	-	Walker et al. 2009	*Archaeological Investigations at Sites 45KI280 and 45KI281, Howard Hanson Reservoir*
45KI291	Skykomish Rock Shelter	Gough and Galm 1988	*Results of Archaeological Excavations at 45KI291, King County, Washington*
45KI428/429	West Point Shell Midden	Larson and Lewarch 1995	*The Archaeology of West Point, Seattle, Washington: 4,000 Years of Hunter-Fisher-Gatherer Land Use in Southern Puget Sound*
45KI431	Allentown Shell Midden	Lewarch, Larson, et al. 1996	*King County Department of Natural Resources Water Pollution Control Division Alki Transfer/CSO Facilities Project Allentown Site (45KI431) and White Lake Site (45KI438 and 45KI438A) Data Recovery*
45KI435	Mule Spring Site	Miss and Nelson 1995	*Data Recovery at the Mule Spring Site, 45-KI-435, King County, Washington*
45KI437	Burton Acres Shell Midden	Stein and Phillips 2002	*Vashon Island Archaeology: a View from Burton Acres Shell Midden*
45KI438	White Lake Site	Lewarch, Larson, et al. 1996	*King County Department of Natural Resources Water Pollution Control Division Alki Transfer/CSO Facilities Project Allentown Site (45KI431) and White Lake Site (45KI438 and 45KI438A) Data Recovery*
45KI450	The George Nelson Allotment Site	Lewarch, Forsman, Iversen, et al. 2000	*Data Recovery Excavations at the George Nelson Allotment Site (45KI450), King County, Washington*

Table 6-2. Native American Archaeological Sites in King County with Reported Data Recovery Excavations

Site	Name	Author	Reference
45KI464	*Stuwe'yuq[w]*	Blukis Onat et al. 2001	*Archaeological Investigations at stuwe'yuqw – Site 45KI464, Tolt River, King County, Washington*
45KI501	Renton High School Indian Site	Kramer et al. 2001; Lewarch 2006	*Renton High School Archaeological Resources and Traditional Cultural Places Assessment, King County, Washington; Renton High School Indian Site (45KI501) Archaeological Data Recovery, King County, Washington*
45KI551	-	Juell 2003	*Letter Report: Recovery Results Associated with Emergency Archaeological Excavation Permit No. 02-18, 6307 SW Marguerite Court, West Seattle; Archaeological Site 45-KI-551*
45KI686	Henry Moses Aquatic Center Site	Lewarch et al. 2003;	*Letter Report: Data Recovery Excavations-at the Henry Moses Aquatic Center Site (45KI686) Washington State Office of Archaeology and Historic Preservation Emergency Excavation Permit No, 03-12.*
45KI686	Henry Moses Aquatic Center Site	Kaehler et al. 2004	*Data Recovery Excavations at the Henry Moses Aquatic Center Site (45KI686), Renton, King County, Washington*
45KI703	Duwamish River Bend Site	Blukis Onat et al. 2010	*The Duwamish River Bend Site: Data Recovery at 45KI703*
45KI717	-	Willis 2008	*Data Recovery Excavations at Archaeological Site 45KI717, King County, Washington: a Post-Osceola Mudflow Occupation on the Enumclaw Plateau*
45KI724	-	Bernick et al. 2009	*Results of Archaeological Date Recovery at Site 45KI724, Carnation, King County, Washington*
45KI757	East Norway Hill Lithic Scatter	Rooke and Chatters 2009	*Data Recovery at 45KI757, an Olcott Isolate, King County*
45KI815	*Lwalb* Old Channel One	Schultze et al. 2013	*45KI815 Archaeological Data Recovery, South Park Bridge Replacement Project*
45KI834	-	Ferris et al. 2010	*NE Novelty Hill Road Project Site 45KI834 Data Recovery Investigations*
45KI839	Bear Creek Site	Kopperl 2016	*Draft Results of Data Recovery at the Bear Creek Site (45KI839), King County*
45KI843	*qebqebaXad*, Manzanita Beach	Deppen et al. 2014	*Report on the Investigations at 45-KI-843 (qebqubaXad, the Manzanita Beach Site) Maury Island*
45KI1176	Maclean Site	Shantry et al. 2015	*Data Recovery Investigations at 45KI1176 for the Issaquah Memory Care Center*

Reliability of the Professional Archaeological Investigations in King County

Archaeological field and reporting standards have changed over the past 50 years, and most of those changes have increased the reliability of the archaeological record. Field archaeologists generally did not use standardized subsurface probes to obtain samples of subsurface matrix during archaeological surveys conducted in King County prior to 1980. Survey transects were sometimes spaced at intervals that were too large to identify small, low artifact density pre-contact archaeological sites, or were not systematically placed. If archaeologists prepared reports that summarized archaeological surveys, the reports often consisted of a few pages of generalized text with no detailed maps that delineated project areas or locations of individual survey transects, or discussions of the rationale for field techniques.

On the whole, the quality of archaeological field investigations and reporting in King County have dramatically improved in the past two decades. Contemporary professional standards include the use of field techniques to obtain samples below modern ground surfaces, close interval pedestrian transects to inspect ground surfaces of project areas, more rigorous use of screens and fine-mesh screened samples, and detailed reporting of field techniques and areas examined, including maps that show the locations of inspection transects and subsurface sample points. Because of changes in professional standards, DAHP has set forth guidelines regarding reporting standards and generally requests a resurvey of a project area using contemporary techniques if a project area was surveyed prior to 1995. The quality of the archaeological database has also increased as greater attention has been paid to specialized laboratory analyses such as dating by radiocarbon, luminescence, and other techniques; sourcing lithic raw materials such as obsidian, and petrographic analysis of lithic artifacts; analysis of protein and lipid residues; and zooarchaeological and botanical analyses on samples that are routinely collected today.

THE KING COUNTY DATABASE AND BURKE MUSEUM DATA SET

In addition to the database of archaeological sites and historic resources from DAHP and ethnographic locations discussed in Chapter 3, the HPP database includes more informal accounts of archaeological sites and artifacts reported by the public to the Burke Museum of Natural History and Culture at the University of Washington. The museum maintains a list of people who contact the Archaeology Division with information regarding possible archaeological materials and, in some cases, curates artifacts that are donated to the museum by members of the public. Information ranges from location of isolated artifacts to more extensive studies by amateur archaeologists. An example of such avocational work is the survey of Quartermaster Harbor by E.O. Roberts in 1919 and 1920 (Stein and Phillips 2002). Another data set curated at the Burke Museum is a collection of notes, maps, photographs, and correspondence generated by the University of Washington’s former archaeological contract wing, the Office of Public Archaeology (OPA), regarding investigations they conducted for the Washington State Department of Highways in the 1960s and 1970s, and other clients into the mid-1980s. These records provide information not found in site forms or reports archived elsewhere.

Although the Burke Museum data set is not used in construction of the GIS site sensitivity model, it provides insights on the distribution of archaeological resources in King County and where people seek such material. The Burke Museum data set was reviewed in detail during production of the first phase of this project (Lewarch and Larson 2003), at which time information was reviewed and coded from more than 190 contacts the museum made over the past 90 years. Quality and detail vary by case, sometimes including detailed locational and descriptive information, such as the kind and shape of artifacts, descriptions of the environmental setting, and precise location. Other cases have only a general description of materials and approximate location taken from a brief telephone conversation with museum personnel.

Archaeological materials were most frequently (almost 25% of cases) reported from the marine littoral, followed by material found on glacial drift plains above the marine littoral near the shoreline (slightly over 10%). Less frequently reported were materials from farther inland on the glacial drift plain, at estuaries, on river floodplains, along the west shoreline of Lake Washington, and the shoreline of Lake Union. The relatively large number of shoreline-related Burke localities parallels the abundant subsistence resources found along the marine littoral zone of King County. Cotemporary land use patterns and population density, however, probably also condition the distribution patterns of the Burke Museum data. The majority of the marine littoral localities are on Vashon Island, specifically the shoreline of Quartermaster Harbor. Duwamish Island, which includes West Seattle, and the Seattle Peninsula, which encompasses Beacon Hill, Downtown Seattle, Capitol Hill, Magnolia, Queen Anne, Ballard, and the north end of urban Seattle, also have a relatively large number of localities represented in the Burke Museum data set.

ARCHAEOLOGICAL SITE TYPES IDENTIFIED IN KING COUNTY

Site records inventoried at DAHP for recorded Native American archaeological sites in King County were classified into site types using the classes outlined in Chapter 5 (dividing procurement/processing sites into those focused on hunting, fishing, shellfish gathering, plant gathering, or quarrying), and tabulated in Appendix D, Tables D-2 and D-3. Approximately 300 sites with pre-contact components (including isolated pre-contact artifacts) have been classified in this manner. In a few cases, more than one site type could be assigned to multiple-component sites and they are represented in the table by more than one entry, and are tabulated per site type in the discussion below. Despite the overall improvement in the consistency and rigor of definitions and classifications relating to functional aspects of the King County archaeological record, however, archaeologists still rarely employ standardized terminology to describe landforms, vegetation patterns, artifact classes, or feature classes.

A standardized set of criteria was applied to classify sites whenever possible into probable residential and activity types, using attributes listed in Table 5-2. In review of King County site records and research reports, activity association (residential, non-residential, and non-activity) is inferred based primarily on presence or absence of features thought to be structural remains such as postmolds, or thermal features that may represent hearths. Non-activity sites are classified in a relatively more straightforward manner, based on presence of cairns, CMTs, trail treads, burials, rock art, or artifact isolates unassociated with other archaeological deposits. Task intensity (multiple- or single-task) at residential and non-residential sites is inferred primarily by richness and diversity of categories of artifacts noted in site forms and reports, richness and diversity of faunal remains if present and analyzed, and proximity to several obvious and major categories of subsistence resources. It is acknowledged that this classification should be considered tentative—for example, further elucidation of existing site data or generation of new data at sites considered simple resource procurement sites may suggest residential activities or harvest and processing of several kinds of resources at the same location. Also, better chronological control and differentiation of stratified archaeological deposits may isolate components representing different site types at the same location. This is the case for the West Point Site Complex (45KI428/429) and the Jokumsen Site (45KI5); the former having undergone substantial excavation (Larson and Lewarch 1995) and the latter having two well-defined components based on geological context (Hedlund 1976).

Many of the inventoried resources listed in Appendix D were not classified into site types when their records indicate they consisted of artifact isolates; sparse scatters of lithic debitage, unanalyzed flake tools, and/or fire-modified rock; artifacts from disturbed contexts; or questionable associations of fire-modified rock considered possible features. They are listed as "N/C" (not classified) in the appendix tables, and comprise about 44 percent of the King County inventoried site database. An objective classification of all inventoried sites in King County based on archaeological, environmental, and occasionally ethnographic data is impossible given the inconsistencies in field methodology and reporting standards. Most principal investigators of particular sites would probably offer a confident evaluation of the age and potential of a site to yield remains of residences and particular economic activities, given an adequate sampling strategy. Using the existing King County data set, however, to accomplish the same task for almost 300 resources is difficult at best. This is reflected in part by the accelerated rate of isolated artifacts being found and inventoried over the past decade, and non-descript lithic scatters being identified during the course of cultural resources management projects with the need for their further investigation avoided through project redesign. Even resources that cannot be classified, such as simple scatters of lithic debitage and isolated artifacts, may still be useful to test the GIS sensitivity model (see Chapter 8). As long as the majority of archaeological resources are recorded as "lithic scatters," however, and field sampling, laboratory analyses, and subsequent synthetic research do not permit archaeologists to infer any sort of activity aside from some level of lithic reduction, the majority of resources will not be able to be meaningfully classified.

Village

Three recorded archaeological sites in King County are inferred to be villages, including the Fall City Riverfront Park Site (45KI263) on the Snoqualmie River floodplain (Nelson 1998a, 2000a; Schumacher and Burns 2005); a large shell midden site on the marine littoral at the mouth of a small creek in Redondo (45KI3); and an ethnographic village reported near the early historic period mouth of the Duwamish River (45KI52). Russ Hanley completed a site form for the reported ethnographic village in 1979, although Hanley did not identify any archaeological deposits in the area. In 1985, Hal Kennedy observed archaeological materials in backdirt from geotechnical borings in the vicinity of 45KI52 that suggested archaeological deposits probably occurred in the area. Site 45KI52 is included as a village because of the apparent congruence between archaeological deposits and the ethnographic village. More archaeological village sites are expected than what have previously been recorded along the marine littoral and at the confluences of major rivers and rivers and streams, based on ethnographic data and interpretations of habitat productivity. The low number of recorded village sites is most likely due to extensive shoreline modifications carried out after 1870 in King County. Urban and commercial development along the marine shoreline of Seattle probably destroyed or covered village sites that predated the early historic period. Although the Sbabadid Site (45KI151) had a house structure, the site was probably a field camp with a fishing focus rather than a winter village (Chatters 1981a).

Base Camp

Five base camp components occur in archaeological sites recorded in King County. Archaeological deposits with a wide range of feature types and indicators of multiple seasons of occupation occur in Components 1 and 2 of the West Point Site Complex (45KI428 and 45KI429) in Seattle (Larson and Lewarch 1995). Other sites that have undergone relatively less archaeological investigation yet still yield evidence of possible residential features and transportation to the site of resources from diverse parts of the landscape include 45KI11, 45KI20, 45KI55, and 45KI450. Base camps are analogous to Thompson's (1978) Settlement Type 6, which are multi-season residential bases that served as the hub for task groups to access nearby resources.

Base camps, like villages, are underrepresented in the archaeological record of King County. Base camps were probably the primary seasonal hub of settlement in Western Washington from 14,000 years ago to approximately 2,500 years ago. Areas on the marine littoral that have been inundated by the rise in the surface elevation of Puget Sound and on the older, deeply buried alluvial levees and deltas in the Duwamish River–Green River Valley probably have base camp deposits that have been inundated or buried. Archaeological deposits at West Point, below the contemporary surface elevation of Puget Sound, are examples of the kinds of archaeological materials that should occur at stream mouths along the marine littoral of King County and on the former marine shoreline of the Duwamish Embayment.

Field Camp

The King County database has examples of 49 field camps focusing on the acquisition of either one or several resources. Some multiple-component sites categorized as base camps also had components that indicate the areas were used as field camps by smaller groups and for shorter time periods. The West Point Site Complex (45KI428 and 45KI429) in Seattle was used as a field camp during occupations after about 2,500 years ago. Other sites classified as field camps include the Jokumsen Site (45KI5) on the Enumclaw Plateau (Hedlund 1983), Mule Spring Site (45KI435) on Huckleberry Mountain (Miss and

Nelson 1995), and 45KI20, a large site on a Snoqualmie River levee, at the confluence of the Raging River and Snoqualmie River. The large size and indication of a diverse artifact assemblage from accounts of knowledgeable residents at 45KI20 suggested use of the area as a field camp. The Jokumsen Site (45KI5) covers a large area on the gently undulating surface of the Enumclaw Plateau. Hedlund (1983) reported pits and postmolds and a diverse stone tool assemblage that suggests use of the area as a field camp on more than one occasion. The Mule Spring Site (45KI435) has fire pits and huckleberry processing features, as well as a diverse lithic tool assemblage and calcined bone (Miss and Nelson 1995).

Many of the identified components have data from archaeological test excavations and/or archaeological data recovery excavations that include a range of faunal materials, plant remains, hearths, pits, stone and bone tool manufacturing debris, formed stone and bone tools, and fire-modified rock. The Duwamish No. 1 Site (45KI23) on a stream terrace and uplifted marine shoreline is one of the most extensively studied sites in the Greater Seattle area (Campbell 1981; URS Corporation and BOAS 1987). Hunter-gatherers used the Duwamish No. 1 Site as a field camp through approximately 1,100 years ago, when the area was on the marine littoral of Elliott Bay. The marine shoreline was uplifted during an earthquake on the Seattle Fault Zone approximately 1,100 years ago and land use patterns shifted. Over the past 300 to 200 years, the Duwamish No. 1 Site was on the west side of the delta of the Duwamish River as the delta prograded into Elliott Bay. The Allentown Site (45KI431) is a field camp on a Duwamish River levee and point bar, with a focus on fishing activities and ancillary hunting and shellfish processing (Lewarch, Larson, et al. 1996). The Sbabadid Site (45KI51) (Chatters 1981a) and the Tualdad Altu Site (45KI59) (Chatters 1988) are field camps on the Black River floodplain that had a fishing emphasis, but also had evidence of hunting and plant collecting activities. Although found in lower densities than would be expected at a village site, lithic artifacts and fire-modified rock in buried alluvium nearby at the Renton High School Ball Field Site (45KI1010) may be associated with the ethnographic settlement of *skah-TELBSH* (Shong and Rinck 2011).

The Marymoor Site (45KI9) is a field camp on the Sammamish River floodplain, near the confluence with Bear Creek (Greengo 1966; Greengo and Houston 1970). A wide array of projectile points, abundant fire-modified rock, and faunal remains indicate hunting and fishing activities that span the period between ca. 5,000 and 1,100 years ago. One earlier component in the same general environment is the Bear Creek site (45KI839), which has artifact assemblage characteristics of a variety of activities suggesting its use as a field camp despite a lack of features or fire-modified rock (Kopperl et al. 2010). Six components on the Enumclaw Plateau are field camps, including the Pederson Site (45KI4) (Hedlund 1983) and the George Nelson Allotment Site (45KI450) (Lewarch, Forsman, et al. 2000). All have features, fire-modified rock, and diverse stone tool assemblages. Three components at the large sites near the outlet of Chester Morse Lake were reoccupied throughout the Holocene (Samuels 1993). Some areas of 45KI25, 45KI30, and 45KI31 have surface clusters of cobbles from hearth features, projectile points, cores, scrapers, utilized flakes, and stone tool manufacturing debris, and calcined bone that suggest use episodes as limited-task field camps (Samuels 1993). The Eagle Gorge Terrace I Site (45KI1083) was also found in a mountain lake setting, and included material indicative of a camp where animal and plant resources were processed (Cooper 2012). Field camps occur most frequently on river floodplains, on the prairies of the Enumclaw Plateau, and adjacent to mountain lakes.

Resource Procurement/Processing: General

A total of 28 site components in the King County database were classified as general resource procurement/processing sites. Sites with lithic artifact assemblages consisting of generalized tools and debitage, sometimes including fire-modified rock, were usually not associated with a particular economic focus despite these indications that more than just stone tool maintenance occurred there.

Presumably any of these sites could be classified into a more specific category with additional sampling and analysis.

Resource Procurement/Processing: Hunting Focus

Resource procurement/processing hunting localities are relatively well-represented in King County, with 25 archaeological components recorded in the DAHP database. Hunting sites have formed stone tools such as scrapers and projectile points, utilized flakes, tool resharpening and maintenance flakes, and fire-modified rock. There may be some overlap in the classification of King County sites that were residential hunting camps (limited-task hunting field camps) and those associated with non-residential animal procurement and processing, a distinction that is easily made in theory but harder to differentiate in practice, and even harder to accomplish when interpreting archaeological site inventory records with insufficient information.

The large number of hunting sites associated with river terraces and at river confluences is partly a function of sites recorded by Benson (1986) at the confluence of the main stem of the Green River and the North Fork of the Green River in the Howard Hanson Reservoir (see also Cooper 2012). Boreson (1999) excavated test units in some of the sites, collecting surface artifacts and plotting the distribution of artifacts and features. Five sites classified as hunting localities also have quarrying or lithic reduction area components. Hunting sites occur in a variety of habitats and have been assigned dates that span most of the Holocene. *Stuwe'yuqw* (45KI464) is on a glacial outwash drift plain above the deeply incised channel of the Tolt River and was utilized intermittently (Blukis Onat et al. 2001). Projectile point styles indicate occupations between ca. 7,000 and 3,500 years ago (Blukis Onat et al. 2001). The Williams Hole Boulder Shelter (45KI476) is a hunting camp below the overhang of a large boulder that is situated on a mountain bench at an elevation of approximately 1,280 m (4,200 feet) (Burtchard and Miss 1998). Hunting sites and residential hunting camps occur on a variety of landform types throughout King County, and are fairly common on glacial drift plains, near lakes in mountain environments, and on river floodplains near confluences of tributary streams or main stems of rivers. Resource acquisition sites with a hunting focus also include very small, very low density lithic artifact scatters with no indication of a residential aspect and little indication of specific function aside from projectile points.

Resource Procurement/Processing: Shellfish Gathering/Fishing Focus

Most archaeological deposits in King County and the greater Puget Sound region consisting of marine or estuarine shell middens with fish bones and possibly fishing implements are categorized as “shell middens” with specific functions left unspecified unless faunal remains, features, and artifacts are thoroughly analyzed. A site matrix composed in part of shell is often what is required to preserve bone, so these resources are quite often associated even though a shell midden may represent primarily shellfishing with incidental inclusion of fish remains, or vice versa at a fishing camp or processing site in which shellfish are incorporated into the deposit as a secondary resource. With exception of a few cases, non-residential deposits with unspecified concentrations of shell and bone are generally categorized as shellfish/fish procurement sites. In the case of *Lwalb* Old Channel One (45KI815), a shell midden along a former channel of the Duwamish River, fishing was likely a focus of the archaeological deposit although other littoral, riverine, and riparian resources were also observed (Schultze et al. 2013). In 2015, 21 such site components were in the database for King County, found in variety of marine shoreline and estuarine settings. Exceptions that can be attributed to either shellfish procurement or fishing are described below.

Resource Procurement/Processing: Fishing Focus

Only three components are classified as resource acquisition fishing locations based on the presence of fish bone, processing features, fire-modified rock, and charcoal, and the landform they were found on. Many other components in similar settings also contain features that suggest residential occupation as well, and are therefore classified as field camps. Two sites on the Cedar River-Black River floodplain in Renton have features and faunal remains indicative of a focus on fishing and fish processing. The Renton High School Indian Site (45KI501) (Kramer et al. 2001) has small, basin hearth features and surface hearths of cobbles with charcoal and calcined bone. This site is classified as a fishing site and may be associated with residential occupations found nearby in the Renton area. The Skykomish Rock Shelter Site (45KI291) is a fishing site in a very different environmental setting near the Skykomish River, which dates within the past 1,000 to 200 years (Gough and Galm 1988). Fish bones were identified in the faunal assemblage, indicating fish processing, as well as burned terrestrial mammal bone from hunting. The Des Moines Site (45KI449) is a small shell midden with fish bone on a terrace above Des Moines Creek (Iverson et al. 2000). Fish bones and position above a salmon-bearing stream suggest the area was used as a fishing location. Although no fish bones were identified at the Cherry Creek Falls Fish Camp site (45KI1108), which is unsurprising given a depositional setting unlikely to preserve them, ground and flaked stone tools were found in association with a stone fish weir below a waterfall of this upland tributary.

Fishing sites are underrepresented in the archaeological record of King County given the relatively large number of ethnographically documented fishing localities, suggesting that many more fishing localities should occur in the archaeological record. Fish weirs should occur in contemporary and abandoned channels of rivers and streams in the glacial drift plain zone in the west half of the county. Fishing sites on the marine littoral may be covered by alluvial sediments at stream mouths. Fishing sites on alluvial floodplains may be buried beneath flood deposits from historic-period floods dating back to the late 1800s.

Resource Procurement/Processing: Shellfishing Focus

The King County database has two components inferred to be primarily shellfish processing sites based on attributes such as fire-modified rock, shell strata, and low densities of stone tools and little or no non-shell food remains such as fish bone. Similar to fishing locations, most shellfish gathering/processing sites are either associated with features suggesting residential occupation, and are therefore classified differently, or lack information to specify the economic focus of the site as shellfish. The Bear Creek Midden (45KI22) and 45KI296 are notable and easily categorized because they are freshwater mussel processing locations without evidence of fishing activities. The Bear Creek Midden (45KI22) extends for more than 75 m (250 feet) along the stream bank in the middle reach of Bear Creek. Site 45KI296 is a small, low density artifact component on the bank of Covington Creek, west of the outlet from Lake Sawyer.

Shellfish processing sites are underrepresented in the archaeological record of King County. More shellfish sites would be expected to occur on the contemporary marine littoral and in the lower reaches of the Duwamish River–Green River Valley. Former marine shorelines of the Duwamish Embayment from contemporary Elliott Bay south to Tukwila should have hosted shellfish processing sites, especially localities where small streams enter the floodplain. Shellfish processing sites older than 1,000 years probably have been inundated by Puget Sound. Sites at the intersection of the valley wall and the floodplain of the Duwamish River–Green River Valley have likely been covered by recent alluvium.

Resource Procurement/Processing: Plant Gathering Focus

Unlike other nearby regions in the greater Northwest, such as the Willamette and Pend Oreille River Valleys, however, features inferred to have been used for plant processing are all associated with residential sites in King County. The best evidence for recorded plant processing locations here comes from the Enumclaw Plateau, where several components have been recorded that contain likely plant processing features, and in at least one upland site corresponding with ethnographic accounts of intensive huckleberry collection. Good early historic records of prairies in the area are available along with ethnographic information that attests to the importance of plant processing locations on and adjacent to prairies and in upland huckleberry habitat. Prairie habitats have been correlated with Buckley silt loam, a dark, organic-rich soil type that formed within the exposed surface sediments of Osceola Mudflow deposits. Hedlund (1973, 1983) and Lewarch, Forsman, et al. (2000) inferred that the high organic content of Buckley silt loam derived, in part, from hunter-gatherer land management practices.

Ethnographies describe hunter-gatherers periodically burning prairies to keep trees from encroaching and to improve the productivity of grasses, bulbs, and shrubs. Some of the plant processing locations have utilized flakes with use-wear damage on concave-shaped, low angled edges, which are correlated with shaping digging sticks and other wood implements used to gather plant resources. In the uplands, vegetation associations between silver fir and both huckleberries and native blackberries suggest that a fairly broad zone at moderate to high elevations within the county was utilized. The Mule Springs site (45KI435), though classified as a multiple-resource field camp that took advantage of a location ideal for both berry collecting and hunting, yielded a series of trench features that were likely used for berry processing (Miss and Nelson 1995).

More plant processing sites should be recorded in the archaeological record of King County. Many plant processing sites identified to date are small and have a low density of chipped stone tools. Features such as drying racks and rock pavements would be buried beneath the contemporary surfaces of prairies and therefore would be difficult to identify in archaeological surveys.

Resource Procurement/Processing: Lithic Quarry

Quarry sites account for seven components in existing Native American archaeological site databases. Most represent lithic manufacturing and testing at rock outcrops on mountain landforms, although one (45KI828) is a possible red ochre processing location near a source in the lowland Green River valley. The remaining assemblages are composed mainly of stone tool manufacturing debris and cores with few or no finished tools. Site records indicate nodules or bedrock exposures of toolstone within site boundaries or adjacent to sites. The Naches Lithic Scatter (USFS Number MB227) and the South Lindsay Ridge Site (45KI483) typify lithic reduction sites situated on mountain ridges above 1,200 m (4,000 feet), with formed tools, cores, and debitage associated with silica rock exposures (e.g., Blukis Onat et al. 1988). The Cherry Valley Lithics Site (45KI964) is an example of a lithic scatter near known sources of fine-grained raw materials.

The number and distribution of quarry sites is conditioned to a large degree by the bedrock geology of King County, which accounts for most recorded quarry sites occurring on mountain ridges. Basalt, dacite, metamorphosed mudstone, jasper, petrified wood, and quartzite toolstone are also found in gravel and cobble deposits exposed on shorelines along the marine littoral, on lake shorelines in the glacial drift plain zone, and in river and streambeds.

Culturally Modified Tree

Only five CMTs have formally been recorded in the Washington State Archaeological Inventory or USFS site inventory in King County. There are also accounts of them in the Burke Museum database, however, and their identification in other areas of Western Washington in which they have been explicitly considered during surveys and other research projects suggest that they should occur in areas within King County that have not been logged in recent years.

Trail

All of the six recorded trails are on mountain ridges and in mountain stream drainages. Most recorded trails are on USFS land in the southern part of the county and are associated with the Huckleberry Mountain and Grass Mountain landforms.

Burial

Most burials recorded in King County to the Washington State Archaeological Inventory were found in the context of larger sites. Isolated human remains may still be identified, however, in the absence of other artifacts or midden deposits (Schalk and Schwarzmiller 2002; Sharley 2009).

Rock Art

Archaeologists have recorded four petroglyph sites in King County. The Green River Petroglyph (45KI40) and the Flaming Geyser Petroglyph (45KI63), which may actually represent the same resource recorded on two different occasions, are on bedrock outcrops of the Green River Gorge in the middle reach of the Green River. The Green River Petroglyph is represented by three figures: a fish, a quadrupedal animal, and an anthropomorphic figure. The Smith-Parker Petroglyph (45KI443) is on the bank of the Raging River in the glacial drift plain and depicts a fish and a rayed disk, although it may be of modern origin. Site 45KI39 was a large boulder in the tideflats of Elliott Bay, near West Seattle, that was reported by a local resident as having a petroglyph.

ASSOCIATIONS AMONG SITE TYPES AND ENVIRONMENTAL VARIABLES

The archaeological record for King County is classified here into a diverse range of site types that are distributed on landforms from the shoreline of Puget Sound to the crest of the Cascade Range. Information regarding these sites reflects the biases of land management agencies and the large number of archaeological investigations conducted in the alluvial floodplains, marine littoral, and glacial outwash plains of the western portion of the county. Archaeologists have recorded numerous hunter-gatherer archaeological sites in the Cascade Range. In the Alpine Lakes Wilderness Area of northeast King County, every alpine lake that has been surveyed by a professional archaeologist has at least one recorded hunter-gatherer site. Figures 6-5 and 6-6 show the distribution of DAHP-inventoried pre-contact archaeological sites in King County at a very broad scale. Associations between recorded resources and particular landforms are clearly biased towards areas undergoing urban and suburban development and along road and utility corridors that favor particular landforms and other physical characteristics of the landscape. In this regard, many aspects of settlement preference by today’s residents of King County parallel those of earlier people living in the region.

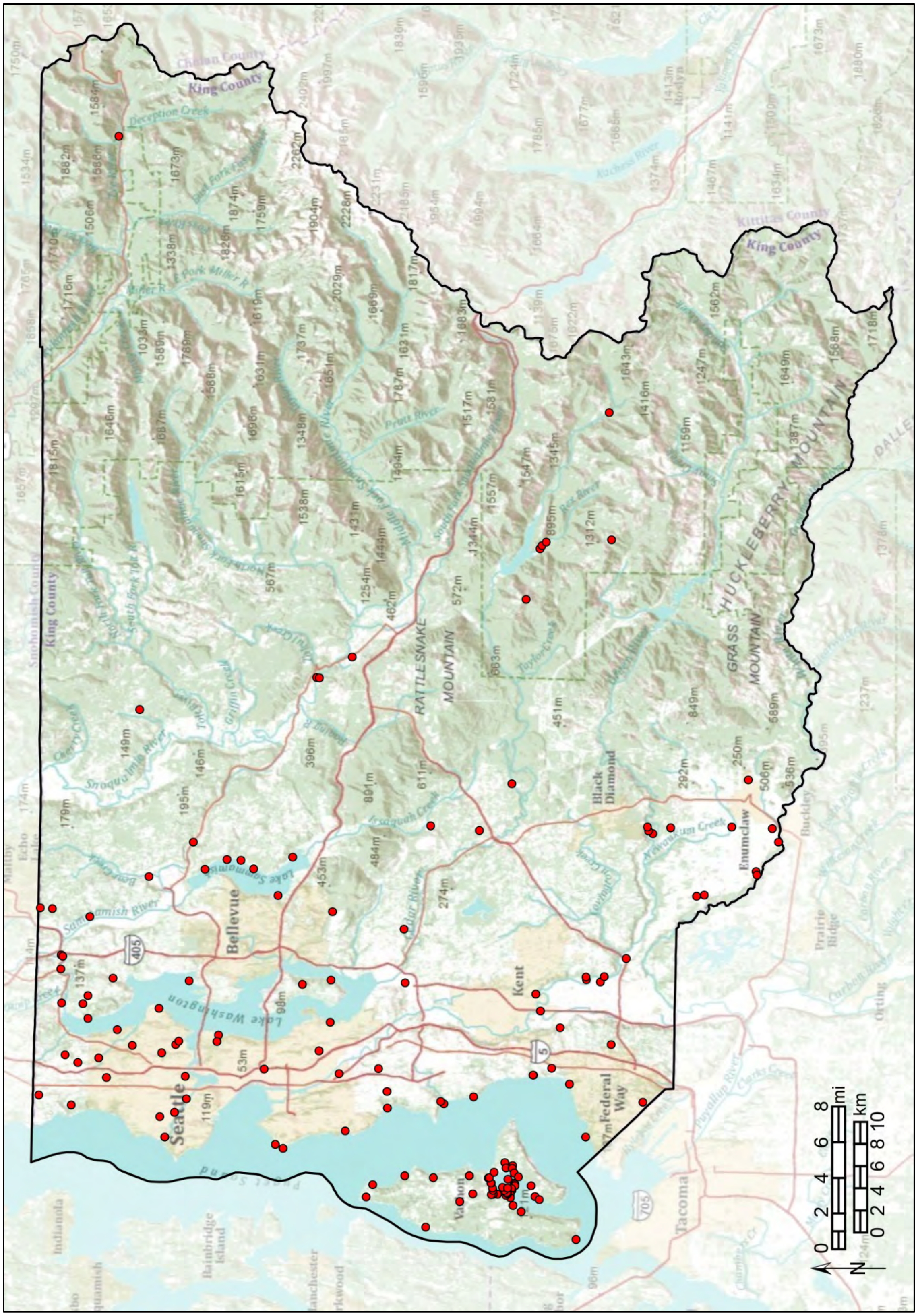


Figure 6-5. Map of Burke Museum data set for King County.

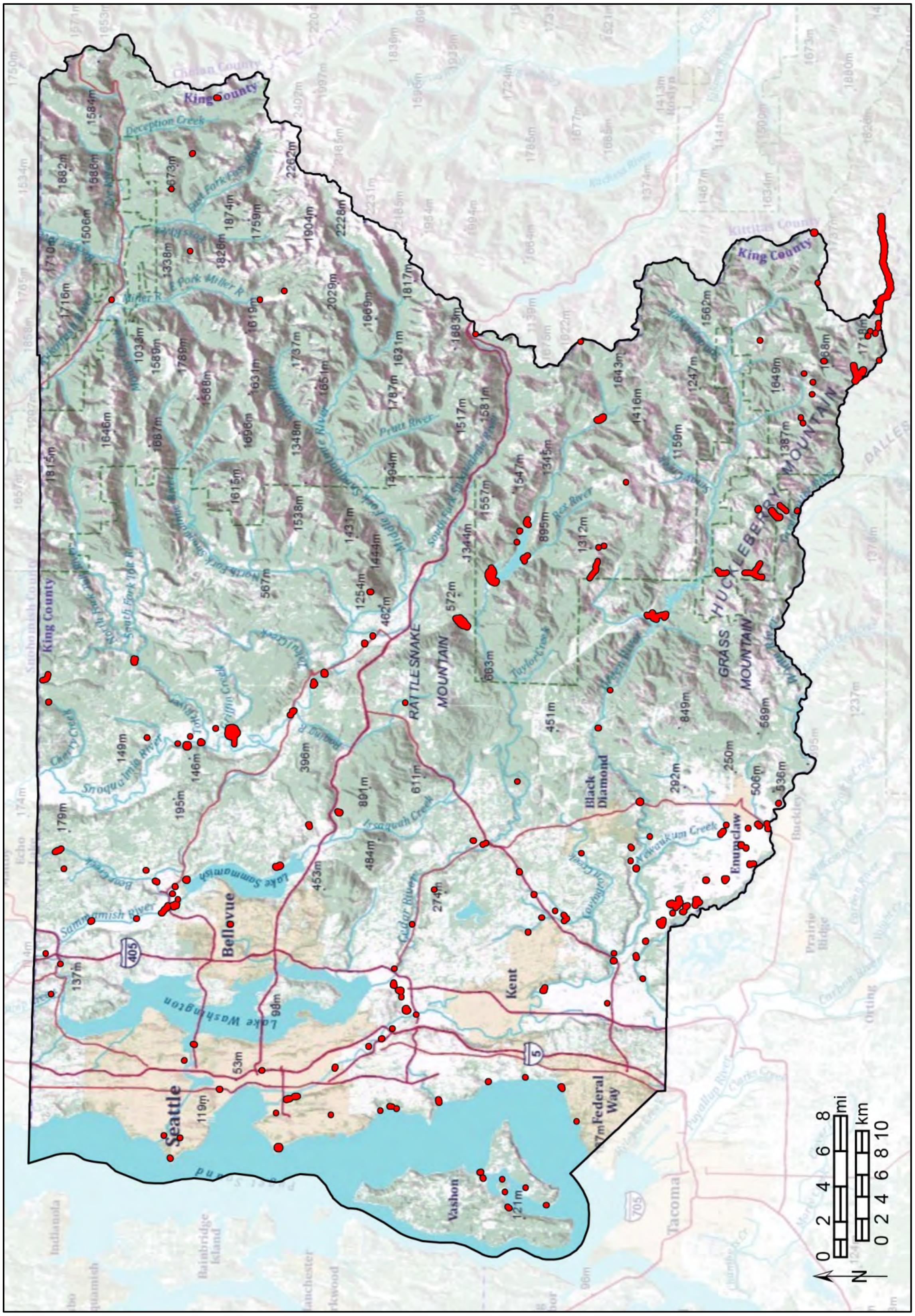


Figure 6-6. Map of Washington State Archaeological Site Inventory of pre-contact archaeological sites in King County.

CHAPTER 7. An Explanatory Model of Pre-Contact Native American Settlement and Subsistence in King County

One goal of the King County CRPP is to create an explanatory model of settlement and subsistence prior to Euroamerican contact. This model in turn assists in creation of the archaeological site sensitivity model that estimates the distribution of unrecorded hunter-gatherer archaeological sites in the county. In order to estimate site distributions, the explanatory model makes assumptions regarding the subsistence and technology of the people who lived in the Southern Puget Sound basin, and uses archaeological "yardsticks" to measure variables such as the diversity of food resources, kinds of technologies employed, and population sizes of groups. The explanatory model may therefore be seen as a linked set of theory-based hypotheses that are testable using archaeological data, and its development should be considered an iterative process with the model itself open to revision as new data support or refute it. The model takes into account factors such as seasonal abundance and location of food resources, technology, and human population size to derive specific hypotheses about choices regarding where to locate settlements during a particular time of year, how long to stay at a given settlement, and when to move to other environments. Archaeological correlates of these choices during particular analytic time periods are also provided as general guidance for testing the hypotheses.

The explanatory framework is the foundation onto which the archaeological sensitivity model is built. The choice of variables used to determine sensitivity of particular places on the King County landscape and how they are weighted at particular times in the past are justified in the explanatory model. The GIS-based sensitivity model is geared towards several expected audiences: 1) scholars who will use the model and database for research, 2) proponents of projects within King County who are not archaeologists but require the data to assist them in making management decisions, 3) archaeologists working as consultants for project proponents, and 4) the King County HPP. In this regard, the explanatory framework must be useful to all of these audiences. The sensitivity model is described in more detail in Chapter 8.

The ways in which pre-contact Native American settlement may be explained are first discussed in this chapter. Several anthropological and archaeological theoretical frameworks have been used in the Pacific Northwest to explain broad patterns in the development of Native American culture. Some of these are more amenable than others to use in testing the archaeological record of King County. Ones that focus on settlement and subsistence are the most likely to assist in formation of a general archaeological site sensitivity model and are emphasized here. Several models grounded in evolutionary ecological and Darwinian selectionist theory have been archaeologically tested with some success in other parts of Western Washington. Their chronological sequences were described in Chapter 4. Here, their explanatory frameworks are briefly summarized followed by a more detailed assessment of their utility in formulation of the model created for King County. Frameworks that focus on the development of other aspects of Native American culture are not discussed here but may find King County an appropriate research environment as new discoveries of archaeological material are made that better reflect non-economic and settlement aspects. A diversity of approaches to explain the archaeological record is encouraged, and their ultimate success and acceptance should be determined by the professional archaeological community as a whole.

EXISTING APPROACHES EXPLAINING THE PAST IN WESTERN WASHINGTON

Archaeological research in Western Washington has often been limited to a culture historical framework focusing on questions of chronology and spatial distribution of remains, without an overt explanatory interest in particular processes or adaptations. The explanations that the culture historical framework provides are essential, however, both to the most basic understanding of what people were doing, when and where they were on the landscape, and to the "how" and "why" questions regarding changes in past human behavior and the archaeological record. The end products of culture historical research are temporal sequences of archaeological phenomena for discrete geographic areas, such as those described in Chapter 4. Without a reasonable understanding of the basic parameters addressed by culture history, our confidence in inferences about other questions is much more tenuous. When gaps or other problems in a culture historical sequence are encountered, they must therefore be addressed prior to, and concurrent with, explanations of the archaeological record that use the sequence. That being said, there is no reason to limit our inquiry to basic culture historical questions, and the following discussion moves beyond the general sequence building described in Chapter 4 to summarize some of the more pertinent theoretical orientations that can most fully use King County's archaeological and environmental data.

In the Pacific Northwest, and especially the Puget Sound region, there is often a disconnect between explanatory frameworks and the available archaeological data set. Moving beyond the culture historical framework, several archaeologists have used general anthropological theory to test hypotheses that may explain particular aspects of Native American settlement and subsistence in the Puget Sound region. Most notable are models developed from evolutionary ecology, primarily used to explain settlement and subsistence in the foothills and Cascade Range as well as the Columbia Plateau east of the Cascades, and models adapted from Darwinian selectionist biology that attempt to overcome perceived shortcomings of other frameworks to establish a unified historical explanation of the archaeological record.

In recent years, the literature of North American archaeology has included extensive discussions of the anthropological aspects of economic and social organization of hunter-gatherers (Bettinger 1991; Hart and Terrell 2002; Kelly 1995). These approaches are the basis for some of the most useful archaeological investigations in the Pacific Northwest and Western Washington. Some of these approaches use natural selection as an underlying mechanism to explain changes in settlement and subsistence behavior. Other applications of anthropological theory include analysis of economic differences among individuals in a group, or social inequality, to account for development of complex social organization among the hunter-gatherers of the Pacific Northwest (e.g., Ames 1985; Matson and Coupland 1995; Sassaman 2004). Anthropological approaches that appear to have the greatest utility for estimating and managing hunter-gatherer archaeological resources in King County that primarily reflect economic pursuits and broad settlement patterns include ideas derived from evolutionary ecological studies.

Data requirements of particular explanatory frameworks condition field and analytical techniques employed by archaeologists, which in turn affect the quality and kinds of archaeological data available for an area, such as the Southern Puget Sound basin or King County. Quality of archaeological data informs the development of archaeological sensitivity models and the ability of planners and archaeologists to effectively manage the archaeological resource base. Explanatory frameworks, such as evolutionary ecology, employed by archaeologists thus have far-reaching practical consequences for planners and managers, especially when implementing cultural resource management initiatives such as the CRPP. Some approaches that explain past human behavior and estimate parameters of the archaeological record of the region are more applicable than others for analyzing data specific to King County, given their topical focus or data requirements. The reader should keep in mind the following discussion of the general approach of each framework and the assumptions they entail. Testing those assumptions is an essential component of future archaeological research in King County.

Evolutionary Ecological Theory

Evolutionary ecology, also termed behavioral ecology by some practitioners (Boone and Smith 1998), has increasingly become a useful anthropological paradigm in Americanist archaeology (Bettinger 1991; Broughton and O'Connell 1999; Kelly 1995). Evolutionary ecology accounts for cultural and behavioral change through adaptation to changing ecological and social conditions. Using this approach, archaeologists assume that human groups respond to local environmental conditions in fitness-enhancing ways. Fitness is usually defined in terms of how many individuals survive each generation and have offspring who contribute to the succeeding generation. Directed, adaptive change occurs through cognition and intentional choices by humans that generally focus on either optimization of currencies such as energetic returns or on minimization of risk from subsistence-related pursuits (Smith and Winterhalder 1992). Specific decisions and actions of humans are often not driven by anticipated economic benefits. However, at the temporal scale of several human generations (a scale at which the archaeological record often manifests itself) many of these decisions by hunter-gatherer groups, especially regarding subsistence, are hypothesized to follow certain economic rules.

Evolutionary ecology employs some tenets of Darwinian theory developed in the biological sciences, but interprets processes outlined in paleobiology from an anthropological perspective that emphasizes cognition, choices made by humans, and processes of cultural transmission (e.g., Boyd and Richerson 1985; Richerson and Boyd 1992). The evolutionary ecology approach assumes behavioral variation is directed by complex problem solving skills that are unique to humans. Human behavior allows groups greater flexibility to respond to environmental fluctuations in ways that enhance the survival of the group and individuals.

As is the case with many explanatory frameworks social sciences, there are divergent viewpoints on the meaning of terminology, correct use of variables, and role of various mechanisms that operate on human populations to produce variation and change over time. The importance of directed, intentional change through human cognition has been viewed differently in various applications of evolutionary ecology (Boone and Smith 1998; Broughton and O'Connell 1999). One critique of archaeological applications of evolutionary ecological theory is that most anthropological case studies cover short spans of time, which are not comparable to the longer time line of archaeological studies. While anthropologists can offer hypotheses regarding cognition and choices made by hunter-gatherers in terms of short-term adaptive fitness and natural selection, assessment of long-term evolutionary fitness is usually not possible. Thus, the utility of many assumptions and processes conceptualized in the anthropological time span of less than a few generations have not been evaluated for long time periods that are more closely analogous to the temporal units employed by archaeologists.

Most applications of evolutionary ecology in anthropology and archaeology have utilized ideas from optimal foraging studies founded in the biological sciences (e.g., Krebs and Davies 1997; Stephens and Krebs 1986). Elements of the optimal foraging approach include consideration of time and energy costs to acquire economic resources, social costs in organizing and obtaining resources, energetic benefits of different strategies to acquire resources, and maximization of resource return relative to energy expended to acquire resources. Although few archaeological applications of optimal foraging have been made in the Pacific Northwest, they employ rigorous sampling designs and quantitative analyses of environmental and archaeological variables. Some models test hypotheses about many aspects of pre-contact settlement and economy within a relatively limited area, derived from basic principles and assumptions of optimal foraging theory (e.g., Burtchard 1998), while one notable application focuses specifically on subsistence activities at a very broad regional level (Butler and Campbell 2004). Evolutionary ecological research often incorporates mathematical models to derive predictions of human decision-making, ranging from simple to complex. For the purposes of the explanatory model developed for King County, principles and assumptions used in evolutionary ecology are delineated to provide predictions of relative, as opposed to quantitative, changes in the behavior of hunter-gatherers over time and the consequent changes in the archaeological record.

The applicability of a model derived from evolutionary ecological theory for King County can be assessed primarily in terms of its utility in accurately estimating the range of variation in the archaeological record of the county. Explanatory models derived from evolutionary ecology generally characterize the entire range of archaeological resources in a study area, which is necessary for managers of archaeological resources to evaluate resource significance and to effectively manage the archaeological resource base.

Darwinian Selectionism

Practitioners of the Darwinian selectionist approach emphasize quantification of artifact attributes and artifact classes to measure changes in range and abundance (e.g., Dunnell 1978). Natural selection is invoked to account for changes through time in the kind and distribution of functional artifact classes. Change through time in stylistic artifact traits is viewed as a stochastic process and allows chronological seriation of certain material classes. One of the most significant contributions to the development of regional pre-contact models is the research conducted by Thompson (1978), which also stands as the most detailed regional-scale study using a selectionist framework.

Selectionists quantify variation in the archaeological resource without an explicit reliance on culture historical phases or human intent (Dunnell 1989, 1992). Dunnell and other selectionists note that most human societies control population size through cultural means that have been selected by evolutionary mechanisms, such as natural selection. Selectionists suggest that population increase and resulting “population pressure” is not a necessary consequence for all human societies. Archaeological measures of non-subsistence energy expenditure demonstrate that many societies in the past increased the amount of non-subsistence energy to control population size when the population of the societies approached the carrying capacity, or societies expanded beyond their carrying capacity and collapsed. Population control is one option available to human societies and one that appears to have conferred increased fitness to human groups who utilized it.

Selectionist theory allows derivation of some expectations regarding long-term changes over time in coastal hunter-gatherer settlement and subsistence patterns that are similar in direction and amplitude to those derived from evolutionary ecology. Additionally, expectations for expenditure of non-subsistence energy or capital may be derived from selectionist theory, providing specific archaeological predictions of changes in extent of long-distance trade and elaboration of stylistic and functional elements of artifacts. Although there are some fundamental discrepancies in their treatment of the causal role played by population pressure, the selectionist framework makes an important contribution to the explanatory model.

Other Approaches

Evolutionary and ecological frameworks may be most appropriate when explaining change in cultural patterns manifested by archaeological sites representing past economies, more so than explaining domestic organization or non-subsistence pursuits. Other approaches, however, have made important contributions despite their lack of feasibility for inclusion in the King County explanatory model. Risk minimization studies are one such framework, developed to describe economic systems that change in response to fluctuations in abundance of food resources throughout a year or over longer time periods by adopting a variety of strategies, including reduced or increased mobility, subsistence diversification, and storage and exchange of food (e.g., Halstead and O'Shea 1989; Lovis et al. 2005). Ames and Maschner (1999) summarized studies in the Pacific Northwest that employed hypotheses regarding risk minimization, where hunter-gatherers accommodated yearly and decadal fluctuations in salmon, shellfish, fish, and plant productivity through a variety of mechanisms, including sharing, reciprocal altruism, intergroup marriage alliances, and other social patterns.

Risk minimization approaches often emphasize the larger, more readily visible elements of the archaeological record, such as villages, and have been used to investigate hunter-gatherer economic and social systems in British Columbia (Ames 1994b, 1996; Ames and Maschner 1999). Risk minimization theories have been most useful in geographic areas where detailed archaeological information documenting resource acquisition at the household and village level is available, such as the Portland Basin, Fraser River, and coastal British Columbia. Such data are so far not available in the archaeological record of King County, which currently limits the utility of this approach for the context document.

Croes and Hackenberger (1988) developed an economic model for the north coast of the Olympic Peninsula based on risk management. This model, centered on the Hoko site complex, cites a pattern of population growth and eventual territorial circumscription along the northern Olympic coast by about 4000 cal BP, when some communities were compelled to adopt subsistence strategies that focused on territorial resources. Subsequent culture historical phases are characterized as a series of alternating periods of population increase and plateau, increasing emphasis on subsistence strategies focused on low-risk and relatively non-seasonal returns (such as intensive shellfish harvesting and marine fishing), and adoption of storage technology to offset population pressure and the greater risks that were entailed by reliance on certain resources. Noting that very little is known of the pre-contact human population dynamics of the Olympic Peninsula, Wessen (1993) levels the same critique at this model as he does toward others (Schalk 1988).

North of the Puget Lowlands, more in-depth examination of sociocultural parameters of pre-contact Native American communities has been undertaken. Such parameters have been explored directly using archaeological and bioarchaeological data from houses and villages. Similar data is not available between the Fraser Delta and the Portland Basin. Frameworks that have followed anthropological and archaeological applications of Marxist principles (e.g., Gilman 1989) have perhaps found the greatest traction explaining changes in social mechanisms that have been the focus of Northwest Coast anthropologists since Franz Boas. Instead of relying on economic optimization assumptions inherent in behavioral ecology to explain cultural change, such models focus on the social aspects of the environment and interactions within and among communities. Environmental variability in space and time are generally considered peripheral to human decision-making and the specific mechanics of these kinds of models. For example, Grier's (2003, 2006) examination of the Gulf of Georgia focuses on interactions among communities, the production and subsequent flow of food and other material goods within and among them, resource surplus development, and the differential roles of individuals of varying social status within those communities as catalysts of production, exchange, and polity formation. A wide spectrum of archaeological data is used to test his hypotheses, including the physical remains of houses and storage features and their spatial patterning within village sites, decorative objects such as stone sculptures reflecting symbolic aspects of culture, and zooarchaeological data.

Researchers have recently hypothesized that the fluorescence of social complexity during the Marpole phase in the lower Fraser River and delta is linked to lower salmon productivity and a climatic shift resulting in greater frequency of drought and forest fires (Lepofsky et al. 2005). The explanatory framework used in this research focuses on both the cultural and ecological context of the time period and socio-behavioral responses to increasing uncertainty in resource acquisition. Such a framework is amenable to testing with the archaeological and paleoecological record.

The nature of the archaeological record in the Gulf of Georgia, the Lower Columbia River, and other areas surrounding the Puget Lowlands makes empirical testing of many of these models possible. Although such aspects are not pursued in the explanatory model developed for King County, there is no reason to discount the plausibility of the idea that social mechanics of the sort modeled by Ames (1996), Grier (2006), and others were involved at least proximately in the formation of the archaeological record in King County. Absence of the most appropriate data categories to fully explore these issues, most notably a sufficient database of household remains and spatial patterning of village and campsite features, should not preclude their consideration in the future as such data are generated. We should therefore continue to ask questions regarding why these data have yet to be generated in any useful quantity in so clearly an important area, how we can be more successful in finding the appropriate archaeological deposits, and how we can better generate local paleoenvironmental data that are necessary to explain the past regardless of theoretical orientation.

EVALUATION OF THEORETICAL APPROACHES

Most reviews in the archaeological literature of the past 40 years that assess investigations generated by various schools of thought have centered on testable hypotheses and organization of deductive arguments (Dunnell 1971; Hesse 1978; Winterhalder 2002). The practical application of interpretations and analytical techniques to the archaeological record of Western Washington is of primary interest for developing our model and incorporating assumptions and mechanisms of existing explanatory frameworks. Five general criteria are proposed to evaluate the utility of various anthropological theories in the Pacific Northwest:

- Availability of adequate archaeological data to test or evaluate hypotheses;
- Parsimony and elegance of arguments;
- Performance criteria that measure predictions against empirical results;
- Consilience of the theoretical frameworks; and
- Utility of paradigms for archaeological resource management.

Availability of Data

An explanation has little use if data are not available to test and evaluate its arguments and predictions. Data availability is one of the most crucial factors in limiting the application of contemporary anthropological theories in King County. The extant data for hunter-gatherer archaeological sites in King County include only a few site types, with a limited range of information. Environmental data sets, on the other hand, are important in developing an archaeological sensitivity model and are available for all parts of the county. Model development is focused in part on identifying a set of environmental factors that are associated with archaeological sites throughout Western Washington, and using these environmental characteristics as proxy measures for archaeological probability.

Evolutionary ecology studies would maximize use of the extensive environmental data for King County, because this approach focuses on social and technological adaptation to particular environmental conditions. Burtchard (1998) provided a useful example of combining archaeological and anthropological data with GIS environmental themes and other environmental data to estimate archaeological resource density and location. Other explanatory frameworks may be limited by the quality and range of extant archaeological data for King County.

Extant archaeological data for King County also have limited utility for testing complex archaeological hypotheses. Investigations have not cumulatively yielded large enough samples of artifacts, features, or faunal or floral remains to make statistically confident inferences. The archaeological data also has a strong spatial bias. Most archaeological investigations have been conducted on the marine littoral of Puget Sound, on river floodplains, or on the Enumclaw Plateau, all in the western half of the county. Archaeological information on hunter-gatherer households is virtually absent. Only the Sbabadid Site (45KI51) in Renton has postmold patterns that are sufficiently documented to indicate probable house structures. King County has little systematic, detailed, analytical information regarding burials that would be useful for studies of diet or social status. Some gaps in the burial information are a function of poor preservation. Another factor is the sensitivity of burial data for contemporary Native American groups, who generally discourage analysis of burials and human remains. Even if burials are identified in future archaeological investigations in King County, detailed information on diet and other biological aspects will probably not be collected.

Parsimony and Elegance

Simplicity is the hallmark of scientific analyses that use multiple working hypotheses. Simple arguments with few assumptions are preferred for most studies. Complex arguments are difficult to understand and to implement. Explanations with the fewest assumptions are the most parsimonious, and explanations with the fewest number of statements are the most elegant. Theories based on assumptions that have been verified or identified empirically in the anthropological or archaeological record are stronger and more useful than studies with unproven or untested assumptions.

Archaeological applications of evolutionary biology by archaeologists working in the Pacific Northwest, as elsewhere, are often composed of complex arguments. These archaeological studies have numerous assumptions regarding energy capture, energy expenditure, technological organization, and costs associated with seasonal movement. Many applications of evolutionary ecology use of the concept of population pressure as a causal mechanism to account for change in hunter-gatherer archaeological systems, thereby limiting their explanatory potential according to some critiques (e.g., Cowgill 1975).

Performance Criteria

Performance-based assessment compares predictions with actual empirical patterns and evaluates how closely predictions match. From an archaeological resource management perspective, performance criteria assess how well hypotheses predict the location, kinds, and ages of archaeological resources in a study area. Hypotheses should define expected patterns in real-world data that will allow a disinterested party to determine whether the hypothesis accounts for patterns in data. Empirical sufficiency is a term used to describe the connection between theory and real-world data, and measurability of variables (e.g., Hunt et al. 2001; Lewontin 1974). Models and hypotheses should define units that can be measured in data. Expected patterns in data should be outlined prior to testing to assess whether a hypothesis is correct. The concept of “tolerance limits” identifies in advance how close a predicted pattern must be to patterns in empirical data. While the fit between a hypothesis and reality is never expected to be perfect, a definition of “how close is close enough” (Dunnell 1989) must be established to accept an explanation.

Studies based on the evolutionary ecology approach in Western Washington provided estimates of the kinds and locations of hunter-gatherer archaeological sites that should occur in various environmental zones (Burtchard 1998; Schalk 1988). Patterns in site distribution were proposed in initial, overview stages of these investigations (e.g., Burtchard 1998; Mierendorf 1986; Schalk 1988). Burtchard (1998) especially provided fairly detailed expectations for the distribution of hunter-gatherer archaeological materials in Mount Rainier National Park. But archaeologists have not been able to establish precise tolerance limits to evaluate goodness of fit between hypothesized distributions and expected empirical patterns because the applications are in the formative stages. As an interactive approach, evolutionary ecology offers clear performance expectations regarding age, type, and location of archaeological resources.

Consilience of Theoretical Frameworks

The strengths and weaknesses of the more pertinent explanatory frameworks for the King County model are summarized in this context document and the end product incorporates assumptions and principals from several of them, as described in the remainder of this chapter. It is important, however, to keep in mind that the theoretical orientations and potentially disparate data sets must mesh if such a synthetic explanatory approach is to be successful. This congruency has been termed *consilience* by E. O. Wilson (1998), who proposed a far-reaching unity of both the natural and social sciences as well as the humanities to derive the most meaningful explanations of how our planet (and universe) works. In terms of this context document, consilience is more of a guiding principle than one for practical implementation or universal synthesis. The different theoretical frameworks discussed here retain a level of unity that allows explanation of a particular phenomenon using one set of theoretical tools, such as change in artifact styles using a selectionist model, without rendering untenable a treatment of a different phenomenon, such as subsistence change using models derived from evolutionary ecology and foraging theory.

Utility of Approaches for Resource Management

The diversity of goals of the various anticipated model users and the variation in strengths and limitations of different explanatory frameworks requires some compromise in the structure and operationalization of the model described in the following section. Planners, resource managers, and engineers have little interest in esoteric arguments regarding the structure and utility of archaeological theories or schools of thought. Assessing the practical utility of different approaches includes two elements. First, real-world planning professionals and engineers are required to determine if a proposed construction project may affect archaeological resources. If an inventory of resources in a project area has not been completed or is ambiguous, project managers and engineers would like an estimate of the probability that their project might encounter archaeological resources, for planning and risk analysis purposes. Second, archaeological resource managers have an additional professional responsibility with respect to the archaeological record. Rigorous data requirements of scientific approaches in archaeology require a representative sample of all portions of the archaeological record. In the past, archaeologists focused on large archaeological sites with dense middens and abundant artifacts and features. Most contemporary archaeological research programs, such as those described here, require samples of all elements of the record, including small, low density scatters of stone tool manufacturing debris, isolated rock cairns, and other kinds of archaeological resources that were often neglected in past studies. To evaluate site significance and to accurately estimate resource density throughout a management unit, archaeological resource managers also must consider the occurrence of different kinds of archaeological resources from a regional perspective.

To assess the practical utility of different theoretical approaches, potential outcomes of investigations shaped by them must be considered from the perspective of numerous end users. The model will be employed by King County cultural resource managers, King County planners, King County engineers, professional archaeologists who conduct investigations in King County, and Native American tribes. Various stakeholders require different levels of rigor and detail. Given the responsibility of King County to a variety of stakeholders, the model should incorporate the most rigorous and detailed data sets available, which will generally be those collected by professional archaeologists. The professional archaeological community will require statistically reliable measures of all variation in the archaeological record, entailing delineation of site types, delineation of artifact types, estimates of ages, identification of landforms and their availability through time, and assessment of research potential of resources in a regional framework. Data generated by practitioners of the different schools of thought ideally should be useful to archaeologists from all research viewpoints, regardless of which approach guided the data collection.

ANTHROPOLOGICAL AND ARCHAEOLOGICAL ESTIMATES OF HUNTER-GATHERER LAND USE IN KING COUNTY

The following general assumptions are organized into three categories: general assumptions about human populations; assumptions about how they go about obtaining resources when hunting, fishing, and gathering; and assumptions about how those groups formed communities and settled on the landscape. These assumptions in turn guide the archaeological expectations for each Analytic Period discussed in the final section of this chapter.

Characteristics of Human Populations

Cohen (1981), Jones et al. (2003), Keeley (1988), and Kelly (1995), among others, discuss carrying capacity, population growth, and population stability in human forager populations. Six assumptions regarding human populations provide a basis to estimate population patterns of hunter-gatherers in King County. These assumptions allow archaeologists to estimate patterns in population growth of hunter-gatherer groups and to outline expected patterns in the type, size, and distribution of archaeological sites at various times in the past.

1. At the chronological starting point of this model 14,000 years ago, a very small human population lived in Western Washington and present-day King County.

2. Humans have a reproductive strategy that involves the bearing and rearing of few offspring who mature slowly—a strategy termed “K-selected” in contrast with an “r-selected” strategy of other kinds of organisms that involves bearing exponentially greater numbers of offspring who mature, reproduce, and die quickly (e.g., MacArthur and Wilson 1967). This assumption and the previous one provide a starting point to estimate hunter-gatherer population growth rates after around 14,000 years ago.

3. Colonizing populations generally follow an exponential growth curve. The earliest populations in a particular area are small and grow slowly at first, but soon the population growth rate increases. When considered on a broader scale beyond colonizing groups, human populations generally follow a logistical growth curve as the growth rate of the population slows following the initial increase, and then plateaus as the total population in a region approaches carrying capacity (e.g., Kelly 1995, Kelly and Todd 1988). Carrying capacity is the theoretical equilibrium of population size at which a particular population in a particular environment will stabilize when its supply of resources remains constant, holding technology constant, and is the maximum sustainable population size. This assumption provides expectations regarding hunter-gatherer population growth in King County. After initial entry into the region, the human population (and by extension the number of archaeological sites) is expected to increase through time. Numbers of sites should increase rapidly a for a few millennia after the first Analytic Period, and

then plateau. Figure 7-1 shows a theoretical model of human population growth during the five Analytic Periods defined earlier, followed by a demographic collapse at the time of Euroamerican contact and introduced disease epidemics. In theory, this curve could include several inflection points and shifts in direction through time as carrying capacity changes relative to a changing population, but the curve is kept general here.

4. Human populations tend to stabilize near carrying capacity for a given technology and subsistence resource base, but their trajectories frequently take them past this theoretical line. Sustainability at or just below the “K-line” of carrying capacity is difficult if not impossible for most human societies in their given environmental and technological situations. Common archaeological characteristics of pre-contact populations in North America that appeared to be approaching, and possibly exceeding, carrying capacity include development of elaborate art styles or monumental architecture, development of complex long-distance trade networks, construction of mounds, and development of elaborate mortuary complexes. Material expressions of population excess occurred in environments with marked and unpredictable temporal fluctuations in major attributes of the environment, such as rainfall patterns, shifts in patterns in river system hydrology, or changes in the fisheries of nearshore marine habitats. Fluctuations in carrying capacity are expected in regions subject to these environmental perturbations.

5. Human societies may impose cultural mechanisms that control population through measures such as migration, infanticide, investment of energy or capital in non-subsistence activities, and other social tools when carrying capacity is reached and exceeded (Kelly 1995). Natural curbs on human population size include starvation and extinction of a local group. Again, archaeologists have identified what they assert to be material expressions of population control in archaeological cultures including investment in non-subsistence activities such as elaborate mortuary customs and monumental architecture. These

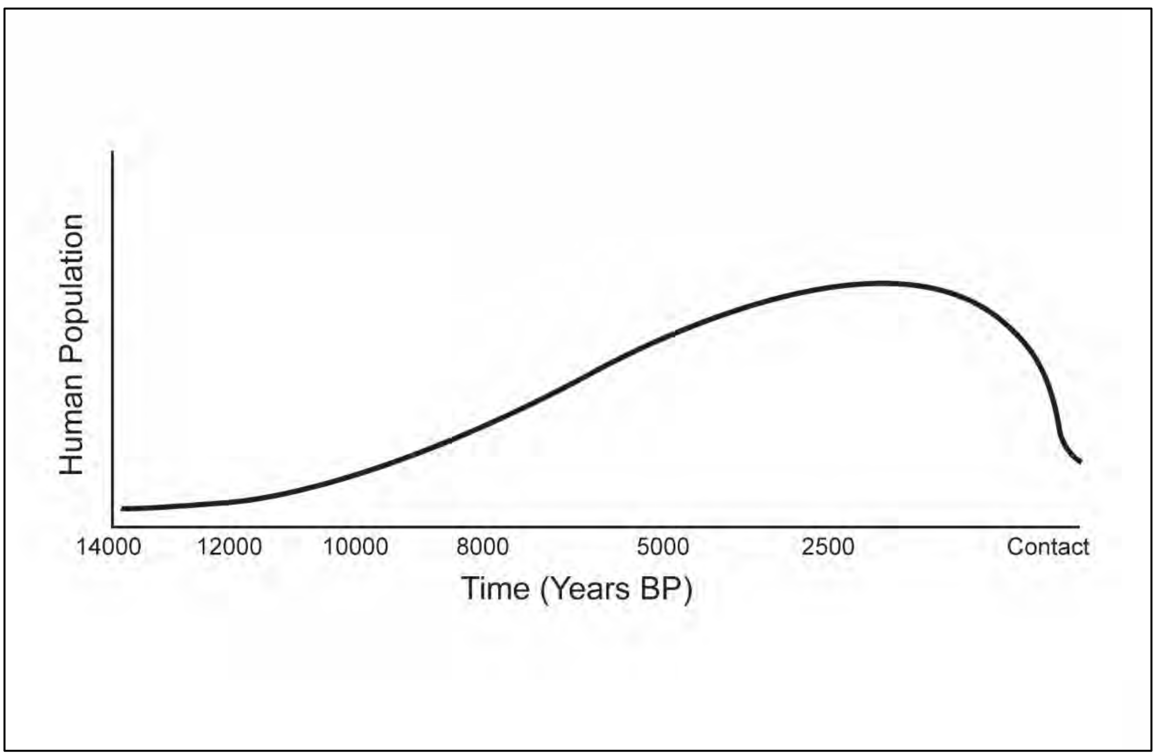


Figure 7-1. Theoretical population growth curve for King County during the five Analytic Periods.

phenomena often direct resources and energy toward activities that do not enhance reproductive success or fitness, but instead are a means of population control through costly signaling (e.g., Dunnell 1999). Some Darwinian selectionist models seek, for example, explanations for the construction of mounds in the Mississippi valley during periods of climatic uncertainty (Hamilton 1999), and for construction of monumental architecture and adoption of complex mortuary practices in coastal Peru (Kornbacher 1999). If hunter-gatherer groups in King County reached carrying capacity at a given point in the past, the archaeological record may contain material potentially correlated with population control, such as evidence of formalized long distance exchange, elaboration of art styles, development of elaborate mortuary complexes, or other such markers—manifestations yet to be found here. Alternative explanations for these phenomena if they are found should, however, be considered to account for specific patterns of elaboration of architecture, mortuary customs, or other aspects of material culture without ascribing them as means of population control or buffers against perturbations in carrying capacity (e.g., Ames and Maschner 1999; Martindale 2003).

6. Environmental perturbations may raise or lower a given carrying capacity by disrupting the balance between a human population stabilized near carrying capacity and its resource base. Such perturbations include processes or events that lower human population (natural disasters, disease epidemics) relative to the resource base, or those that cause fluctuations in the resource base relative to human population. Changes in climate or habitat of important subsistence resources may increase or decrease their abundance on the landscape and availability to human populations.

7. Cultural responses to imbalances between human communities and subsistence resources, aside from population control, may raise carrying capacity by increasing resource availability relative to population. Technological innovation is one such means, epitomized by the development of agriculture (Kelly 1995). However, technological change that increased carrying capacity and population did not occur in all areas and was not an automatic attribute of the "progress" of human society. Fitzhugh (2001) models technological innovation as part of individuals' responses to risk; times of greater uncertainty lend selective advantages to inventive behavior, and in turn natural selection may operate on a greater pool of technological variability (many instances of which will fail). Aside from, and yet linked to, technological change are changes in the choices of where and what to harvest, and at what intensity, which may also increase carrying capacity. Hunter-gatherers in King County may have altered the carrying capacity of the regional environment through a combination of technology, land use practices, and changes in movement of members of family groups from season to season and year to year.

These demographic assumptions allow estimates of patterns in the organization and distribution of hunter-gatherer groups in King County. Hunter-gatherers who entered King County and lived in the area for 14,000 years had patterns in economic organization and site classes that were similar to those noted by archaeologists in hunter-gatherer societies throughout the New World. Archaeological indicators of population growth include increases in the number of sites in an area. Archaeological indicators that hunter-gatherer populations approached carrying capacity include elaboration of material culture and investment of energy in non-subsistence activities that do not contribute directly to increased reproductive success.

Characteristics of Human Subsistence

In this study, the ideas of subsistence and net energetic returns are used in a way that is similar to some of the basic tenets of optimal foraging theory (Kelly 1995). Although the rationale for establishing these assumptions is often to allow direct tests of hypotheses regarding diet breadth and prey and patch choice using quantitative zooarchaeological analyses (e.g., Broughton 1994, 1997; Butler 2000; Butler and Campbell 2004), they also allow more general archaeological expectations of this model to be derived, involving relative trends in subsistence over the course of 14,000 years in King County.

1. Subsistence systems of human hunter-gatherer populations have been shaped by natural selection over the course of hundreds of generations to maximize some reproductive fitness-related currencies (Krebs and Davies 1997; Smith and Winterhalder 1992; Stephens and Krebs 1986; Winterhalder 1981). In the case of this explanatory model, the currency is net energetic returns from hunting, fishing, and gathering.

2. The most profitable resources, in terms of caloric returns relative to the cost of pursuit, processing, and transportation given a particular subsistence technology, will always be utilized. Additional resources will be added to the diet until the energetic costs of adding additional resources to the seasonal round exceeds the energetic benefits of that addition (Kaplan and Hill 1992; Stephens and Krebs 1986). For example, assuming a population uses technology oriented towards generalized hunting and fishing within a fairly homogenous environment, large animals would be the focus of subsistence activity and smaller animals and fish added to the subsistence round as long as such effort continued to be worthwhile. Mass harvesting of fish would likely not be an option given the kind of technology that is employed, but might become a seasonal subsistence focus once the technological means, population threshold, and labor organization were obtained that would make such an endeavor worthwhile from an energetic perspective. In such a situation, the mass harvesting of a somewhat predictable resource such as salmon will always be the focus for part of a seasonal round, and other resources will be added to the diet depending upon their profitability relative to all other potential resources.

3. Resources are not distributed across King County in a homogenous manner. They are clumped into patches that are more, or less, productive relative to other parts of the landscape. Therefore, hunter-gatherers would make the same kinds of decisions as in assumption number 2 above regarding which resource areas to utilize and when it may be more profitable to leave one area and forage in another when the energetic returns in a particular area decrease over time (Charnov 1976; Kaplan and Hill 1992; Stephens and Krebs 1986).

4. Cultural systems maximize the economic potential of local environments through time given their level of technology (e.g., Jones et al. 2003; Kelly 1995). All things being equal, hunter-gatherers harvested the resources of a given environment using a specific kind of technology. Innovations of food harvesting and processing technology and watercraft allow an increase in net energetic returns of particular resources (Fitzhugh 2001) and mobility into and through previously under-utilized resource areas (Ames 2002).

5. Prey populations subject to intensified human harvest pressure or non-human forcing mechanisms may undergo resource depression, depending upon their biology and population dynamics. Human response to such resource depression may include changes in diet, land use, technology, labor organization, or other social mechanisms (e.g., Kopperl 2003). Zooarchaeological tests of hypothetical anthropogenic resource depression in the Pacific Northwest to date do not, however, indicate such a process occurred in this region (Butler and Campbell 2004; Etnier 2002).

6. Considering subsistence strategies on a broader scale amenable to this explanatory model, two kinds of systems are defined here: *generalized* systems and s*pecialized* systems (e.g., Thompson 1978). Generalized subsistence systems utilize a diverse array of subsistence resources and respond to stress by increasing the diversity of food resources that are utilized through time. In the archaeological record, changes in generalized subsistence systems are manifested by the addition of different site types and

landforms represented through time, and in the tools that are associated with particular aspects of local environments. Generalized systems increase the complexity of the subsistence system through extensification, that is, increasing use of a more diverse array of energy resources. They are characterized by low population densities and long-term population stability, and do not produce much surplus energy on a yearly cycle. Generalized subsistence systems may rapidly reach carrying capacity equilibrium in relation to the local resource base.

Specialized subsistence systems focus on one or a few relatively dependable resources within an existing diet, usually requiring a suitable labor pool for the increase in energy directed towards specialized pursuits. Development of the technological means of efficiently extracting the resources, processing them, and storing and distributing them may counteract the overall decrease in foraging efficiency entailed by intensification. Pre-contact specialized subsistence systems have been inferred along the Pacific Northwest coast based on a range of evidence, from simple comparisons of relative taxonomic abundance of salmon remains (Coupland et al. 2010) to more comprehensive quantification of faunal data (e.g., Butler and Campbell 2004) and considerations of a wider body of archaeological data (e.g., Ames and Maschner 1999; Matson 1992; Whitlam 1981).

Beaton (1991, following Boserup 1964), models a change from 1) generalized subsistence systems relying on extensification to meet shifting needs by adding new resources to the diet, to 2) specialized systems incorporating intensified use of a particular part of the existing subsistence spectrum to meet those same needs, as one outcome of increased population density coupled with territorial circumscription. Generalized and specialized economic systems have different developmental patterns through time, maintain different population densities, require different kinds of labor organization and scheduling, and produce different kinds of archaeological sites and tool assemblages. Differences in the size and location of archaeological sites in King County through time would be expected if subsistence was generalized rather than specialized. Extensification would lead to toolkits aimed at harvest and processing of a variety of resources from a range of habitats—in the case of Central Puget Sound, this would include fishing tackle of a variety of sizes, terrestrial and marine mammal and bird hunting implements, and tools for gathering shellfish and plants. Specialized economies may have a similar richness of tool types and subsistence remains, but skewed towards those of particular plant and/or animal taxa and their corresponding toolkits.

The six assumptions regarding subsistence described above allow estimates of the locations and kinds of archaeological sites in King County, given environmental characteristics during particular time periods and archaeological evidence regarding technological organization. Detailed analysis of caloric return on investment of energy to obtain food is not part of estimates of hunter-gatherer adaptations in King County but provides the theoretical basis for the other assumptions regarding general patterns of subsistence and what might prompt changes to them. Relative importance of broad subsistence resource categories, however, can be hypothesized. Environmental changes influenced broad-scale subsistence during the first four Analytic Periods, followed by cultural and human demographic changes during the last Analytic Period as the most critical factors in shaping subsistence. Figure 7-2 shows the relative importance of these resources, seasonally averaged, as follows:

> 1) The first three Analytic Periods prior to the establishment of closed canopy forests and stabilization of stream and shoreline systems, when terrestrial resources would be most profitable, followed by marine resources and to a lesser extent plant resources, riverine resources, and birds;

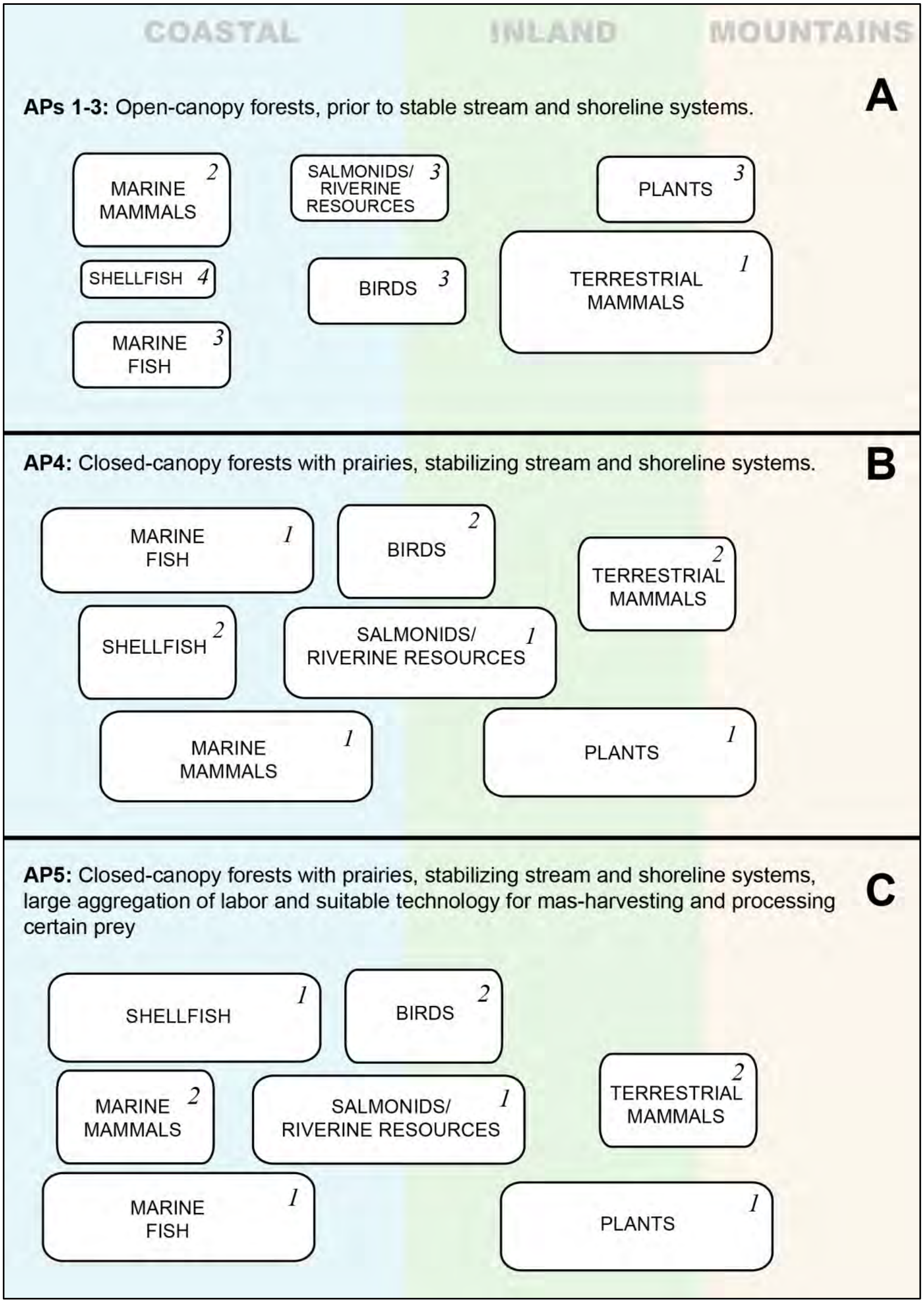


Figure 7-2. Hypothetical model of hunter-gatherer subsistence priorities on an annual scale.

2) AP 4, when closure of the forest canopy across much accessible terrestrial habitat lowered the availability of ungulates and sea-level stabilization increased the relative importance of salmonid and littoral resources; and

3) AP 5, when technology and labor organization made harvest of salmonids, plants, and certain marine and littoral resources the most profitable subsistence targets.

The model conceptualizes subsistence systems in the Southern Puget Sound basin as consistently generalized, utilizing a wide range of food resources. Increase in the profitability of anadromous fish after about 5,000 years ago is tied to innovation in processing and storage technology, and therefore salmonids became an integral part of the subsistence system at that time. The utilized resource base, however, remained diverse and would have consistently emphasized at certain times such lower-return items as shellfish and plants. The combination of technological innovation and labor organization suitable for mass harvest of smaller-bodied prey explains the more recent shift during the last few millennia towards seasonal specialization within a generalized subsistence economy.

Attributes of Community and Settlement Types

The foundation of the hypotheses regarding settlement patterns in the explanatory model is not based on a linked set of assumptions so much as a dichotomous definition of residential mobility and a spectrum of possible settlement strategies utilizing the environments of King County.

Numerous anthropologists note differences in the composition of residence groups based on access to resources (e.g., Binford 1980, 2001). Foragers practice residential mobility, where the functioning economic group moves as a single residential unit throughout a year from base camp to base camp (Kelly 1995:117). Collectors practice logistical mobility, where task groups and individuals travel on a seasonal or temporary basis from a single residential base or village to access resources and to bring those resources back to the residential base. As Kelly (1995:117) notes "foragers move consumers to food resources, and thus map onto a region's resource locations, while collectors move residentially to key locations not necessarily defined by food." Changes in community types in the archaeological record may signal shifts in subsistence organization or responses of groups to changing technology or environmental patterns.

In the context of this explanatory model, one or more family groups formed the economic residential unit of foraging communities between 14,000 and 5,000 years ago. The regional archaeological record suggests a shift in community organization after about 5,000 years ago. Hunter-gatherer families shared winter villages and base camps, and subgroups dispersed to field camps and other sites during the spring through the fall. This change in organization reflects a shift from foraging to collecting and from a residential to a logistical system of mobility.

In addition to the distinction between forager and collector communities, Binford (1980, 2001), Kelly (1995), Schalk (1988), and others note important patterns in the way areas around residential sites are utilized. Binford (1980) hypothesizes the foraging radius and the logistical radius extending outward from residential sites, comprising an area routinely accessed from residential bases. Kelly (1995:Table 4.1) summarizes ethnographic data regarding mobility, number of moves made between residential bases by a group in a single year, average distance of moves between bases, and size of a group's territory. Kelly (1995:133) suggests "a 20- to 30-kilometer round trip appears to be the maximum distance hunter-gatherers will walk comfortably in a single day." Conservative estimates of foraging areas around sites in temperate environments, such as Western Washington, average 5 to 6 km (3–4 miles) from a site (Kelly 1995:132–148). Schalk (1988:112) suggests an area within 10 km (6 miles) of a residential base encompassed the “foraging zone” of hunter-gatherers utilizing terrestrial resources on the Northwest Coast. A logistical radius, or logistical zone, is the area away from the residential site that is routinely used by task groups who travel and stay overnight away from the residential base. Schalk (1988:112–114) and Ames (2002) make the important distinction for the Northwest Coast that canoes allow people to extend their foraging and logistical zones around residential bases to much larger areas in the marine pelagic and marine littoral zones and along riverine corridors.

Foraging radii can be modeled and estimated in the manner described above; however, the distances hunter-gatherer communities will go to obtain resources is heavily conditioned by the size of the human population and extent of competition over limited resources, as well as available transportation technology (i.e., canoes and other watercraft). Territoriality and defense on at least a seasonal basis can be expected at locations of resources that are predictable and dense, such as salmon fishing locations, berry picking grounds, and shellfish beds (Dyson-Hudson and Smith 1978). This is especially the case when the economic benefits of remaining at and defending a resource outweigh the costs of its defense, potential risks of remaining in the area, and missed opportunities of hunting, fishing, or gathering elsewhere. For this explanatory model, when the human population in King County and the surrounding region reached the point where the foraging radii of different communities began to intersect, one response was an increase in territoriality over and defense of particular resources. One consequence of territoriality would be an increase in associated procurement and processing sites relative to residences such as base camps and villages, as full use of a newly circumscribed area developed.

Whatever the size of its territory, a functioning economic residential unit may constantly move within it, or may remain completely sedentary. It is assumed in this model that mobility strategies are generally structured to access the most productive suite of energy sources that are available at any given time of the year for a given population size and subsistence strategy. Archaeological expectations may be articulated for various points on this scale of settlement mobility. Schematic diagrams of expected site types, their use during the annual subsistence cycle, and basic spatial relationships are shown in Figure 7-3. In this figure forager and collector strategies are differentiated at a basic level by site types and the directions of seasonal mobility between them. The evolution of Native American settlement and subsistence in the region and archaeological correlates over the past 14,000 years ranges along a continuum with change at a temporal resolution too fine in most instances to recognize archaeologically.

Water transportation technology was also an important factor that shaped mobility and, by extension, affects to some extent the patterns seen today in the archaeological record of King County. In his overview of the role boats have played in mobility, settlement, and subsistence of Northwest Coast Native Americans, Ames (2002:20) notes that the archaeological record of terrestrially oriented and marine oriented hunter-gatherers may be quite distinct, and boats, as critical tools for subsistence and general economic production of Northwest Coast Native American communities, would have had an important role to play in that dichotomy. A variety of watercraft and the sophisticated set of skills required to use them to their fullest potential have always been part of the technological arsenal of Northwest Coast Native Americans (Drucker 1951; Durham 1960; Rousselot 1994), but probably improved and were periodically refined over the course of the Holocene as the natural or social environment selected for such innovation (Fitzhugh 2001). Changes in boat technology are not modeled here, but to some extent expectations about changes in their use as a result of other major shifts in human population and settlement dynamics can be made.

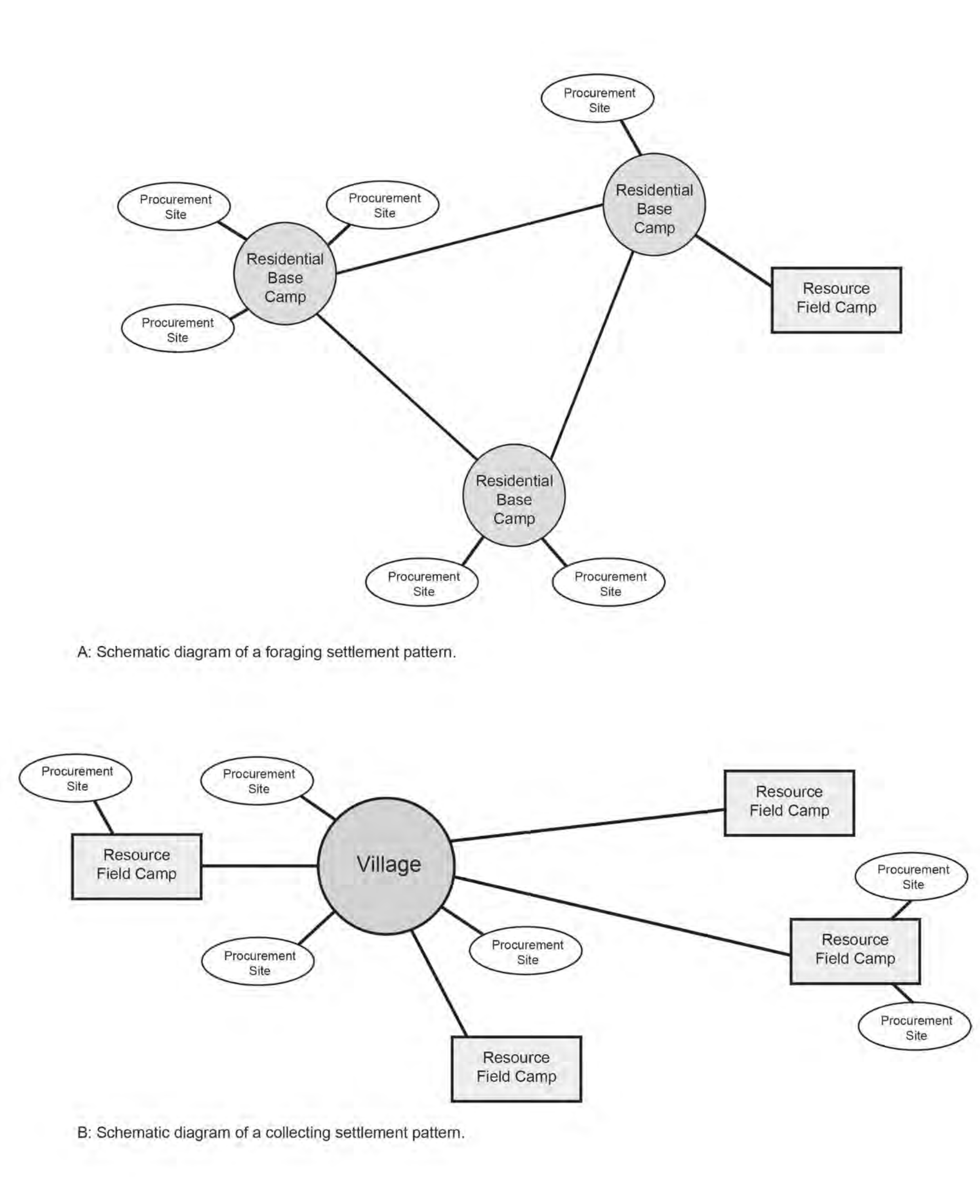


Figure 7-3. Schematic diagrams of Forager and Collector settlement patterns.

As territorial circumscription occurred in King County, access to marine and littoral resources became limited for some communities, while others found their access to inland resources limited, despite the exchange of resources and rights of access facilitated through marriage and kinship networks. Mobility patterns should, however, be differentiated between those of shoreline and marine-centered settlements and those centered on river valleys. Both employed sophisticated travel networks that combined watercraft and pedestrian mobility, as seen ethnographically, and most Native American groups in the region today rightfully attest to their use of canoes and other kinds of watercraft regardless of their proximity to the marine shoreline. As the extent of territorial circumscription increased, however, boats would be more critical to shoreline-based communities in which travel between residences and logistical camps and resource procurement areas was primarily across water. Decisions regarding the duration and distance of logistical forays, which resources to pursue, and the extent to which they would be processed hinged on the abilities and limitations of these communities' watercraft and crew (Ames 2002:34–44). The proportion of procurement sites to field camps in marine-oriented foraging radii would be lower than that of riverine-focused territories based on the speed of watercraft on marine waters and their storage capacity. The relative speed of boat transport would generally (weather permitting) lessen the need for stopover encampments (e.g., Schalk and Nelson 2010:305–306), the storage capacity of boats would decrease the number of required trips for a given resource encumbrance and offset the necessity of field processing certain resources entailed by foot transport, and the travel corridors of boats in open water would not retain the archaeological remains of temporary stops that would likely occur in situations of pedestrian (or equestrian) mobility.

In King County, communities with primarily inland territories used the east-west-trending river valleys and north-south-trending glacial landforms as corridors, with boat travel being only one of several options in most cases. In contrast with settlement focused on the marine shoreline, more short-term residential and small non-residential activity sites relative to the number of base camps and villages would be expected along those corridors. With increasing circumscription expected during the last 5,000 years based on the discussion above, this dichotomy in the proportions of long-term residential sites and short-term encampments is hypothesized for APs 4 and 5.

The following sections describe hypothetical settlement patterns during each of the five Analytic Periods and attempt to articulate more specific expectations of site types and their inferred relationships than those shown in Figure 7-3.

HUNTER-GATHERER ADAPTATIONS IN KING COUNTY

Hunter-gatherers entered the Puget Sound basin sometime after 16,000 years ago, when glacial ice had retreated and marine water filled embayments that were formerly occupied by proglacial lakes (Porter and Swanson 1998). No competing human populations were in the Puget Sound basin, which was undergoing changes in the physical environment after the retreat of the Puget lobe of the Cordilleran ice sheet. Table 7-1 summarizes the expected characteristics of human land use for each subsequent analytic time period, as well as expectations for the archaeological record based on both the explanatory model and known characteristics of the natural environment.

Table 7-1. Expected Characteristics of Land Use and the Archaeological Record in King County

Analytic Period	Subsistence System	Population Density	Settlement Type	Mobility Pattern	Expected Archaeological Site Types	Areas With Site Preservation
1	Focus on large terrestrial mammals.	Very low	Frequently moved base camps, ephemeral acquisition sites.	Initial "settling in" and constant residential mobility followed by a shift to more seasonal mobility.	Small residential base camps, most terrestrial resource acquisition localities near base camps. Identified sites, however, may be limited to isolated artifact finds.	Kettle lakes, peat bogs, and bluff edges on glacial drift plains; old river terraces; mountain lake basins, and unglaciated mountain ridges.
2	Generalized subsistence of marine and terrestrial resources.	Low but increasing relative to carrying capacity.	Residential base camps, ephemeral acquisition sites.	Established seasonal mobility pattern.	Small residential base camps , field camps, resource acquisition, quarry sites.	Kettle lakes, peat bogs, and bluff edges on glacial drift plains; old terraces, unglaciated mountain lake basins and ridges.
3	Generalized subsistence of marine and terrestrial resources.	Increasing, approaching regional carrying capacity, some circumscription of territories and foraging radii.	Base camps, seasonal dispersal of task groups.	Seasonal round; shift from residential mobility to logistical mobility.	Base camp, field camp, various kinds of resource acquisition and other non-residential sites.	Kettle lakes, peat bogs, and bluff edges; old river terraces, mountain lake basins and unglaciated mountain ridges.
4	Generalized subsistence and diversification of resources habitats.	Increasing, approaching regional carrying capacity.	Base camps, seasonal dispersal of task groups structured by increased territoriality and trade.	Seasonal round pattern.	Base camp, field camp, resource acquisition sites for hunting, fishing, shellfish and plant gathering, quarry; possible villages.	Near water on glaciated drift plains; mountain lake basins and mountain ridges; marine littoral, especially protected embayments; levees and terraces on alluvial floodplains; on Enumclaw Plateau.
5	Generalized but with seasonal specialization of resources that could be mass harvested with appropriate technology and sufficient labor.	Increasing, approaching regional carrying capacity prior to drop at Contact.	Centered on winter village, with seasonal dispersal of elements of the functional residential unit during the annual cycle.	Seasonal round pattern approximating ethnographic patterns.	Winter village, base camp, field camp, resource acquisition sites for hunting, fishing, and shellfish and plant gathering, quarry.	Marine littoral, especially protected embayments and sandspits, intact levees and terraces on alluvial floodplains, mountain lakes, mountain ridge complexes, and the Enumclaw Plateau.

Resource Types and Adaptations Between 14,000 cal BP and 12,000 cal BP

AP 1, between 14,000 cal BP and 12,000 cal BP, marks post-glacial entry of humans into the Puget Sound basin. Sites throughout North America dating to about 14,000 cal BP suggest people lived in small groups, had toolkits with a limited number of artifact types, and had a relatively unsystematic and highly mobile settlement pattern (e.g., Kelly and Todd 1988). Across much of the continent, early hunter-gatherer groups developed different kinds of seasonal settlement patterns within a few millennia of initial settlement that dovetail with regional-scale seasonal differences in resource availability (Anderson 1996; Chalifoux 1999; Jones et al. 2002; Jones et al. 2003).

Vegetation and sea-level elevation in the Puget Sound basin changed remarkably as hunter-gatherers entered and initially occupied this area. Southern King County at the beginning of AP 1 would have been a landscape covered by outwash sediments, dissected by braided gravelly streams, and devoid of vegetation, similar to areas near the terminus of large glaciers in modern Alaska. Deglaciated ground surfaces in the region were rapidly colonized by plants and animals from refugia in the Puget Lowland south of the southernmost extent of the Cordilleran Ice Sheet, however, and were covered by open forest parklands within a few hundred years. Relative sea level rose during AP 1 as the large ice sheet melted and isostatic rebound of the Puget Sound lowlands had yet to compensate for this incursion of the fresh water of glacial Lake Russell and, once the Puget Lobe retreated north of the Strait of Juan de Fuca, salt water from the Pacific Ocean. Isostatic rebound began to push the shoreline back towards its present limits by the middle of this time period. By the end of AP 1 rebound outpaced eustatic sea-level rise, resulting in the now-submerged shorelines characteristic of the following two Analytic Periods.

Based on patterns generalized from archaeological sites throughout North America, hunter-gatherers in King County between 14,000 cal BP and 12,000 cal BP lived in small groups that were constantly mobile and often targeted large terrestrial herbivores for subsistence. Based on early Paleoindian artifact assemblages across western North America, however, the groups used relatively generalized toolkits for a variety of food acquisition tasks. Smaller-bodied animals would have been an important component of the diet despite receiving less attention from archaeological studies (see Cannon 2004; Meltzer 1993, 2009:274–280). Archaeological sites dating to this period do not demonstrate use of food preservation or storage technologies, although Ames and Maschner (1999) suggest that groups moving into North America from northern Asia via the Bering Land Bridge must have had knowledge of such technology.

Small groups probably entered the Puget Lowlands from south of the southernmost extent of the Puget Lobe of the Cordilleran Ice Sheet, and from the Columbia Plateau east of the Cascades. Some archaeologists have proposed that hunter-gatherers moved down the Pacific Coast of Alaska and British Columbia during the late glacial period, sometime prior to 16,000 years ago. The best documented evidence of early hunter-gatherer occupation in the Pacific Northwest is from contexts in Eastern Washington and Oregon and does not predate approximately 14,000 cal BP. Groups moving into the Puget Sound basin from the east were entering environments that were different from the steppe habitats of the Columbia Plateau that had recently seen massive alteration of the landscape during the Missoula floods (e.g., Galm and Gough 2000, 2008; Huckleberry et al. 2008; Mehringer 1989). Access routes from the east over the crest of the Cascade Range would have been blocked, however, during periods when alpine glaciers advanced—a pattern and chronology independent of continental glaciations (Kaufman et al. 2004:83–87).

Despite the continent-wide distribution of the earliest sites predominated by inland locations, some have been found near present and former marine shorelines. Archaeological investigations on the coast of South-Central California demonstrate use of the marine littoral by early foraging groups (Jones et al. 2002; Rick et al. 2001). Evidence from the Cross Creek Site on the marine littoral of San Luis Obispo County is similar to early coastal adaptations on the Northwest Coast, reflecting “a very early coastal occupation” (Jones et al. 2002:227). A diverse array of shellfish and fish bone at the Daisy Cave Site in the Channel Islands offshore of the Santa Barbara County marine littoral also demonstrate early coastal foraging adaptations dating between 13,000 cal BP and 8,400 cal BP (Rick et al. 2001:Table 1). Although the littoral zone was substantially more unstable in the newly deglaciated Puget Lowlands, it was still an ecotone between a large expanse of water (first freshwater, then saltwater later in AP 1) and glacial drift uplands and therefore would have had some draw to human activity.

The small base camps central to the settlement pattern during AP 1 would have been most advantageously situated in productive microenvironments throughout what is now King County. These environments would have concentrated subsistence resources into relatively limited areas as the deglaciated landscape was revegetated. They include kettle lakes on glacial drift plains, confluences of rivers with other streams and lakes, mountain lake basins, and shorelines. Most inland resource acquisition sites would be within a few hours walk (about 6 to 10 km [4–6 miles]) from base camps.

Mobility patterns shifted from the frequent residential moves made by colonizing populations to a more regionally-restricted and seasonally-oriented, but still highly mobile, pattern by the beginning of the next Analytic Period about 12,000 years ago based on patterns in the archaeological record elsewhere in the New World, such as the Southeastern United States (Anderson 1996), coastal California (Rick et al. 2001; Jones et al. 2002), and the Northeastern United States and Canada (Chalifoux 1999).

A limited range of site classes are expected to date to AP 1 in King County, given the hypothesized land use pattern. Small base camps with very low densities of stone tools should be the most common site type representative of this period. Evidence of resource acquisition within the foraging radius of base camps would include isolated projectile points and very low artifact density scatters of stone tool chipping debris and stone tools. In the formerly glaciated drift plains and foothills, base camps would be situated along the valley floors of the Cedar River, Green River, Snoqualmie River, and Issaquah Creek. These areas, that today are the upper reaches of major rivers, were once closer to the heads of inlets. The isolated fluted projectile point at the Hamilton Bog Site (45KI215), on the glacial drift plain above the Cedar River, is typical of the kind of isolated artifacts that may occur within the foraging radius of base camps. The residential base for the Hamilton Bog Site may be nearby and, in fact, may have been within the margin of the same peat bog where the isolated point was found, which would not have been a peat bog during AP 1. A more likely location for the residential base associated with the Hamilton Bog Site would be near stream confluences on the floodplain of the ancestral Cedar River, to the east. The littoral zone was constantly shifting as sea level rose and fell and therefore did not provide a stable landform that fostered long-term repeat use. Shorelines still gave access to resources and transportation routes, however, and therefore would be likely locations of resource acquisition sites if not base camps.

Today, evidence of hunter-gatherer sites dating to the period of initial occupation would survive on old landforms that have not been extensively modified since Late Pleistocene deglaciation. The most extensive old landforms in King County that date to this period are the surfaces of glacial drift plains in the western half of the county, including former shorelines on the drift plain that were stranded by about the end of AP 1 when relative sea level fell below modern sea level. Kettle lakes and peat bogs on the glacial drift plains and bluff margins of the glacial drift plains have the highest probability for these archaeological deposits between 14,000 and 12,000 years ago.

Resource Types and Adaptations Between 12,000 cal BP and 8000 cal BP

Hunter-gatherers living in the Puget Sound basin between 12,000 cal BP and 8000 cal BP experienced a relatively stable environment compared with the previous Analytic Period, albeit one hotter and drier than today's climate. Sea level fluctuation was the most significant long-term environmental perturbation; isostatic rebound outpaced rising global sea level for much of AP 2, resulting in marine shorelines that are today, in most cases, submerged. Brush fires and forest fires were common during periods of summer drought and caused short-term, localized environmental changes in the forest parkland habitats. Terrestrial flora and fauna recolonized the glaciated Puget Sound basin landscape before 12,000 years ago, river systems probably had anadromous fish runs, and the marine littoral zone provided access to shellfish, and marine fish and mammals. Paleobotanical data indicate there were seasonal differences in temperature and precipitation, which probably affected abundance and location of food resources throughout the year, such as the distribution of larger terrestrial mammals like elk and deer. Abundance and predictability of anadromous fish runs probably varied throughout the period in concert with fluctuations in precipitation, stream sedimentation, and sea-level elevation. These environmental factors helped shape human land use patterns as well as preservation of archaeological deposits during AP 2.

In terms of site preservation, sea-level change during this period was one of the most important limiting factors for survival of AP 2 archaeological deposits on the present-day landscape. For several thousand years after about 12,000 cal BP relative sea level fell and the shoreline of Puget Sound migrated westward from mainland King County, outward from Vashon Island, and inward for much of present-day Lake Washington. The archaeological remnants of human activity along this rapidly shifting shoreline are therefore inundated today. One notable exception is the Duwamish River–Green River Valley almost as far south as the present-day Pierce County line, which was a marine embayment during this time. The short Black River Valley was a narrow passage of marine water into a series of lakes within present-day Lake Washington. Camps and resource acquisition locations situated along the long embayment may today be buried under alluvium, but in this regard such archaeological deposits would still be preserved and potentially accessible.

Hunter-gatherers in the Puget Lowlands probably maintained a generalized subsistence system between 12,000 and 8,000 years ago, following patterns seen in the archaeological record from Eastern Washington, adaptations on the marine littoral of British Columbia (Matson 1996), Central California (Jones et al. 2002; Rick et al. 2001), the Northeastern United States and Canada (Chalifoux 1999), and the Southeastern United States (Anderson 1996; Anderson and Sassaman 1996). Human population increased and should be manifested archaeologically by a greater number of sites. The archaeological record of Western Washington at this time does reflect this, as well as a slight increase in the diversity of site classes compared with the previous Analytic Period. This pattern may be explained, however, by the larger sample of AP 2 sites identified in the region.

In the Strait of Georgia region, the first well-dated evidence of generalized, marine littoral subsistence appears in the earliest components of the Glenrose Cannery Site near Vancouver. Initial occupations were at the mouth of the Fraser River on the marine littoral, when the river mouth was several miles east of the contemporary outlet (Matson 1996). The early Glenrose Cannery archaeological materials represent a generalized subsistence strategy centered on a base camp on the marine littoral at the mouth of a major river. Matson (1996:122) suggests sites in the region dating to this time demonstrate “use of a wide range of coastal and terrestrial resources, although no known site is indicative of much residential duration,” effectively describing multi-season and single-season base camps.

Expectations have been derived by archaeologists for site distributions on glacial drift plains and mountain environments during this time period, some hypothesizing a relatively low intensity use of mountain habitats on the western flanks of the Cascade Range because of the generally low density of large terrestrial mammals during this period (Burtchard 1998:138–139; but see Burtchard 2007; Mierendorf and Foit 2008). Forest parkland habitats on the glacial drift plains and foothills of the Cascade Range would have been productive habitats for deer and elk and today should retain evidence of hunter-gatherer residential bases. Kettle lakes and wetlands that later became peat bogs were the most productive environments within the forest parkland habitats and are the most likely locations for residential bases on the glacial drift plains. Resource acquisition sites, such as hunting localities, would be within the foraging radius of residential bases. Field camps are first documented in the archaeological record of Western Washington during this period, as inferred from the archaeological material at Lake Cushman in the foothills of the Olympic Mountains.

Residential base camps between 12,000 and 8,000 years ago would be situated near the most productive microenvironments (e.g., Anderson 1996; Jones et al. 2002), such as along the marine littoral, on alluvial floodplains, at kettle lakes on glacial outwash drift plains, in mountain lake basins, and on mountain ridges that provided west-east travel corridors from the glacial drift plains to the Cascade Mountain crest. Identification of sites in mountain environments in the North Cascades, Olympic Mountains, and at Chester Morse Lake suggests hunter-gatherers seasonally used higher elevations. Thompson's (1978) data for early periods of occupation in Northern Puget Sound suggests seasonal residential bases in productive marine littoral and river delta environments utilized by multiple family groups during more than one season. Radiocarbon dates from the Cedar River Outlet Site at Chester Morse Lake and near the mouth of Bear Creek firmly establish hunter-gatherer occupations in King County during this time period in valleys on the glacial drift plain (Kopperl et al. 2015) and by mountain lakes (Samuels 1993).

The most probable localities for base camps along the former marine littoral zone were inundated or covered with later alluvium but still may be preserved as buried deposits (e.g., Kopperl et al. 2010). Hunter-gatherers continued to utilize the same productive marine littoral localities as before and "filled in" areas between sites that had been occupied between 14,000 and 12,000 years ago. Infilling also occurred in the glacial drift plains and glaciated foothill physiographic zone. More localities in and adjacent to the glaciated foothills were used, such as wetlands and kettle lakes on the surface of glacial drift plains, and stream bottoms.

Resource Types and Adaptations Between 8000 cal BP and 5000 cal BP

Hunter-gatherers in the Puget Sound basin between 8000 cal BP and 5000 cal BP occupied a region that was undergoing major environmental changes in climate, vegetation patterns, and sea level elevation. More localized environmental changes occurred, most notably the Osceola Mudflows that led to reconfiguration of the Enumclaw Plateau and infilling of the Duwamish Embayment near the end of AP 3. Humans accommodated these environmental changes with a generalized subsistence system that expanded diet breadth, utilizing a wider range of resources. Increasing complexity of settlement patterns resulted in additional archaeological site types, more elaborate toolkits, and more intensive use of the productive marine littoral and anadromous fish runs that grew more productive as the pace of rising sea level slowed.

The increasing number of recorded archaeological components that date to AP 2 and distribution of sites in a greater variety of environments suggest hunter-gatherer population density increased throughout the period, and may have begun to approach regional carrying capacity. Burtchard (1998) and Schalk (1988) hypothesize decreasing regional carrying capacity when closed canopy Western hemlock-Douglas-fir forests covered most of Western Washington after about 6,000 years ago. Assuming elk and deer were the most economically important food resources prior to 6,000 years ago when the regional vegetation pattern was mainly forest parkland, such a drastic change in availability of high-ranked prey would likely cause a major shift in subsistence. In the Puget Sound basin, hunter-gatherers probably intensified utilization of montane resources such as huckleberries, marine littoral resources, and riverine and lacustrine resources to replace the energy sources that had been provided previously by elk herds and deer on the glacial outwash drift plains. Foraging distances would decrease around base camps and field camps if the human population grew to a point where the territory of individual communities became circumscribed. Long-distance exchange and addition of food resources that require more investment of energy to acquire may reflect populations approaching carrying capacity. Components with fish and shellfish on the marine littoral and evidence of huckleberry processing in the mountains are documented after 7,000 years ago and could be another indicator of regional hunter-gatherer populations approaching carrying capacity.

Increases in seasonal mobility moved task groups more often throughout an annual cycle, and to a greater variety of microenvironments. Mierendorf (1999) provides useful insights into the increasing use of the North Cascades beginning around 8,000 years ago, suggesting that food gathering and quarrying raw materials were but two elements that conditioned use of the mountain environment. Maintenance of social ties and demarcating boundaries of the regional territory of a particular social group also were important factors. He posits a link between population densities in the lowlands and hunter-gatherer use of the mountains, and suggests that periods of high population density in the lowlands correlate with more intensive use of montane environments. The archaeological record of Western Washington has evidence of obsidian obtained from Oregon and silica rock from sources in Eastern Washington, an indication of at least some long-distance trade and transportation networks through these montane environments as well.

The period between 8,000 and 5,000 years ago has the first extensive archaeological evidence of residential camp sites in Western Washington, allowing more detailed inferences about land use to be made than for the two earlier Analytic Periods. In King County, 10 archaeological components document hunter-gatherer use of the mountains, glaciated foothills, and glacial drift plains east of the Duwamish Embayment at this time (Appendix D). The Southern Puget Sound basin has evidence of a resource acquisition site with a focus on shellfish, near the former marine littoral at the mouth of the Nisqually River. Resource acquisition sites with a focus on hunting, such as *Stuwe'yuq*^{w} on a glacial outwash drift plain high above the Tolt River, occur in glacial drift plain settings, as do field camps such as the Marymoor Site on the Sammamish River floodplain and the Jokumsen Site on the Enumclaw Plateau. The number of documented field camps in the Southern Puget Sound basin increases markedly during this period compared to the time prior to 8,000 years ago. Part of the documented increase in the number of identified archaeological components is likely due in part to the increasing population of hunter-gatherer groups during the time period. Better preservation and the higher visibility of site types with a higher density of artifacts, such as field camps, also probably contribute to the greater number of identified components. Thirteen identified components are in the Cascade Range, including sites at Chester Morse Lake in the upper Cedar River drainage, in the Howard Hanson Reservoir on the Green River, and on the west-east ridge system on Huckleberry Mountain, in south central King County. The first well-documented base camp on the west side of the north and central Cascade Range, 45WH286, is documented at Ross Lake in the North Cascades.

The expected distribution of residential base camps occupied for multiple seasons between 8,000 and 5,000 years ago includes productive areas along the marine littoral, at major river confluences along the Duwamish Embayment, on the Sammamish and Snoqualmie River valleys, along productive mountain ridge environments, and in mountain lake basins. The Osceola Mudflow altered the surface of the Enumclaw Plateau ca. 5,800 years ago. The Enumclaw Plateau was probably revegetated by 5,500 years ago, covered with grasses, alder, and shrubs. Hunter-gatherers probably started to burn the vegetation on the Enumclaw Plateau periodically to stop the encroachment of coniferous trees after the mudflow. The Osceola mudflow at end of AP 3 also marks a major landscape change as the Duwamish Embayment began infilling, although it took several thousand more years to approximate the modern extent of Elliott Bay at the mouth of the Duwamish River. Present-day Lake Washington during AP 3 was an arm of the embayment that emptied through a narrow passage, later becoming the Black River as sea level further stabilized. Although archaeological manifestations of base camps older than about 5,000 years ago have yet to be identified in montane settings in King County, data from Mount Rainier and North Cascades National Parks suggest they may be present as well (Burtchard 2007; Mierndorf and Foit 2008).

In terms of contemporary preservation of AP 3 archaeological deposits, conducive landforms include glaciated drift plains such as sub-Osceola surfaces on the Enumclaw Plateau; old river terraces; and mountain ridges, ridge complexes, and mountain lake basins that have not been modified by Holocene alpine glaciers. Most former marine littoral zones dating to AP 3 are submerged in the subtidal zone along Vashon and Maury Islands and King County's Puget Sound shoreline. The most notable exception is the former littoral zone of the Duwamish Embayment and Lake Washington inlet, which today flanks the Duwamish River–Green River Valley, the vicinity of the City of Renton, and the Lake Washington shoreline. These zones may retain archaeological remains of protected marine shoreline settlement during AP 3.

Resource Types and Adaptations Between 5000 cal BP and 2500 cal BP

The period between 5,000 and 2,500 years ago is pivotal in archaeologists' interpretations of changing human land use in Western Washington. Some (e.g., Burtchard 1998; Schalk 1988) propose shifts from foraging to collecting and from residential mobility to logistical mobility, and consequently an increasingly diverse range of site types. Development of a closed canopy forest and coeval reduction in the density and distribution of ungulates is an important factor underlying those propositions. As Burtchard (1998:142) notes:

A shift to winter reliance on mass harvested and stored anadromous fish is the key element underlying land-use change from the high mobility foraging pattern to the limited mobility collector pattern that dominated Northwest hunter-gatherer economies in the latter part of the Holocene.

Several substantial changes to the landscape occurred during AP 4, however the regional environment in the Puget Lowlands was generally stable. The resource productivity of the Duwamish Embayment increased as the Green River delta prograded into the Duwamish Embayment and the channel of the White River was rerouted north into the embayment. The alluvial floodplain that replaced the south and central portion of the Duwamish Embayment provided a previously unavailable suite of resources and established a direct land connection between the Enumclaw Plateau and the former island landform that is composed of the contemporary West Seattle and Des Moines Drift Plains. The pace of rising relative sea level slowed during this period and reached an elevation within a few meters of the contemporary surface of Puget Sound by about 2,500 years ago.

Human population in the Puget Sound basin during AP 4 may have approached carrying capacity. Mechanisms reflected in the AP 4 archaeological record that could have helped maintain balance with carrying capacity included the seasonal round mobility pattern, use of resources that required a somewhat greater investment of energy to obtain, such as shellfish, fish, huckleberries, and the energy expended in land management activities, such as burning prairies on the Enumclaw Plateau or burning meadows and huckleberry fields in the mountains. The energetic costs associated with use of huckleberries were typical of a pattern of elaboration of the generalized subsistence system and a factor that could help a growing hunter-gatherer population raise the carrying capacity of its environment. Huckleberry processing localities were part of a broader pattern of use of the mountains that included collecting plants for medicine and raw materials and communication with groups from Eastern Washington for trade and social interaction. Huckleberries were in areas that were accessed by multiple groups, which also promoted trade and exchange of exotic and expensive items and facilitated social contacts. Seasonal mobility also used non-subsistence energy to move task groups multiple times throughout a single year to an increasing number of microenvironments.

New and intensified land management practices are hypothesized during APs 4 and 5 following the closing of the forest canopy. These efforts maintained prairie habitats, improved forage in mountain habitats, and improved huckleberry fields; in doing so, carrying capacity could be raised to accommodate an increasing population. Such practices also developed in concert with natural revegetation of the barren surface of the Osceola Mudflow slightly over 5,000 years ago. Based on evidence from the landscape around Mount St. Helens following its 1980 eruption, grasses, shrubs, and forbs would have revegetated the surface of the Osceola Mudflow sediments fairly rapidly, providing browse for deer and elk. Hunter-gatherers created an ecologically immature landscape on the Osceola Mudflow deposits through periodic burning, thus maintaining a productive grassland habitat. Burtchard (1998) suggested hunter-gatherers also periodically burned middle and higher elevation mountain habitats between 5,000 and 2,500 years ago to improve forage for ungulates.

In this explanatory model, storage and processing technology are expected as seasonally intensive components of a generalized subsistence economy. Storage technology would facilitate intensive processing of anadromous fish resources and set the stage for a dramatic shift from a generalized economic system to a seasonally specialized economic system focused on anadromous fish. The archaeological record of the Puget Sound basin has ample evidence of storage and food processing technology, inferred by some to be part of the technological system of a generalized economy and by others to be evidence of a shift to a specialized economy. Several components that postdate 5000 BP in a variety of environmental contexts across King County have hearths, pit features, drying racks, cobble platforms, or other kinds of features that demonstrate storage and preservation technology.

The archaeological record of King County shows an increase in the diversity of site types and number of sites between 5,000 and 2,500 years ago, which suggests population growth, but without indications of population exceeding carrying capacity. Artifact assemblages from the period demonstrate use of more elaborate technologies to access an increasingly diverse range of resources, and there is continued evidence of obsidian obtained from Oregon and lithic raw material such as silicated wood brought from Eastern Washington. Labrets, or decorative lip plugs, similar to styles in Southern British Columbia are part of the artifact assemblage of the earlier components at the West Point Site Complex, which date between 4,250 and 2,700 years ago (Larson and Lewarch 1995). The West Point Site Complex also had obsidian from Southern and Eastern Oregon in assemblages dating between 3,550 and 2,350 years ago. This evidence for expenditure of non-subsistence energy at the site was associated with a generalized subsistence system and components that were residential bases occupied during multiple seasons. Despite these manifestations in some sites, the archaeological record of King County has few expected indicators of an elevated population coping with a dramatic decrease in subsistence returns, such as elaboration of art styles or development of elaborate burial complexes. A better understanding of subsistence via analyses of more direct zooarchaeological evidence from sites in King County, however, will refine the model in this regard.

Based on the diversification of the generalized subsistence system in King County, archaeological sites dating between 5,000 and 2,500 years ago should occur in a variety of environments, including the marine littoral, alluvial floodplains, glaciated drift plains, mountain lake basins, and mountain ridges. A broad range of settlement types, including residential bases, field camps, and special activity locations should occur. Sites analogous to winter villages described in the ethnographic literature, however, appear in the archaeological record of the Southern Puget Sound basin after 2,300 years ago. Currently the oldest recorded component with evidence of a winter village in the Southern Puget Sound basin is at Old Man House (45KP2), which was probably occupied some time before about 1,800 years ago (Schalk and Rhode 1985:24). The remains of smaller residential structures reflecting a variety of family and economic group sizes and related functions should be distributed widely across non-eroding landforms.

Many more base camps should occur on old shorelines on the margins of the Duwamish Embayment, on Duwamish Island, and on Vashon Island, based on the large number of field camps and resource acquisition sites that have been recorded and the inferences of most researchers that population density increased during the period. Again, the distribution pattern may be a function of rising sea-level elevation, which inundated landforms on the marine littoral with a high probability for archaeological resources and which affected the gradients of major rivers and streams. Large numbers of base camps and field camps probably occurred on beaches or on the surfaces of river floodplains, but have been inundated by rising sea level on the shoreline or buried beneath alluvial sediments in floodplains. If one compares the ratio of base camps and field camps to resource acquisition sites in mountain and glaciated drift plain zones, many more resource acquisition sites and camps should occur on river floodplains and the marine littoral. Despite this expectation, the West Point Site Complex and Duwamish No. 1 sites provide some of the very few well-documented occupations of old, inundated marine littoral landforms in King County and the Southern Puget Sound basin. The large number of sites in the Cascade Range, in contrast, may reflect accelerated population growth across the broader region after about 5,000 years ago.

Landforms exposed between 5,000 and 2,500 years ago that hosted productive habitats at that time have yielded relatively high densities of recorded sites when systematically surveyed. Broad stream terraces and floodplains in the Cascade Range exposed at Ross Lake and the Howard Hanson Reservoir have base camps, field camps, quarries, and resource acquisition sites with a focus on hunting. Sites on the margins of Chester Morse Lake also indicate regular, intensive use of mountain settings, as does the long archaeological sequence at the Mule Spring Site on the ridgetop of Huckleberry Mountain. Some river and stream floodplains have terraces or topographic high points that date between 5,000 and 2,500 years ago. The Marymoor Site and Woodinville Village along the Sammamish River north of the outlet of Lake Sammamish, and the Quadrant Site on the North Creek floodplain north of the confluence with the Sammamish River, are examples of hunting and probable fishing sites on floodplains or low terraces incised into glacial deposits in the drift plain.

With the surface elevation of Puget Sound stabilizing near the modern level and alluvial floodplains developing, a larger number of landforms with intact surfaces survive from the period between 5,000 and 2,500 years ago. Archaeological deposits from AP 4 may occur at the contemporary marine littoral in sheltered embayments, such as Quartermaster Harbor on Vashon Island, or may be associated with sandspits, such as at West Point. The Duwamish River–Green River alluvial floodplain, Sammamish River floodplain, and floodplains in the middle reaches of the Snoqualmie River should have intact archaeological deposits buried beneath more recent alluvium. Archaeological deposits associated with old levees or terraces around a meter above the surrounding floodplain may be extant in relatively undeveloped areas in King County, or possibly buried under fill in places subject to more intensive historic and modern development. Glaciated drift plains, mountain lake basins, and mountain ridge systems also should have intact archaeological deposits that date between 5,000 and 2,500 years ago.

Resource Types and Adaptations Between 2500 cal BP and 200 cal BP

Across the Puget Lowlands diversity, size, and location of archaeological sites in multiple microenvironments by about 2,500 years ago suggest a well-established seasonal round analogous to the ethnographically described subsistence-settlement pattern. Land use during AP 5 is consistent with interpretations of the last 3,000 years in northern Puget Sound by Thompson (1978), in which fishing that targeted Fraser River sockeye salmon took precedence in a settlement pattern that still remained generalized over the course of the seasonal round. Based on site size, food remains, artifact assemblages, and settlement location, Thompson infers that the generalized subsistence system was directly comparable to the seasonal round subsistence-settlement pattern in the northern Puget Sound basin noted by ethnographers.

The environment of King County during AP 5 has generally been stable, but some notable changes occurred on a local scale that likely affected human land use. Over the last 1,000 years alluvial systems have evolved, including periodic avulsion of the Cedar River and Black River deltas and progradation of the Duwamish River delta into Elliott Bay. The prograding Duwamish River–Green River delta filled the northern portion of the Duwamish Embayment, and the main channel of the ancestral Duwamish River–Green River moved from the east side of the valley to the west side of the valley during an avulsion event. A substantial earthquake around 1100 cal BP had localized implications for settlement and subsistence as areas along the Seattle Fault rose or subsided. At much higher elevations, the Cascade Range experienced periodic fluctuations of alpine glaciers and snowpacks. These changes, some subtle and some dramatic, would have altered resource abundance, distribution, and access over the past 2,500 years.

Human populations in the Puget Sound basin may have met or exceeded carrying capacity during AP 5, but the absence of material manifestations and zooarchaeological data that would demonstrate an imbalance between population size and carrying capacity suggests that there was no catastrophic over-shooting of this trajectory in the Puget Lowlands prior to Euroamerican contact. Ethnographic data suggest Native American communities throughout the Puget Lowlands expended considerable non-subsistence energy in religious and other ceremonies at winter villages by the time of contact, however, although extensive material evidence of this expenditure of non-subsistence energy is not found in the archaeological record.

A land use pattern centered on a winter village was probably established in the Central Puget Sound basin by approximately 1,800 years ago, based on data from the Old Man House site on the Kitsap Peninsula. Winter villages similar to Old Man House would have been advantageously situated in King County on the marine littoral near the confluences of rivers and Puget Sound, and on the middle and lower reaches of major river systems, such as the Duwamish River–Green River, the Sammamish River, the Snoqualmie River, and the White River. These river floodplains represent dynamic alluvial landforms and may retain evidence of winter villages. As during the previous Analytic Period, residential structures reflecting a variety of family and economic group sizes and related functions should be distributed widely across non-eroding landforms.

Most landforms in King County have the potential to retain intact archaeological material dating to the period between 2,500 and 200 years ago, but areas with the highest probabilities include the marine littoral, intact levees and terraces on alluvial floodplains, the shores of mountain lakes, mountain ridge complexes, and areas with Buckley silt loam on the Enumclaw Plateau. Portions of the marine littoral north of the Seattle Fault Zone, the Sammamish River floodplain, and the northern margins of Lake Sammamish and Lake Washington may have archaeological deposits below the level of contemporary Puget Sound, the contemporary surfaces of Lake Sammamish and Lake Washington, and the contemporary surface of the Sammamish River floodplain. The marine littoral, northern shorelines of Lake Sammamish and Lake Washington, and the Sammamish River floodplain subsided during an earthquake on the Seattle Fault Zone around 1,100 years ago.

Areas with the highest probabilities for the most recent pre-contact hunter-gatherer archaeological deposits include Quartermaster Harbor on Vashon Island, mouths of small streams at the contemporary marine littoral of Puget Sound, the Duwamish River–Green River–former White River confluence in the Auburn vicinity, the Black River–Cedar River floodplain, floodplains at the confluences of small tributary streams and all major river systems in King County, mountain lakes, and mountain ridge systems with meadows and huckleberry fields. Many of these areas correspond with recorded ethnographic sites and place names.

Summary

The various aspects of the explanatory model of pre-contact land use in King County are discussed in the preceding sections and summarized in Table 7-1. This set of hypotheses and archaeological expectations posits a very small human population that first settled in present-day King County almost 14,000 years ago, grew steadily throughout the Holocene, eventually to the extent that subsistence ranges for individual communities overlapped and territorial circumscription occurred. Across this long time span, hunting, fishing, and gathering strategies changed with new challenges posed by both environmental and demographic perturbations. The focus on large terrestrial mammal hunting inferred continent-wide near the end of the Pleistocene may characterize people living along the margins of the retreating ice sheets and proglacial lakes of the Puget Lowlands during the first part of AP 1, but soon it shifted to a broader generalized pattern of subsistence as some mammals became extinct and other resources, both animal and plant, took hold of the King County landscape with distinct habitats and seasonality. A subsistence base that diversified over time did not preclude more intensive seasonal use of some resources and their habitats, especially anadromous salmon runs, berry picking grounds, and good places to dig roots. As the forest canopy closed after about 6,000 years ago, many subsistence resources were aggregated in time and space. Growing human populations contributed to a larger labor pool, and technological innovations supported more efficient harvest and processing of those seasonal resources that would be less profitable otherwise. By AP 3, mobility during the annual cycle centered on a series of base camps was replaced by more permanent base camps that were still seasonally occupied but supplemented by an increasing array of dispersed logistical camps and resource procurement sites. By AP 5, the winter village site became the focal point of economic and social activities during the annual round. The expected complexity of the archaeological record increases through time, however much of this is a result of processes throughout the Late Pleistocene and Holocene that have differentially preserved archaeological deposits and archaeologically sensitive landforms.

CHAPTER 8. Archaeological Site Sensitivity in King County

This chapter provides a link among the environmental setting of King County described at the beginning of this document, the explanatory model developed in the last chapter, and the sensitivity model that operates on a GIS platform. Variables were chosen for the sensitivity model, rendered into spatial GIS layers and divided into polygons, and then the variable layers weighted for input into the GIS model. Two axes of variability are considered, which condition the archaeological sensitivity of particular portions of the modern-day King County landscape: 1) a *Sensitivity* axis that uses physical characteristics and proxy variables for resource productivity to quantify the suitability for occupation and spatial proximity to important economic resources across the King County landscape for each Analytic Period, and 2) a *Preservation* axis that uses geophysical variables to identify the depositional or erosional condition of modern-day landforms and their potential for preserving archaeological deposits.

Sensitivity variables are based on hypothesized land use patterns modeled in Chapter 7, focusing on where humans were likely to live, travel, and utilize the landscape at various times in the past. Some of these variables are *Physical* and not justified or weighted based on anthropological or archaeological theory. For these variables, it is assumed that humans in the Puget Sound region will prefer occupation on relatively level surfaces with, all else being equal, southern exposure to maximize solar insolation. Other variables are those of *Productivity* and *Mobility*. Productivity variables correspond with the distribution of certain resources that drew people to certain places on the landscape, and therefore affected archaeological site sensitivity. These variables are incorporated in the GIS model either as direct or corrected map data (e.g., presumed distribution of salmon), or as proxy map data (e.g., distribution of ungulates using proxy vegetation data). Mobility variables highlight the relative archaeological sensitivity of transportation thoroughfares such as shorelines, terraces, ridgelines, passes, and saddles, as well as stream confluences and estuaries that are given weight as intersections of a variety of human activities. These variables conditioned site sensitivity through time, each differentiating portions of the King County landscape and becoming more or less important as human land use evolved over the past 14,000 years. The variables are used to create sensitivity maps for each of the five Analytic Periods and a synthetic map that unifies all of the sensitivity information on the modern King County landscape.

Preservation variables are tied to the geophysical evolution of King County. They provide information about the age of extant landforms, and may condition the post-depositional preservation or destruction of archaeological resources. Archaeological sensitivity rankings on the modern-day landscape can be viewed in light of the potential of sites situated on some landforms to have been destroyed or buried. For example, level bluff-tops overlooking river valleys and the marine shoreline are given relatively high values for archaeological sensitivity, especially during earlier Analytic Periods, however these same bluffs in some parts of the county have undergone extensive retreat and may not retain those archaeological deposits today. Similarly, the spits and other features that characterize the marine shoreline of King County today did not exist prior to the last several thousand years, and many ideal places for settlement along the marine littoral before that time, when relative sea level was much lower, are now inundated. Archaeological sites on landforms that have undergone substantial deposition may be deeply buried, such as sites on floodplains and the portion of the glacial drift plain covered by the Osceola mudflow on the Enumclaw Plateau. These examples highlight the importance of considering the reasons why a site might or might not be preserved at a particular location, as well as reasons why humans might have left archaeological signatures there in the first place.

Rendering these two axes in spatial terms is a goal of GIS sensitivity modeling. In this chapter, that goal and the rationale for the GIS model are first briefly discussed, followed by descriptions of the methods of creating and operationalizing spatial data for the GIS model, and individual review of the variables in terms of their sources and weighting. Sensitivity variables are considered first, along an archaeological site sensitivity axis that provides a relative scale of sensitivity for any place within King County. Different gradients are given for each Analytic Period, conditioned by the theoretical land use model given in Chapter 7. A composite gradient synthesizes site sensitivity from all five Analytic Periods onto the modern King County landscape, and provides the most direct means of establishing archaeological resource management protocols based on an objective measure of archaeological sensitivity.

Preservation variables are then considered, which are tied to the modern landform GIS layer. Each kind of landform is ascribed values for age, erosion, estimated stability, and reliability of these data. These values in turn provide a preservation axis, separate from the sensitivity axis, that quantifies the likelihood of a place on the modern King County landscape retaining buried archaeological deposits, if present at one time. Discussion of initial quantitative testing and implementation of the GIS model finish the chapter.

GOALS AND THEORETICAL ASPECTS OF GIS MODELING

Two general goals of the GIS model are 1) to provide the King County HPP digital maps of general sensitivity for Native American archaeological resources, which they will use to assist project proponents to develop project-specific preservation and management options associated with planning and construction, and 2) to provide a series of GIS-based tools useful for any professional archaeologist conducting research in King County, including archaeological site sensitivity maps for each Analytic Period derived from the explanatory model discussed in Chapter 7, shapefiles of previously inventoried archaeological resources, and metadata on all of the variables discussed below.

For the past several decades, GIS has been used to create “predictive” models of archaeological site distribution for particular study areas. Some of these GIS models were developed to assist government agencies manage cultural resources and guide assessment methodology on land under their jurisdiction, while others were developed as research tools to help explain patterns in the archaeological record or test explanatory models derived by some other means. GIS models define areas of site sensitivity (the “predictive” part of the model) in one of two general ways—either using an inductive method that correlates existing site distribution data with certain physical variables to derive a map that defines areas of archaeological sensitivity; or using a deductive method that develops a model and variables that condition archaeological site sensitivity independent from existing site distribution data. Both methods have their proponents and detractors, and debate about the advantages, shortcomings, and semantic issues of both kinds of models has been ongoing in academic literature for as long as GIS has been used to infer archaeological site sensitivity (e.g., Kamermans 2000; van Leusen 1996, 2002; Wheatley 2000). One thing that has become clear from broader academic debate, however, is that the deductive/inductive dichotomy contributes little towards development of a useful tool for the King County HPP and archaeologists working here (see Verhagen 2007:13–14). The GIS model developed for King County may be considered deductive in that existing archaeological site data with all of their biases and other sampling issues are not used to infer potential distribution of other sites on the same landscape, as is the case with many correlative/inductive models.

Although independent variables are defined and weighted from a general explanatory model and then analyzed through GIS to create site sensitivity maps apart from existing site data, much of what informs the King County explanatory model is the existing archaeological record of the County and its vicinity and the patterns explored by professional archaeologists working in King County over the past five decades. No claims are made that this model is purely deductive. Also, the iterative nature of this model cannot be overly stressed, and new data should be included for both the independent variables (better environmental data and more confident reconstructions of past environments) and King County archaeological data that test the explanatory and GIS models. Finally, because archaeological sensitivity estimates are in part developed from an explanatory model with a particular evolutionary ecological-oriented theoretical framework, research on the archaeological record that pursues explanations based on other theoretical orientations (especially those with lesser roles for environmental variables) may not find some aspects of the model directly useful.

Comparison of this model with the goals and structure of other sensitivity models is informative. In particular, DAHP coordinated development of a state-wide GIS-based predictive model specifically to assist regulatory review of construction projects that may impact archaeological resources (GeoEngineers 2009). Several instances of unanticipated discovery and damage to important archaeological resources and their consequent monetary costs are cited as an impetus for model development (e.g., MacDonald 2006). The DAHP model correlates known archaeological site locations with seven physical environmental variables: elevation, slope, aspect, distance to water, geology, soils, and landforms. Geostatistical spatial estimation is used to add the additional information of negative survey results and proximity to areas of suspected, but not formally inventoried, archaeological resources to the correlative model. The sensitivity estimates generated by the model were evaluated both informally with review by professional archaeologists, and by detailed comparison of sensitivity estimates within small areas of state with the boundaries of geologically old landforms. The DAHP model does an admirable job synthesizing data across a very large area encompassing substantially different environments and environmental histories. Although the consequences of data gaps in the archaeological record are compounded for an inductive model at the scale of the entire state, implementation of the model for cultural resource management is straightforward. Like the DAHP model, the GIS site sensitivity model for King County is meant to be a useful management tool that will guide survey recommendations and management decisions. Like model construction, implementation will be an iterative process undertaken by the King County HPP.

GIS DATA AND METHODS

All GIS data was developed using ESRI ArcGIS 9.3 with the Spatial Analyst plug-in, then updated to ArcMap 10.3 and imported into a geodatabase for the final iteration. Most GIS shapefiles used for the sensitivity model were acquired from the King County HPP, from various King County and Washington State agency sources, or the U.S. Department of Agriculture (USDA). All files used had a maximum scale of 1:24000 (or a 30-m cell size), although in some cases (e.g., landforms), hand-digitized data was drawn at a much finer scale. Where different data sources were available for the same variables or proxies, preference was given to more recent shapefiles and/or those that included more robust metadata. However, the reliability of these data sets was not evaluated in any kind of quantitative manner.

All layers, except aspect and slope, began as point, line, or polygon shapefiles. In most cases, some distance of buffering was used to create a catchment area around the resource resulting in a polygon (e.g., salmonids). Other resources, especially those based on landform, elevation, or vegetation, were drawn as polygons and not buffered (e.g., Thoroughfares and Huckleberries). Variables representing resources that are spatially constrained on the landscape were buffered to give sensitivity weight to places nearby. Buffering variables with corresponding data that cover all, or large patches of, King County, would not be meaningful, and thus those variables were not buffered. For example, the greater relative archaeological sensitivity of a level place does not carry over to adjacent steep slopes. Similarly, large vegetation zone polygons that serve as proxy for huckleberry habitat and cover thousands of acres are not buffered, because a zone of reduced sensitivity weighting around the perimeter of such a large area is not meaningful.

Some variables entail relatively high sensitivity value within and/or immediately adjacent to the variable's mapped extent, and lower values for buffered areas farther away but still near where the variable may still condition archaeological site sensitivity. Divisions of those buffer distances, for example a value of 2 for areas 0–100 m from mapped fresh water and a value of 1 for areas 101–200 m away, are obviously arbitrary.

As a result, all the final shapefiles that make up the model are polygonal. Although much input data for the final layers were constructed using Universal Transverse Mercator (UTM) (NAD83, Zone 10N, meters), all layers were converted to the project projection of State Plane Washington North (NAD83, HARN, feet) before they were incorporated into the final model.

The base of the model begins with slope and aspect, both derived from King County–supplied bare-earth LiDAR. No bathymetry was used so waterbodies are shown as zero for slope and aspect even though there is topography under the water. Similarly, soil data that was used to develop other variable shapefiles does not include modern water bodies. Because of these false zeroes and missing datasets, areas covered by modern water bodies were not considered when developing the model.

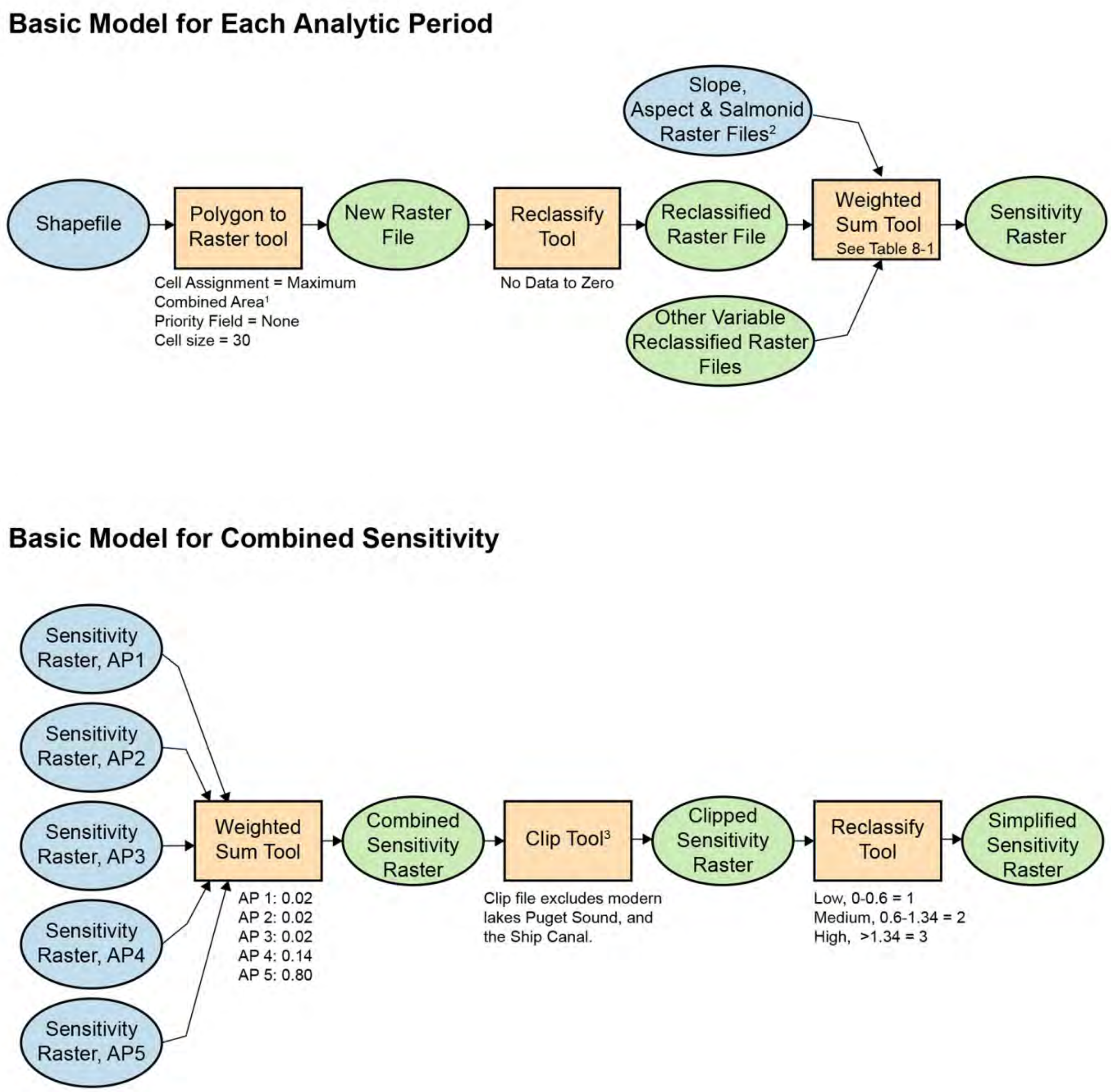
In general, a model for each Analytic Period was constructed by first converting the shapefile to a raster using the Polygon to Raster tool using the Maximum Combined Area setting and a cell size of 30 m (98.42 feet), then reclassifying the areas coded for no data to zero, and finally adding the rasters using the Weighted Sum tool (see section below for weighting) (Figure 8-1). The data must be reclassified as when working with raster data, a no data value for a cell indicates that no measurements have been taken and thus will not be included in any mathematical formula until converted to a numerical value. The final combined model was created by summing each individual Analytic Period Model using the Weighted Sum tool. Modern water bodies were then clipped from the final combined raster, changing those areas from zero to no data, as these are areas where no measurements were taken for many of the original variables.

Given that this model will likely require periodic updating, every effort was made to ensure easy modification of the components. As such, most variables enter the model as easily-editable shapefiles. The exception to this are the physical variables, slope and aspect, as those were derived from digital elevation models, and the salmonid data for APs 4 and 5. These last two variables are submitted as rasters as they represent additive data and mathematics can only be performed using ESRI tools on raster data. While the final variables assigned to each cell and the final weighting can easily be updated for these rasters, in the case of the salmonid data, changes that effect the spatial geometry of the base watercourses or buffering distances will not be possible without first recreating the baseline shapefiles.

SITE SENSITIVITY AXIS

Physical and biotic attributes comprise the variables used in the model along a site sensitivity axis, following the set of expectations derived from the explanatory model in this document and demonstrated use of some of these variables in other spatial site sensitivity models (e.g., Brooks et al. 2000; Dalla Bona 1994; GeoEngineers 2009). The specific locations of human activity on the King County landscape over the millennia and their archaeological signatures have certainly been shaped in part by non-environmental and non-subsistence related factors, however our knowledge of regional archaeological patterns and the condition of available data for spatial modeling precludes inclusion of other aspects into this sensitivity model at this time.

The variables and their roles in the GIS model are summarized in Table 8-1. Two variables common to most archaeological sensitivity or predictive GIS-based models are slope and aspect. Their inclusion is



[1] If there is more than one feature in a cell with the same value, the areas of these features will be combined. The combined feature with the largest area within the cell will determine the value to assign to the cell.

[2] Salmonid variable is raster for APs 4 and 5 only.

[3] Effectively reclassifying areas covered by water from zero to No Data so final classification statistics are not skewed.

Caveat for both models: a polygon of the King County boundary must be used to set extent and raster analysis area for the geoprocessing environment. It is also used to extract only King County after reclassification in the basic model.

Figure 8-1. Basic ESRI geoprocessing models showing tool automation for individual Analytic Period and Combined Sensitivity Models.

Table 8-1. GIS Model Variables

Variable	Data Source*	Summary	Polygons	Intra-Variable Value	Diachronic Adjustments (Aside from Paleoshore/ Paleochannel)	Physiographic Zonation	Inter-Variable Weighting AP 1	AP 2	AP 3	AP 4	AP 5
PHYSICAL											
Slope	DEM	Slope categories	A=Level Ground (0%–5%)	6	None	None	0.15	0.15	0.15	0.09	0.09
			B=Slight/moderate Slope (6%–30%)	2							
Aspect	Slope and compass direction derived from DEM	Aspect categories	A=136°–225° aspects	3	None	None	0.05	0.05	0.05	0.02	0.02
			B=Negligible aspect on level ground	2							
			C=91°–135° and 226°–270° aspects	1							
PRODUCTIVITY											
Fresh Water	KC and DNR	Proximity to streams (A, B), lakes (A, B), and springs (C, D)	A=0–100 m	2	None	None	0.15	0.15	0.15	0.09	0.09
			B=100–200 m	1							
			C=0–100 m	4							
			D=100–200 m	2							
			E=Valley Bottoms	2							
Salmonids	DNR Fish Distribution Data	Proximity to stream segments with known and potential runs of important salmonids	A=Valley Bottoms of large rivers	2*# of runs	AP 1–3 limited to 500 m buffer around mainstems of streams and no multiplier for # of runs; value of 1.	None	0.04	0.04	0.10	0.12	0.13
			B=0–50 m around smaller stream/lake segments	2*# of runs							
			C=51–200 m around smaller stream/lake segments	1*# of runs							
Marine Shellfish Access	T-Sheets and Elevation Contours	Intertidal width and low-elevation access points; layer includes beach-front landforms from corrected shoreline inland to 40 m contour	A=Zone 200 m wide fronting intertidal greater than 150 m wide, AP 5	8	AP 1–3: Corrected shoreline inland to 40 feet above sea level (asl) contour.	None	0.04	0.04	0.05	0.12	0.12
			B=Zone fronting intertidal 50–150 m wide, AP 5	6							
			C=Corrected shoreline inland to 40 feet asl contour with <20% slope, AP 1–3	4							
			D= Corrected shoreline inland to 40 feet asl contour with <20% slope, AP 4	6							
Other Marine Resources	T-Sheets and Elevation Contours	Low-bank beach access zones and estuary margins	A=Low-gradient access zones between backing bluffs or estuaries and marine shoreline	6	Subjective evaluation of T-sheets and LiDAR for AP 4–5 and paleoshorelines for AP 1–3. High value for AP 4–5, low for AP 1–3	None	0.10	0.10	0.08	0.11	0.11
				10							
Ungulates	Vegetation and Landform Layers	Vegetation zones and landform Classes that serve as proxy deer/elk habitat	A=Upland Zone Subalpine Vegetation and Valley Bottom Landform	4	AP 1–3: Open mosaic forest vegetated area = 4; riparian forest = 2	Floodplains in Upland Physiographic zone differentiated and given value as elk yarding areas	0.30	0.30	0.24	0.11	0.11
			B=Lowland Zone Muckleshoot Prairie	4							
			C=Lowland Zone Low- and Mid-Elevation Forest and Riparian Woodland Vegetation	2							

Table 8-1. GIS Model Variables

Variable	Data Source*	Summary	Polygons	Intra-Variable Value	Diachronic Adjustments (Aside from Paleoshore/ Paleochannel)	Physiographic Zonation	Inter-Variable Weighting AP 1	AP 2	AP 3	AP 4	AP 5
Freshwater Shellfish	WDFW Data Points and Stream Gradient Data	Segments of stream systems for which few mussel data exist and fall within elevation range of those data points	A=0–100 m around stream segments;	1	Variable not used in model for AP 1–4	Lowland Zone only	0.00	0.00	0.00	0.00	0.03
			B=Sammamish and Snoqualmie R vallies buffered by 100m	1							
Birds	Shoreline, T-Sheet, and Wetland Data, and Drawn Polygons for Flyover Areas	Marine littoral and lakeshores, buffers around wetlands, and certain known or suspected land passes ideal for bird netting	A=Large estuaries and saltwater marshes	1	Flyover areas not considered for AP 1–3	None	0.00	0.00	0.00	0.03	0.03
			B=0–50 m around margins of fresh water and valley bottoms of large rivers	1							
			C=Flyover areas	1							
Huckle-berries	Vegetation Zone layers	Veg. associations used as proxy for huckleberry habitat	A=Areas within silver fir/huckleberry or silver fir/blackberry polygons	8	Zone develops in later APs, therefore variable not considered in earlier APs	None	0.00	0.00	0.00	0.09	0.09
Wetland Resources	Histic Soils, Mapped Wetland and Floodplain Layers	Margins of wetlands and floodplains of larger river systems in which slackwater environments formed	A=0-50m on either side of wetland margin	4	River Floodplain consideration limited to later APs during which time floodplains developed	Limited to Floodplains in Marine and Lowland Zones	0.03	0.03	0.03	0.03	0.03
			B=Floodplains of larger river systems	2							
Prairie Habitat	Soil Layer	Muckleshoot, Meridian, and Snoqualmie Prairies	A=Within Buckley silt loam, Everett gravelly sandy loam 0–5 percent slope, and Barneston gravelly sandy loam windswept 6–30 percent slope polygons	8	Variable not used in model for AP1-3	None	0.00	0.00	0.00	0.06	0.06
Lithic Material	Geologic and Landform Layers	Bedrock outcrops	A=Bedrock Outcrops	2	None	None	0.10	0.10	0.10	0.03	0.03
MOBILITY											
Thorough-fares	Landform Layer	Littoral, riverine, and montane travel corridors	A=Terraces	1	None	Ridgeline polygons limited to Upland zone	0.05	0.05	0.05	0.05	0.03
			B=Shorelines	1							
			C=Ridgelines	1							
			D=Passes/Saddles	2							
			E=Stream/Marine Connectors	2							
Intersections	Landform and Fishdist	Junctions of major Salmonid-bearing streams	A=Stream Confluences in lowland settings	2	Variable not used in model for AP 1–3	None	0.0	0.0	0.0	0.05	0.03
			B= Stream Confluences in upland settings	1							

*Corrected by Analytic Period using paleoshoreline and major landform reconstructions. DEM = digital elevation model, KC = King County, DNR = Washington State Department of Natural Resources, WDFW = Washington Department of Fish and Wildlife, Fishdist = Fish Distribution of Washington State: Washington Lakes and Rivers Information System based on the fundamental assumptions that humans prefer occupying level ground for most activities, and that archaeological sites are most likely to be preserved on level surfaces subject to less erosion than sloping surfaces. Insolation provides a basic human physiological need and is considered in this category as well, weighted towards south-facing exposures. Variables related to subsistence pursuits and acquisition of other resources comprise the productivity category, and are usually given values based on proximity to a particular resource or a proxy of a resource. Mobility variables are given values based on proximity to presumed transportation routes and their intersections with each other.

The physical, productivity, and mobility variables all contribute in the GIS model to the calculation of overall archaeological sensitivity of 30-m-square cells that cover King County. All of the variables assign a numerical value between 1 and 8 (with a multiplier in the case of salmonids) to a portion of the King County landscape, sometimes on a graded scale of several values and sometime just a single value to a subset of King County cells. The quantitative "meaning" of the intravariable values is heuristic—measures of relative importance of different areas within King County in terms of how a particular variable conditions archaeological site sensitivity. The theoretical underpinnings of this framework are given in the previous chapters (especially Chapter 7), and reviewed for each variable in the following sections of Chapter 8. These numbers do not, however, carry any additional meaning beyond a way of assigning relative values to specific places on the King County landscape in the GIS model, which requires quantification of concepts such as resource productivity that are initially modeled in this document in a qualitative manner.

The variables are in turn weighted in relation to each other based on their relative importance in conditioning the distribution of archaeological resources throughout King County. Those relationships change over time as particular resources become more or less critical within pre-contact land use patterns. Therefore, weighting is given for each individual Analytic Period based on expectations derived in the explanatory model outlined in Chapter 7. Whether or not the modern landform that comprises the cell is likely to retain archaeological material is considered along the separate preservation axis, described in the following section.

Weighting consists of a percentage that the variable contributes to the overall site sensitivity of a particular cell during an Analytic Period. Because of the number of variables considered, no single variable comprises more than 25 percent of the overall site sensitivity, which is the case for ungulates during the first two Analytic Periods. Salmonids were a very important resource, especially during APs 4 and 5, but given the widened diet breadth hypothesized by 5,000 years ago, the contribution of salmonid distribution to site sensitivity relative to the numerous other terrestrial, littoral, and marine resources is not as large as that of ungulates relative to other resources during earlier periods. Although the relative differences between variable weights is based on the explanatory model, the specific numbers and rounding up and down to equal 100 percent for each Analytic Period is somewhat arbitrary and may be adjusted with further research and model building. For example, a continuous variable (such as slope) is divided into two to four categories or kinds of polygons that are given intra-variable values based on inferred archaeological site sensitivity. This creates a simple (and admittedly somewhat arbitrary) ordinal-level scale of values for that variable across the county. This is a somewhat artificial process, as is model-building in general, because the quantitative values of all the variables are a closed array, totaling 100 percent for each period.

Additional information about the rationale for the values and divisions of individual variables is given in their respective sections below.

Physical Variables

Slope

Divided into several increments on a scale between 0 and 90 degrees or percent, slope is a basic physical variable for estimating site sensitivity. The division of slope, a continuous variable, into increments is arbitrary but informed by the known regional archaeological record and common sense. Relatively level ground surfaces (0–5%) are more likely to be subject to residential human activity and are more likely to retain archaeological resources than moderate slopes (6–30%), or steeply sloping (31–90%) surfaces. A value of 6 is given to polygons encompassing level surfaces, and a value of 2 is given to land within the slight-moderate slope category. No value is given to steeper slopes. Certain productivity resources such as bedrock outcrops, described below, may primarily be found on steeper slopes and the sensitivity of those areas is reflected in the valuation and weighting of those other productivity variables.

Slope data for this GIS model comes from the existing digital National Elevation Dataset publically available from the U.S. Geological Survey. Data has a spatial resolution of 1 arc-second (roughly 30 m). The Slope tool was used to identify the rate of maximum change in elevation from each cell, quantified as a percent. King County was then extracted from the larger raster. Areas now covered in water, derived from the Washington State Department of Natural Resources Waterbodies layer, were given a value of zero. The resulting raster was then reclassified based on values defined in Table 8.1. Final rasters for each Analytic Period were clipped by the projected sea level for that date. Areas thought to be below sea level were given a value of zero.

Aspect

The aspect of a particular place on the landscape is the compass direction that its ground surface faces, along the axis of its steepest descent. Aspect data for this GIS model comes from transformation of slope and directional data. South-facing exposures maximize insolation. Following the assumption that solar exposure, especially at residential sites, will be maximized with all else being equal, greater archaeological sensitivity is expected for south-facing or level ground. This assumption may not hold for areas of exceptional topography such as Mount Rainier (e.g., Burtchard 1998, 2007) but it is considered valid for the purposes of this model for King County. Aspect is divided into several categories based on a 0° north compass: south-facing slopes (136°–225°) are given a value of 3, negligible aspects on level ground are given a value of 2, and southeast and southwest aspects (91°–135° and 226°–270°) are given a value of 1. All generally north-facing aspects (0°–89° and 271°–360°) are not given a value under this variable.

As with Slope, this variable is derived from the National Elevation Dataset and has a spatial resolution of 1 arc-second (roughly 30 m). The Aspect raster was created by running the Aspect tool on the original digital elevation model from the U.S. Geological Survey. The Aspect tool identifies the downslope direction of the maximum rate of change in value from each cell to its neighbors. The values of the output raster are the compass direction of the aspect. King County was then extracted from the larger raster. Areas now covered in water, derived from the Washington State Department of Natural Resources Waterbodies layer, were given a value of zero. The raster was then reclassified based on the values identified in Table 8-1. Final rasters for each Analytic Period were clipped by the projected sea level for that date. Areas thought to be below sea level were given a value of zero.

Productivity Variables

Sources of Fresh Water

Water availability is commonly incorporated into GIS-based sensitivity models. It is considered a limiting factor in this model for residential sites, and likely conditioned the location of many non-residential activity sites as well. The value of the variable, like most others in the productivity category, is scaled by proximity. Added value is given to areas near fresh water springs, as they are often in broad landform categories such as foothills and mountains without other ready access to fresh water. The variable is divided into two values, areas within 100 m of streams, lakes receiving a value of 2, and areas between 100 and 200 m of those fresh water sources receiving a value of 1. Areas within 100 m and between 100 and 200 m of springs are assigned values of 4 and 2, respectively. Valley bottoms were given a value of 2.

Shapefiles of sources of fresh water used for this GIS model come from existing King County hydrologic layers. Stream data is from King County Water Courses, and the large river valleys are corrected for the most recent Analytic Period using shoreline and river channel reconstructions created by the University of Washington's Puget Sound River History Project. The layer was then clipped by the shoreline for the relevant Analytic Period. As a way to select for permanent water sources, only streams categorized as "Fish Habitat" or "Shoreline of the State" were used. Springs are a combination of those mapped by King County from the Ground Water Source layer and those mapped from historic maps and ethnographic sources as part of the King County's Historic Preservation Database. Lakes and ponds are taken from the Washington State Department of Natural Resources Waterbodies layer. Only those coded "Lake or Pond" were used.

Salmonids

Salmonids have been one of the most important biological resources for Pacific Northwest Native Americans with archaeological evidence of their harvest extending as far back as at least 10,000 years ago. Each stream and tributary in King County that regularly hosted at least one spawning species may be considered an important productivity resource that potentially conditioned the distribution of archaeological sites in its vicinity.

GIS salmonid data for the sensitivity model are primarily drawn from the Fish Distribution of Washington State: Washington Lakes and Rivers Information System (WLRIS) layer, scaled at 1:24,000 and termed "fishdist." The composite layer of information was revised in 2007 by the Washington Department of Fish and Wildlife (WDFW), Washington State Conservation Commission, Northwest Indian Fisheries Commission, the USFS, National Oceanic and Atmospheric Administration (NOAA) Fisheries, and the U.S. Fish and Wildlife Service (USFWS). This layer provides data on the documented, presumed, historic, and potential presence of salmonids in the lakes, streams, and tributaries of King County. Salmonid taxa recorded for each stream segment are differentiated as follows: Chinook (fall, spring, summer), chum (fall, summer winter), coho, pink, sockeye, steelhead (summer, winter), dolly varden/bull trout, rainbow trout, cutthroat trout (coastal resident, westslope), and kokanee, although as discussed below not all these categories are used to estimate sensitivity.

The fishdist layer is combined with data from the University of Washington River History Project to provide a baseline salmonid distribution layer representing the most recent time period for the model, AP 5. In doing so, historic and modern anthropogenic channel alterations in the lower courses of major rivers, most notably the Duwamish and Sammamish Rivers, are corrected to estimates of their configurations prior to widespread Euroamerican settlement. Salmonid presence data for these rectified lower reaches are then extrapolated from recorded, presumed, and potential presence of particular species and populations documented in fishdist in the reaches and tributaries feeding into those lower reaches.

Polygon buffers around the stream line data are created that delineate proximity zones for salmonid resources. Stream segments for which sensitivity value is assigned are those identified in the fishdist/River History composite layer as having hosted known or presumed historic salmonid populations. Defining a suitable boundary around streams for this variable is difficult because the fishdist data consists of lines instead of polygons of accurate stream width, because stream channels often migrate within a valley floors of varying widths, and because stream productivity does not necessarily correlate with suitability of stream-side landform features for fish processing (and, by extension, presence of salmonid-related archaeological sites). The entire valley bottom landform of the salmonid-bearing mainstem segments of larger rivers are delineated and given a value of 2 in order to capture presumed fishing activity of much of the valley floor of larger river systems in King County as main and side channels migrated and riparian conditions evolved. For smaller salmonid-bearing lakes and streams, a polygon 50 m wide on either side of the stream line is given a value of 2, and a value of 1 is given to the more peripheral zone between 51 and 200 m on either side of salmon-bearing streams. For the two most recent Analytic Periods, these values are multiplied by the number of documented or presumed salmonid species along each stream and tributary segment. Seasonal runs of particular major salmonid species, such as spring, summer, and fall Chinook, are counted separately for the multiplier to take into account increased archaeological sensitivity along stream segments hosting salmonid resources during multiple seasons. Salmonid populations of lesser economic importance, such as cutthroat trout, dolly varden, and kokanee, are mapped in the GIS database but not included in the weighting.

Estimating salmonid availability and distribution further back in time is difficult, as is the case for most biological populations. As described in Chapter 2, there are many factors affecting salmon distribution and abundance as demonstrated by the difficulty in understanding change in stock status over the past century. Extrapolating these patterns for several thousand-year intervals back to 14,000 years ago is therefore an imprecise exercise. However, a few major geologic events, some gradual and some catastrophic, are well known and allow us to at least begin modeling past salmonid availability at a coarse resolution for APs 1 to 3. It is assumed that the model will be refined in the future as more zooarchaeological and fisheries science data are brought to bear on the question of past salmonid biogeography.

Estimates of salmonid distribution during each Analytic Period are derived using the estimated paleoshoreline and major river paleochannel configurations introduced in Chapter 2. Although there have been no definitive studies regarding the timing of salmonid repopulation of river systems in Puget Sound following the retreat of Pleistocene glaciers, it is assumed that at least a pioneering population was present in the lower reaches of the largest rivers in King County at some point during AP 1. Changes in relative sea level present the first major factor that would have conditioned salmon abundance and distribution. The Puget Lobe of the Cordilleran Ice Sheet prevented access to the ocean from King County streams until it retreated north of the Strait of Juan de Fuca. Streams lengthened as relative sea level fell dramatically during the transition between APs 1 and 2, and then they shortened and decreased their gradients during APs 2 and 3 as sea level rose and generally stabilized by about 5,000 years ago. Shortly before that time, near the end of AP 3, the Osceola Mudflow dramatically changed much of the King County landscape and the configuration of the Duwamish, Green, and White River Valleys. Tectonic activity was the primary process of landscape change during APs 4 and 5, and probably had localized and temporary effects on specific salmon runs but to a much smaller extent than broad-scale sea level change and mass-wasting events that characterize the first three Analytic Periods.

Based on the sequence of these general processes, the GIS sensitivity model uses the same basic fishdist/River History composite data for APs 4 and 5, incorporating minor shoreline changes during AP 4. The polygons described above, their values, and multipliers based on number of species are used for APs 4 and 5, under the assumption that differential seasonal availability and salmonid abundance were similar, *at least on a relative scale*, extending back to about 5,000 years ago. For APs 1 to 3, availability of salmonids may not have been limited to the lower mainstem reaches of the rivers, but it is assumed that these were the most dependable portions of river systems to access this resource. The line data for all species in the lower reaches is buffered by 500 m and assigned a value of 1 without a species multiplier.

Marine Shellfish

Along with salmon, shellfish are perhaps the subsistence resource most commonly attributed to Northwest Coast Native Americans. Although this generalization has tended to marginalize the role of plants and terrestrial mammals in anthropological and archaeological discussions, access to shellfish beds would have been a major factor in settlement along the marine shoreline for at least the past several thousand years. As described earlier in the context document, many Puget Sound Tribal groups whose settlement at the time of Euroamerican contact centered on river valleys inland from the marine shoreline still harvested shellfish and maintained relationships with shoreline communities to facilitate such access. It is assumed in the King County model that shellfish comprised a critical subsistence resource during much of the annual subsistence round, and a peripheral but still important role during the rest of the seasonal cycle, especially during APs 4 and 5. Sensitive areas for marine shellfish are those shoreline landforms that provided access to shellfish beds, and they are ranked by estimates of productivity of the beds to which they gave access.

Modern distribution data are available for particular shellfish species and are informative to some extent, but their use in an archaeological sensitivity model that extends back in time from a point prior to commercial and recreational harvest of these resources would lend a false sense of precision to the model. King County GIS data sets include digitized distribution maps of modern economically important taxa such as hard-shell clams, abalone, Dungeness crab, oysters, and shrimp developed for a general survey by the State of Washington (Washington State Department of Fisheries 1992). Although not used for site sensitivity modeling, this reference and other modern biological survey reports (e.g., Dethier 2006; Goodwin and Pease 1987; Striplin Environmental Associates et al. 2001) may be of use for specific research regarding Native American shellfish utilization.

Dethier (2006) provides a general description of habitat preferences of important classes of marine invertebrates in Puget Sound, which in turn prompted the use of a general subtidal/intertidal zone for the King County site sensitivity GIS model instead of attempting to differentiate particular taxa in a spatial layer. The lower intertidal and uppermost subtidal zones are usually inundated, but extremely low tides offer the opportunity in some areas to access additional resources such as geoducks, sea urchins, octopi, and other invertebrates that prefer less tidal exposure. Littleneck and other hard-shell clams, oysters, geoducks, and crustaceans such as crabs prefer a range of intertidal to subtidal habitats, low- to moderate-energy beaches and in some cases estuaries, and substrates ranging from mud (geoducks and oysters) to sand and gravel (clams). Mussels and many gastropod species thrive in higher wave-energy environments on rocky shorelines, only some of which back wide sandy shorelines. This generalized beach zone along a particular stretch of King County shoreline is used in the GIS model as a proxy of shellfish productivity, however it is acknowledged that variability in substrate, salinity, wave energy, water temperature, and nutrient levels among particular beaches all play a role in conditioning the shellfish populations of those beaches. Estimates of relative productivity are important, however the places where shellfish beds may be easily accessed are those highlighted for archaeological site sensitivity as described below.

The marine shellfish access layer is derived primarily from bathymetry and shoreline spatial data combined to create an upper subtidal/intertidal zone that serves as a proxy for suitable marine shellfish productivity, and relatively level shoreline landforms adjacent to them that comprise the archaeologically sensitive polygons. Categories of relative shellfish productivity are estimated using the width of the upper subtidal/intertidal zone. In the King County GIS model, the beach zones serve as general proxies for the mosaic of shellfish microhabitats that extend along King County's marine shoreline, and is defined by the high (shown as shoreline) and low water delineations on nineteenth century T-sheet maps for AP 5. Modern, and probably more precise, tidal boundaries such as Mean Sea Level, Mean Higher High Water, and Extreme Low Water have been delineated by NOAA, but dredging, shoreline armoring, and other historic and modern coastal alterations limit their utility when modeling sensitivity for pre-contact archaeological resources. Despite its relative lack of precision, the zone defined on the T-sheets includes the back beach, the intertidal zone between mean high water and low water, and the upper subtidal zone that includes areas exposed during extreme low water.

A wide intertidal/upper subtidal zone is assumed to have greater average annual productivity and availability of shellfish. Width of this zone widely varies from Dash Point State Park in Federal Way at the south end of mainland King County to Richmond Beach in Shoreline at the north end, and around the entire perimeter of Vashon Island. For the most recent Analytic Periods, it ranges from just a few meters wide where steep bluffs back several headlands between Dash Point and Alki Point, to over 1,500 m in pre-fill Elliott Bay. Intertidal/upper subtidal width is classified in the GIS model as narrow (less than 50 m), moderate (50–150 m), and wide (greater than 150 m). These three categories are based on apparent natural inflection points in beach width along the King County marine shoreline. Narrow marine shellfish habitat zones are assigned a zero value. Moderate ones are assigned a value of 6, and wide zones are assigned a value of 8.

Values for particular productivity categories are applied to polygons comprising the shoreline landform buffered 200 m in width behind the intertidal, using the reconstructed shorelines for AP 5. As no data for high and low water exists for other Analytic Periods, only access to the intertidal area was mapped. For APs 1, 2, 3, and 4, areas within 40 feet (12 m) above (elevation) the marine shoreline with less than a 20 percent slope were given a value of 4 for AP 1–3 and 6 for AP 4. Slope and elevation was derived from modern 20-foot contour data and "bare-earth" LiDAR provided by King County. Therefore, only reconstructed shorelines that are at or above modern sea level, or are in areas that are no longer inundated were examined. For APs 2, 3, and 4, when sea level was thought to be lower than today, only previously inundated areas are mapped. AP 4 also includes the area around Lake Washington, which was likely saltwater or brackish during some part of the period. Topographic data for the entire marine shoreline is available for AP 1 as sea levels are thought to be much higher than today, therefore the whole marine shoreline was considered for that period.

Despite beach access zones that would have been available during AP 1–3, shellfish beds would not have been well established, and as a resource they are not modeled as having nearly the same importance in the subsistence round of the earliest human occupants of King County as AP 4 and AP 5 communities. Weighting of the marine shellfish variable is therefore lowered considerably in the earlier Analytic

Period based on the importance of shellfish relative to other resources hypothesized in the explanatory model in Chapter 7.

Other Marine Resources

Marine resources found in both the nearshore and open water environments were important components of the annual subsistence round during all five Analytic Periods, increasing somewhat in relative importance during the most recent Analytic Periods as modeled in Chapter 7. The GIS site sensitivity model defines this productivity variable on a very general scale and, similar to marine shellfish, operationalizes it in terms of beach access as opposed to biological distribution.

This variable represents access to a range of plant and animal resources found throughout Puget Sound and, at earlier times, incursions of marine water into portions of King County that presently host freshwater lakes and streams. The GIS model does not use modern biological distributions of populations such as sea mammals (Jeffries et al. 2000), benthic and pelagic non-anadromous marine fish (e.g., Miller and Borton 1980; Palsson 1990; Striplin Environmental Associates et al. 2001; Washington State Department of Fisheries 1992), or aquatic plants, because these data in most cases are conditioned by substantial historic alteration of the environment and the sampling strategies of wildlife and ecosystem management scientists. Most importantly, the likelihood of a terrestrial (and former terrestrial, but presently submerged) landform hosting archaeological resources situated to take advantage of marine resources would not be conditioned by the proximity and distribution of those resources nearly as much as the suitability of that landform for processing and possibly residential activities.

The marine resource variable conditions archaeological site sensitivity in the GIS model in terms of access between the uplands and the beach, where such resources are most easily processed and prepared for either consumption on or near the beach, or transport inland. A GIS layer comprising shoreline landforms backed by relatively low-gradient access points such as ravines and the margins of estuaries was created to define this zone during AP 5 using the same corrected pre-1900 shoreline shapefiles described above in conjunction with digital elevation model (DEM) data. In doing so, low-bank beach access points and shorelines in close proximity to ravines are highlighted, as well as the leading edge of the Duwamish delta. It is the shoreline landforms and not the access thoroughfares that are defined for their greater archaeological sensitivity. Because the variable is defined in very general terms, encompassing access points to sea mammal rookeries and haul-outs, areas of productive marine fishing, and collection of kelp and other aquatic plants, sensitivity is not differentially valued within this zone.

For AP 5, polygons were drawn between the mean high water line as shown on historic T-Sheets and the modern 20-foot contour. Slope and access routes were derived from modern elevation data including 20-foot contour line data and “bare-earth” LiDAR, and isometric contours shown on historic T-Sheets. For AP 4, a time where the basic configuration of shorelines is similar to AP 5, polygons were drawn between the reconstructed AP 4 shoreline and the modern 20-foot contour. As with AP 5, slope and access routes were derived from the DEM and LiDAR and isometric contours on T-Sheets. The marine resource polygons for AP 1–3 reflect the lack of precision involved in defining the local geomorphology of particular stretches of former shoreline. As no elevation data exists for time periods between 12,000 and 5000 cal BP, the full reconstructed shorelines for AP 1–3 were simply buffered by 100 m. A value of 6 is given to land within this access zone for AP 1–3 and a value of 10 for AP 4–5. In addition, the variable is weighted differently relative to other variables during each Period based on the explanatory model.

Ungulates

The availability of ungulates, most notably elk and deer, has conditioned the annual subsistence round of Native Americans to a varying extent as long as they have occupied the Puget Sound region, and therefore is assumed to play an important role in the distribution of archaeological sites across King County, especially in its eastern half where elevation and topography condition seasonal movement and aggregation of some ungulate species. Unlike marine resources, processing locations of ungulates and other terrestrial resources may coincide with harvesting locations, which makes the distribution of the resources more commensurate with the distribution of archaeological sites associated with them. Rendering the distribution of ungulates as a GIS layer, however, is problematic. As with the distributions of most biological populations that have been mapped in King County, the spatial limits of deer and elk as defined by wildlife biologists are biased by profound environmental changes and wildlife management policies of the past 150 years and an array of population sampling methodologies (e.g., Spencer 2002).

GIS layers for vegetation are used here instead as a proxy for suitable habitat, and are derived from previously developed vegetation reconstruction layers based on elevation and soils. Specific landforms are also used to highlight areas in which ungulates would have congregated, and therefore where human hunting activity would have been focused during at least certain times of the year. By extension, archaeological sensitivity of the broader area that provided forage for deer and elk is given a baseline value for archaeological sensitivity, and those landforms in which deer and elk hunting would be seasonally most profitable is given a greater value. The weighting of this variable relative to other productivity variables shifts from a dominant one in the earlier Analytic Periods to one more balanced with other resources such as salmonids and shellfish during the later Analytic Periods.

Elk often congregate as seasonally mobile herds, moving from the lowlands in the spring to high elevation vegetation zones in the summer, and back to lower elevations in the winter. Deer are mobile but usually do not congregate in herds in Western Washington. The overlapping distributions of elk and several subspecies of deer with different elevation and microhabitat preferences, combined with the lack of resolution to map open patches within closed canopy forests, precludes creation of a map of the fine-grained mosaic that was the reality of the Puget Lowland forests of the past 5,000 to 6,000 years. It is assumed here that although certain portions of the low- and mid-elevation closed-canopy maritime forest may have yielded better returns during hunting trips than others, the distribution within this broad vegetation zone would have shifted over time during natural forest succession and from anthropogenic fires that fostered deer habitat in many parts of the lowland forest.

For APs 4 and 5, low- and middle-elevation maritime forests and riparian woodlands in the marine and lowland physiographic zones are given a value of 2. In river valley bottoms draining the upland eastern half of King County, concentrations of elk herds during the winter yarding season and in subalpine meadows during warmer months would have made these areas seasonal foci of hunting activity and offered additional resources to procure during upland berry picking in the summer and late fall and winter steelhead fishing along the valleys of some tributary streams in the winter. The subalpine and silver fir/mountain blackberry vegetation zones and floodplains within upland physiographic zone are therefore given a value of 4. The Muckleshoot Prairie is a well-defined woodland-prairie mosaic hypothesized as having been managed in part for suitable deer habitat since its formation atop the Osceola mudflow deposited here about 5,600 years ago. This area is given a value of 4.

Values for ungulate resources are adjusted in the GIS model during the first three Analytic Periods based on major changes in climate and vegetation from the time of glacial retreat near the end of the

Pleistocene to the closing of the forest canopy across the Puget Lowlands between 5,000 and 6,000 years ago, as described in Chapter 2. The lowland and riparian forests that extended from the reconstructed marine shoreline inland to the lower elevations of most major montane river tributaries during AP 1 expanded to their greatest horizontal and vertical extent in AP 2, and then contracted somewhat during AP 3 prior to widespread closing of the forest canopy. This forest has been characterized as open mosaic parkland of lodgepole pine with a gradual increase in Douglas-fir and, later, western redcedar. Until the canopy closed, this kind of forest cover would have provided good habitat for deer and may also have limited the transhumant behavior seen in elk herds today. Riparian forests presumably had denser understory and more canopy than the forests covering the formerly glaciated terrain that they dissected, and therefore are given a value of 2 for APs 1, 2, and 3. The open mosaic forests that extended across almost all of the drift lowlands and, especially in AP 2, the lower flanks of the Cascade Range, are given a value of 4 during these three Analytic Periods.

Freshwater Shellfish

Freshwater molluscs were not a critical subsistence resource conditioning pre-contact Native American settlement in King County as were their marine counterparts. Instances in the archaeological record of King County demonstrate their use (e.g., Younger 1993), however, and the explanatory model described in Chapter 7 hypothesizes an important seasonal role for freshwater mussels when their preferred habitat—interior lowland streams with moderate gradients (Stock 1996; Toy 1998)—is used for other subsistence pursuits as well such as fishing and hunting. Therefore the spatial distribution of freshwater mussels is given some weight, albeit secondary to other subsistence resources.

Spatial data for freshwater mussels are limited compared with other species more rigorously explored during biological surveys, but exist as observation points in numerous streams in the central King County lowlands. Combined with knowledge of the general stream parameters coinciding with thriving freshwater mussel habitat, the existing spatial data are used to model stream segments with potential freshwater mussel habitat during the most recent Analytic Period. A database of field observations of freshwater western pearlshell and Oregon floater compiled by the USFWS gives about 30 points of observation in King County on streams limited to the west and central interior lowlands, with the exception of two observations along the eastern shores of Lake Washington. The stream systems to which these segments belong are assumed to have had suitable river histories, including flow regimes, substrate deposition, and juvenile host fish habitat (see Chapter 2) to promote freshwater mussel populations. A range of preferred stream gradients is not explicitly estimated by freshwater shellfish biologists, therefore the range of gradients included in the data points is used in this GIS sensitivity model to define freshwater mussel habitat zones within the stream systems known to host them. It is acknowledged that this definition is speculative, but it is necessary until a more thorough understanding of local and regional freshwater mussel biology and biogeography is attained.

A habitat layer was established by first selecting the hydrological basins in the King County hydrobasin layer that contain USFWS observation points. The elevation of the observation points was established using a DEM, and range from 5 to 162 m above sea level (asl); the watercourses that fell with the selected hydrological basins were then clipped by this elevation range. The resulting watercourses were then limited to only those with the same "level" (somewhat analogous to stream order, and defined by the King County wtcrs layer) as those with observation points and in the selected basin and elevation range. The basins include Bear Creek, Cherry Creek, Covington Creek, Evans Creek, Griffen Creek, Jenkins Creek, Lower Cedar River, Lower Tolt River, Middle Green River, North Creek, Sammamish River, Snoqualmie River, and Soos Creek. The applicable portions of these watercourses were given 100-m buffers and the resulting polygon given a value of 1. The whole Sammamish River and Snoqualmie River

Valleys, buffered by 100 m, were included due to the extensive channelization either of the river itself or tributary watercourses, and the polygons also given a value of 1. A lack of precision must again be recognized in the definition of this near-stream zone for this first iteration of the GIS model. Similar to the salmonid productivity variable, this particular zone can be refined in the future, perhaps having its outer boundary follow terraces, valley bottom edges, or other landforms instead of the arbitrary and constant distance from the stream used in most cases here.

Estimations of freshwater mussel habitat are not extended back in time before AP 5. This is in part because our understanding of their modern population dynamics has only recently begun. Also, the role of a subsistence resource requiring a substantial expenditure of energy for limited nutritional returns relative to other resources within and outside this particular environmental zone is hypothesized in the explanatory model to be much less important during periods with less territorial circumscription and easier access throughout the annual cycle to larger-bodied terrestrial mammals, as was the case during APs 1–3. During AP 4 other resources such as salmonids and certain plants would have been made more profitable with technological innovations and reorganization of labor, and became more prominent in the diet. Freshwater shellfish, similar to marine shellfish in a chronological framework but with less magnitude in the GIS model, were probably utilized regularly by AP 4 but are not modeled as a variable conditioning archaeological site sensitivity prior to AP 5.

Birds

Birds, more than any other major vertebrate category of subsistence resources in King County, are not particularly amenable to fine-grained estimations of past biogeography and straightforward linkage to archaeological site sensitivity through space and time. Their consistent place in the local and regional ethnographic literature, however, and their ubiquity even in small numbers in many important archaeological faunal assemblages from the Puget Lowlands mean they should at least be considered. Basic habitat preference and areas of flocking would attract human activity, and by extension inform us to some extent of archaeological site sensitivity.

Estuaries, saltwater marshes, the margins of lakes and river valley bottoms are considered broadly defined but reliable areas in which birds, especially waterfowl, might be encountered, harvested, and either processed or transported directly to occupation sites. This habitat layer was only developed for APs 4 and 5 because little is known about the development and location of saltwater marshes, perhaps the most critical kind of waterfowl habitat area, during earlier periods. Polygons were created for 50-m buffers around large estuaries and saltwater marshes along the corrected marine shoreline as shown on historic T-Sheets, valley bottoms of large rivers, and 50-m buffers around the margins of lakes. Only lakes below 460 m (1,500 feet) in elevation were included, as higher-elevation lakes would not support sufficient waterfowl biomass to attract specific harvesting efforts (Dr. Todd Haas, personal communication, June 2010).

Also included in this layer are several isthmuses either ethnographically known or speculated to have been flyover areas for aquatic birds and waterfowl that could be readily netted as aggregate flocks. The most well-known have been mapped and include the Portage area between Vashon and Maury Island and the Interbay area between Seattle’s Magnolia and Queen Anne neighborhoods. These areas are given values of 1. The flyover areas are not estimated prior to AP 5.

Huckleberries

Numerous plant species that provided berries, primarily during the summer, were widely dispersed across almost all of the lowlands and much of the uplands of King County in the past. Of these plants, the various kinds of huckleberry were the most important to Native American communities based on oral testimony and other documents from the ethnographic period in the Puget Sound region. Given their importance and spatial aggregation, especially compared with other kinds of berries and most other plant resources in general, polygons using proxy data are used in the GIS model to add weight to archaeological site sensitivity in the vicinity of vegetation zones that fostered huckleberry habitat. The silver fir vegetation zone is considered a general proxy for huckleberry and mountain/dwarf blackberry habitats in King County. This proxy layer is derived from a previously-developed layer that reconstructs broad vegetation/habitat zones for King County based on elevation and soil types. Areas within these upland polygons are given a value of 8. This vegetation zone was established by about 5,000 years ago as lowland forest canopy closed and the mosaic of higher elevation plant communities developed. Therefore, this variable is considered only for APs 4 and 5.

Wetland Plant Resources

Because slackwater environments and permanent wetlands comprise the general habitat preference for wapato and other plant resources, these areas are given some added weight for archaeological site sensitivity in the GIS model. Historically constructed wetlands were excluded from the layer by using histic soils as a proxy for wetlands. Soil map units were derived from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service soil survey database downloaded from the Soil Data Mart. For those areas mapped as Urban Land, largely within the City of Seattle, legacy soil series from the 1938 soil survey of King County (Poulson et al. 1952) and soil types from the 1909 Pacific Region soil reconnaissance (Lapham 1913) soil surveys were used. Modern histic soils include Borohemists, Mukilteo Peat, Orcas Muck, Seattle Muck, Shalcar Muck, and Tukwila Muck (Snyder et al. 1973). Historic histic soil types are those labeled “peat” or “muck” in the 1909 reconnaissance (Table 8-2), and were mapped as the Rifle Peat, Mukilteo Peat, Greenwood Peat, and Carbondale Muck soil series during the 1938 soil survey (Table 8-3).

Table 8-2. Soils Mapped in King County during the 1909 Soil Reconnaissance (Lapham 1913)

Soil Province	Series name	Soil type
Glacial material	Everett	gravelly loamy sand[a,b]
		coarse sand
		loamy sand[a]
		sandy loam
		stony sandy loam
		gravelly sandy loam[a]
		fine sandy loam
		loam
		stony loam
		silt loam
River Flood Plain	Puget	fine sandy loam[a]
		silt loam[a]
		silt clay loam
		silty clay
Miscellaneous		Muck and Peat[a]
		Tidal marsh[a]

[a] Mapped in King County.
[b] The map unit is keyed in the legend as the combined series name and soil type: thus, “Everett gravelly loamy sand.”

Table 8-3. Portion of the 1938 Soil Classification Hierarchy for Soils Mapped in King County (Baldwin et al. 1938; Poulson et al. 1952)

Great Soil Group (Level IV[a])	Family (Level III)	Series (Level II)
Zonal soils	Brown Podzolic	Alderwood Barneston Cathcart Everett Indianola Kitsap Lynden Oso Stossel
	Podzols	Greenwater Klaus Ragnar Snoqualmie Tokul Prairie Enumclaw Salal
Intrazonal soils	Weisenboden[b]	Bellingham Norma
	Weisenbodenlike	Buckley Issaquah Sammamish
	Bog	Carbondale muck Greenwood peat Mukilteo peat Rifle peat
	Half Bog	Snohomish Woodinville
Azonal soils	Alluvial (well- to moderately-well- drained)	Edgewick Nooksack Pilchuck Puyallup Sultan
	Alluvial (poorly drained)	Puget

[a] Level in classification hierarchy; Level I are series phases such as relief and stoniness.
[b] Translated as “Humic-Gley.”

The 1909 and 1938 soil types and soil series listed above are used “as is” because the United States soil classifications have experienced substantial revisions since the late nineteenth and early twentieth centuries. For this reason, underlying pedological concepts, soil series definitions, and map unit legends characterizing the various systems are not simply translated from one classification to another. For example, the 1935 and 1938 systems represented substantial changes in the United States soil classification scheme from the earlier system codified in 1913 by Marbut et al.: “The [1935] system was a radical departure from that of 1913, both in outline and in underlying concepts. First, soil was conceived as a genetic body, in contrast to geologic concepts of 1913” (Cline 1979:3). A second important concept introduced into the 1938 system was the idea of the “modal” or “normal” soil profile, which was meant to represent an equilibrium stage in the development of the soil horizon profile, and is still retained in attenuated form in the U.S. Soil Taxonomy as the “typic pedon” of the official series descriptions. Most prominent, however, was the move away from the three-tiered system of 1913 and its replacement with a six-tiered system (Cline 1979:3–4). At the highest level of the 1927 version of the new classification devised by Marbut, the earlier concept of "soil province" had been rejected and replaced with the categories "Pedalfer" and "Pedocal" (Cline 1979:9). By the 1938 classification, however, pedalfers and pedocals at the great soil group level were replaced, and the pedalfer and pedocal categories were relegated to the family level in the hierarchy (Baldwin et al. 1938). In any case, by the mid- to late-1930s it is clear the soil classification system was heading more in the direction of Dokuchaev in 1883 (see Bockheim et al. 2014; Hole and Campbell 1985) and Coffey (1912) in placing less emphasis on geology and giving more prominence to the modern concept of soil as a natural entity in its own right (Simonson 1986).

The soil series were buffered 50 m on either side of their map boundaries (100 m total) and given a value of 4. Because slackwater environments constantly evolve as river and stream channels migrate and avulse, and create oxbow lakes and fill former channels over time, the entire floodplains of the larger river systems are included in the wetland resource polygons. Values for the polygons are 2. The resulting polygons were clipped by the reconstructed shoreline for each Analytic Period. Only the margins of estimated wetlands are considered during APs 1–3.

Prairie Habitats

As described in Chapters 2 and 3, anthropogenic prairies played an economic role in most every Native American community in the Puget Lowlands around the time of Euroamerican contact. Although not as extensive as the oak prairies extending south of Puget Sound, two notable areas within King County provided grassland vegetation and acorn-bearing oak trees. The first of these areas includes the Muckleshoot Prairie on the Enumclaw Plateau and the Meridian Prairie on the glacial drift plain adjacent to the north. The second area is the vicinity of Sallal Prairie above Snoqualmie Falls southeast of North Bend. These extensive openings in the lowland forest canopy also fostered camas habitat where drainage was poor and seasonally saturated with water. The prairies and their ecotonal boundaries with the surrounding woodlands also attracted both browsing and grazing ungulates and, by extension, people. The prairies are places containing a suite of resources that structured human activity, and therefore also played a substantial role in structuring the distribution of archaeological resources in King County.

For the GIS sensitivity model, proxy data based on mapped soil series from the USDA Natural Resources Conservation Service soil database are used to define prairie areas. The Muckleshoot Prairie is underlain by the "Buckley silt loam" mapping unit. Soils belonging to the Buckley series are underlain by Osceola Mudflow deposits and developed under restricted or poor drainage (Poulson et al. 1952:102). The Muckleshoot Prairie is considered for APs 4 and 5 in the GIS model, the time following the Osceola mudflow when the complex of prairie vegetation colonized much of the Enumclaw Plateau and was maintained by humans. The soil map units "Everett gravelly sandy loam 0–5 percent slope" and "Barneston gravelly coarse sandy loam 0–6 percent slope" include the Meridian Prairie vicinity. Soils belonging to the Everett and Barneston series have formed in droughty, excessively well-drained substrates similar to conditions on glacial outwash in Pierce and Thurston Counties to the south. Sallal Prairie is represented by the soil mapping unit "Barneston gravelly sandy loam windswept 6–30 percent slope" soil series phase. Values for the Prairie Habitat polygons are 8 and limited to AP 4 and AP 5.

Initial prairie formation on the excessively drained gravelly substrates of the Everett and Barneston series in King County outside of the Enumclaw Plateau likely occurred during the early Holocene, but the persistence of these prairies through the onset of more mesic conditions starting in the mid-Holocene is probably due to human-induced firing of the prairie areas (for example, see Norton 1979; Tveten and

Fonda 1999; Ugolini and Schlichte 1973). Given the limiting date of about 5600 cal BP for the Osceola Mudflow, a major lahar event on the Plateau, other prairies presumably would have developed some time after modern vegetation communities stabilized in the region after about 6,000 years ago. The prairie habitat variable is therefore only considered during APs 4 and 5 and the boundaries based on soil data are assumed to hold relatively constant during this time. Even though the boundary between grassland and woodland would certainly have shifted as climatic conditions and human interactions with the prairies fluctuated over the past 5,000 years, these soil map units are considered to capture the maximum extent of the prairies. It is assumed that the range of human activity and distribution of archaeological material within these two broad time periods is commensurate with the equally broad spatial definition of the prairies. Also noteworthy is the distribution of Everett and Barneston gravelly sandy loam soil phases outside of historically documented prairies. Unlike Buckley silt loam that closely corresponds with the Muckleshoot Prairie, and the Barneston windswept gravelly sandy loam confined to the vicinity of Sallal Prairie, these other soil types are found outside of historic and modern prairie limits on level landforms east of Black Diamond and in small patches of the lowlands between the mainstem Snoqualmie River and Puget Sound, as well as a small portion of Vashon Island. Future paleoenvironmental research will hopefully provide evidence indicating whether or not vegetation associations in these other areas are consistent with their soils data.

Lithic Source Material

Besides fresh water, lithic raw material is the only non-biological productivity variable considered in the GIS model. The category of mineral resources may be conceptualized very broadly, encompassing a wide range of stone for chipped and ground stone tools, and other material such as ochre and quartz crystal. Human activity in the vicinity of areas with easily accessible lithic raw material conditions the sensitivity of these areas for archaeological sites, primarily quarrying locations. Delineating the spatial distribution of these resources is difficult, however, and the GIS model creates very general polygons from known, bedrock outcrops as mapped by the USDA soil survey that have the potential to contain volcanic, metamorphic, and (to a lesser extent) sedimentary rock preferred as toolstone, primarily limited to upland areas within King County. These polygons are given a value of 2. Cobbles of suitable toolstone are also found in exposures of well-sorted glacial deposits and streambeds, and are often more easily obtainable than nodules and tabular outcrops found in the uplands. These exposures, however, are difficult to consistently map at a county-wide scale and therefore are not included in the GIS sensitivity model.

Mobility Variables

Thoroughfares

Terraces, navigable streams, upland ridgelines, shorelines, and mountain passes are all transportation corridors along which past human activity is expected, and consequently greater archaeological sensitivity is estimated in these areas. They are defined using landform and basic elevation data to create GIS polygons, corrected for paleoshorelines and major paleochannel shifts between the Analytic Periods. Relatively level and low-gradient portions of these landforms were defined as polygons from rasterized LiDAR data. Low-gradient valley bottoms and floodplains; ridgelines providing access to major valleys, saddles, or other ridges; lake and marine shorelines; relatively level terraces; and saddles and passes that connect two or more ridges or river basins were defined this way. Local changes in landform availability, most notably during AP 1, must be considered by users of the model independent of the GIS data when examining archaeological sensitivity along thoroughfares. The extent of alpine glaciation near the end of the Pleistocene, for example, has not been mapped in eastern King County, but would limit the influence of this variable on upland ridges during AP 1.

This layer highlights landforms conducive to travel on foot or by boat and canoe. It includes all areas under 30 percent slope in lowlands (below 460 m [1,500 feet] elevation) and small sections of 30 to 50 percent slope above 460 m that trace ridgelines. Most valley bottoms, terraces, marine littoral and freshwater lake shorelines, and ridgelines along upland hills and mountains between passes are given an archaeological sensitivity value of 1 as transportation corridors. Passes and saddles in the upland areas funnel more human movement and concentrate activity in their vicinity, and are therefore given a sensitivity value of 2. Major ridgelines and valleys that connect the Cascade Crest with the Puget Lowlands are also given a value of 2. Areas that connect fresh water to salt water or one river to another are given a value of 2. Lowland valleys are not included for APs 1, 2, and 3 as floodplains and valleys had not reached the current stage of development in these periods.

Intersections

Proximity to the confluences of streams is also considered a mobility variable. Access to multiple river basins and sub-basins is possible from these junctions, and therefore such features are advantageous for logistical residence sites. Confluence polygons include all river valley landforms, including the floodplains and terraces, within 500 m of the intersection of major salmonid-bearing streams as defined by the fishdist (WDFW) layer. Stream confluences are given values of 2 in lowland settings (below 460 m [1,500 feet] asl) and 1 in upland settings under the intersection variable. This data was only developed for APs 4 and 5.

THE PRESERVATION AXIS

Preservation variables are dictated by landform mapping that indicates whether a landform surface is eroding, stable, or accreting. These variables have implications for whether or not a particular modern landform would retain archaeological material, and if so, how old the material might be and if it might be buried below the modern ground surface. This framework is independent of the archaeological sensitivity of a place as defined in the previous section. The most critical attribute regarding preservation of a deposit (archaeological or otherwise) on the modern landscape is whether the landform in question is undergoing erosion, accretion, or maintaining depositional stability. The preservation axis developed here uses this three-value attribute as the basis for a simple model, easily rendered as a separate GIS layer that can be used in conjunction with the sensitivity layer to examine the potential for archaeological resources to be present at any one place on the King County Landscape. Two other landform attributes are also informative—landform age, and whether or not the landform is well-expressed on the modern landscape. Information about these secondary variables for a particular place in King County is given in the metadata of the GIS model.

Landforms, Preservation, and Age

The role of geomorphology and soils in geoarchaeological studies is to provide a context for interpreting and determining the spatial relevance of artifacts at multiple scales (Butzer 1982; Holliday et al. 1993). Geomorphic mapping is one tool for guiding interpretation of the archaeological record in a region as the landscape changes through time (Wells 2001). Since the character of the archaeological record represents not only behavioral patterns, but also transformations occurring since time of deposition, there is a need to understand the formation and subsequent alteration of deposits in archaeological contexts before behavior can be understood (Davidson and Shackley 1976; Schiffer 1987; Shackley 1975; Stein 2001).

As discussed in Chapter 2, the King County landscape has been shaped by geomorphological and pedological processes conditioned by the latest Pleistocene glacial cycle of advance and retreat during the Fraser glaciation. This glacial cycle has played a major role in controlling large-scale sedimentary architecture throughout the Puget Sound basin, and each stage of the glacial cycle left distinctive suites of landforms and sediments exhibiting an orderly spatial organization. The goal of the landform mapping component was to develop a classification system that connected the geomorphic patterning to the archaeological record in the County. The classification system described in this section is intended to assist management of the County's archaeological resources, and to serve as a springboard for future research.

Landforms were mapped on the basis of morphology, position, inferred genesis, and relative age, and were digitized on-screen in a GIS environment with interpretations done as mapping progressed. The mapping utilized several image backdrops. A DEM derived from LiDAR was used to generate three background images: a northwest-illuminated gray hillshade image, a color slope model in which hue corresponded to four local slope classes (0%–6%, 6%–15%, 15%–30%, and slopes greater than 30%), and a contour elevation model with 20-foot and 100-foot intervals. Other background images used in conjunction with the mapping included a county-wide surface geology map, soils maps of King County, and county-digitized shapefiles containing watercourses and water body distributions. Because of the limited spatial context viewed during on-screen digitizing, aerial images from Google Earth™ were also displayed on a second screen to provide larger spatial contexts, and were used to edit newly digitized landform polygons at the end of a mapping session.

The landform mapping initially used a deductive approach employing the land type classification in the Natural Resources Conservation Service's *Geomorphic Description System* (Schoeneberger and Wysocki 2008). The motivation for this approach was to maintain conformity with previous landform mapping efforts in the region (Dorsch et al. 2008; Riedel 2006), and thus produce landform data comparable to geomorphic research in adjacent regions for purposes of understanding the relationship between formation of the archaeological record and landscape history throughout the region. During the early stages of landform mapping, however, a preliminary geomorphic map of Kitsap County was published (Haugerud 2009), and after discussion with the author (Personal communication from Haugerud to Hodges, April 2009), the deductive approach was discarded in favor of an inductive approach more narrowly focused on the specific landscape history of King County. This method was based on the observed distributions of landforms derived from morphology, spatial position, and surface geology. Because King County is adequately mapped in terms of bedrock and surface geology, and the general chronologic sequence of glacial events is understood at least in broad terms, the approach worked well. With minor modifications reflecting archaeological interests, the resulting landform map is also consistent with the Kitsap County geomorphic map (Haugerud 2009). The landform classification was thus able to incorporate morphogenetic and morphochronologic information on the origin and development of landforms, as well as distinguish, at the broad scale, landforms based on time of initiation.

Table 2-1 in Chapter 2 presented the two-part hierarchical landform classification system in which the upper, more general, level represents groups of landforms, called landsystems, that either were formed in similar environments of deposition, or originated during the same time period; the lower level in the classification are individual landforms. The landsystems, coded in Appendix B, generally represent stages of the glacial cycle in the county (full glacial, recessional or proglacial, and postglacial), as well as environments of deposition. For example, the drift uplands landsystem (**du**) represents the ice sheet bed during the maximum extent of the Cordilleran Ice Sheet in the Puget Lowland portion of the county.

The landforms were mapped and coded on the basis of morphologic expression without express regard for landsystem membership, though types of landforms tend to cluster depending on geographic position (Appendix B, Table B-3). For example, in the lowland portion of the County, Holocene erosional channels (large ravines or gullies; coded as **ch**) tended to be restricted to the margins of the fluted glacial till surface (**gf**) in the drift uplands landsystem. Landforms representing locations of sediment accumulation at the bases of slopes (footslopes; coded as **sf**) were predominant in low-order basins in the mountains landsystem. Although footslopes in the mountains tended to show smooth, gradual basal transitions to the valley alluvial fill, similar diffusion slopes in the lowlands often exhibited weak surface erosion (**se**), with distinct, small, coalescent alluvial fans in footslope and toeslope positions.

Certain landforms, for example the fluted glaciated surfaces (**gf**) and recessional glacial drainage systems (**gd**), include sub-features which were not mapped separately. The fluted glacial surfaces express a regular pattern of parallel troughs and ridges representing ice movement along the ice-sheet bed. This landform occupies a significant portion of northern King County, and is a stable surface that has been exposed since glacial retreat. Although there is potential that portions of an early Holocene archaeological record are present on this surface, particularly around wetlands in the troughs, the landform was defined so as to preserve surficial continuity that reflected the overall age and stability of the landform rather than the distribution of individual, discrete sub-features. The glacial drainage systems dominant in the lowlands in the southern portion of the county are treated in a similar fashion, though exceptions were made in cases where ice-contact features or well-defined paleoterraces high on the drainage walls were preserved and readily discernible. The justification for this generalization is that these landforms are contiguous, represent a specific period of formation, have been relatively stable since their time of formation, and retain high potential for containing early Holocene archaeological materials within their limits.

Landform and Preservation Attributes

Each landform type was evaluated with regard to potential for buried archaeological materials. For each landform, besides the landsystem in which it occurs, three types of information were recorded regarding 1) erosional status, 2) age, and 3) reliability. Reliability refers to the confidence the mapper felt in delineating the landform based on the underlying background images and Google Earth™. For example, as to the first two types of information, an alluvial fan is an aggradational landform, and is typically coded as stable because it is undergoing net accumulation of sediments, and therefore has potential to contain buried surfaces. Fans are postglacial features, but because little is known about fan constructional histories in the county, fans are assigned an age range that encompasses the Holocene. For another example, the fluted glaciated surface is stable and experiencing little to no erosion or deposition. Because it formed under the ice sheet and has persisted through the Holocene, it is assigned an age beginning during the full glacial period.

Table 8-4 lists the preservation attributes and their values for each mapped landform in King County. Only the erosional status is used to create the preservation GIS layer because this attribute has the most direct bearing on management recommendations, and whether or not an archaeological survey on a particular landform would need to rely on relatively deep (e.g., greater than 1 m) subsurface exploration to be able to identify potential artifact-bearing deposits. Age and reliability provide important supporting information that is useful in contextualizing the landform in question, and are accessible in the GIS metadata.

Table 8-4. Attributes Assigned to Landform Types

Attribute	Code	Description
Erosional Status	e	Erosional landform.
	a	Aggradational or place of sediment accumulation and storage.
	S	Stable – little or no erosion or sediment accumulation.
Age	geo	Geological – bedrock outcrops.
	g	Full glacial – maximum extent of ice sheet.
	lph	Late Pleistocene-Holocene transition (recessional).
	h	Holocene
	m	Modern
Reliability	1	Confident – feature well expressed.
	2	Less confident – feature obscured by Holocene reworking or modern land use.

Finally, the default scale of the classification is for use at 1:24,000, though some landforms were digitized at scales between 1:12,000 and 1:15,000. Even so, some aspects of the interaction between landform and process have been generalized or simplified, and archaeologically significant details of landscape complexity at large map scales is sacrificed. In particular, details of the range of processes responsible for the formation of some landforms have not been determined at this stage of model development, and refinements to understanding landscape change will depend on the results of future research in the County

TESTING THE MODEL

The primary means of evaluating the effectiveness of GIS sensitivity models is comparing the distribution of sensitivity zones generated by the model with the distribution of existing archaeological data and new data sets as they are generated. Because the King County sensitivity model was not generated using the existing archaeological data set, it may be used to test the model without the risk of circularity inherent in correlative GIS models. A less straightforward aspect of testing this model is establishing acceptable thresholds when asking the question, “how effective is this model for estimating site sensitivity?” and, “what is the best way to divide the sensitivity gradient into meaningful units for management recommendations?”

Ideally, site locations used to test a model will all fall into areas defined as “high sensitivity” that are relatively small. This gives the model both accuracy (the proportion of sites falling within the high sensitivity category) and precision (having that target category be as spatially limited as possible). Precision can be sacrificed for accuracy, but then a relatively large proportion of King County would be categorized as highly sensitive for archaeological resources, thereby limiting the utility and meaningfulness of the model. The *gain* measurement takes equally into account both the accuracy and precision of a predictive model (Kvamme 1988; Verhagen 2007:93–94).

Gain (G) is calculated as

$$G = 1 - \frac{p_a}{p_s}$$

where p_a is the proportion of the area of interest (in this case, the proportion of high, medium, and/or low sensitivity zones in King County), and p_s is the proportion of archaeological sites found within that area or areas of interest. Sites that include more than one sensitivity zone were counted for each zone. Potential values can range asymptotically between 1 to -100, where values close to 1 indicate that the zone includes most of the sites used for testing yet minimizes area compared with the other zones. Values in the other direction, especially those of negative value, indicate a relatively large area encompassing little or none of the site database. Positive gain values for high and combined high/medium sensitivity zones, and low or negative values for low and low/medium sensitivity zones, may therefore indicate that the model has a combination of accuracy and precision that would make it useful as a management tool for the county. Perhaps more important than absolute measures of the model's utility, the gain values for the different zones and zone combinations can be used as a yardstick as new data are added in the future.

The proportions of King County included in the high, medium, and low sensitivity categories (p_a) were calculated in a relatively straightforward manner from the GIS model, however the proportions of sites within each of those zones (p_s) is dependent upon the subset included in the testing data set, which includes most King County archaeological sites inventoried in the DAHP database. Site databases from the HPP and Burke Museum were not used for this test given the inconsistency in the accuracy and precision of their mapped locations. In addition, some of the sites in the DAHP database were not included when it was clear that location mapped in that database was not an accurate portrayal based on site form or report narratives. Examples of these include the Ft. Lawton surface collection (45KI1) and the Elliott Bay Petroglyph (45KI39). Other sites with adequate location information are not included in the testing because of environmental data gaps, such as those in the vicinity of Chester Morse Lake. In that instance, the available GIS salmon distribution layers for the upper Cedar River inadequately characterize pre-contact availability along this portion of the valley. The Chester Morse Lake archaeological data set is an invaluable part of the King County record and should be included in future testing efforts when the environmental data is comparable with those of the other upper basins, such as the vicinity of the Howard Hansen Reservoir.

Five different iterations of high, medium, and low sensitivity divisions along the composite (AP 1–5) sensitivity gradient were compared to determine a framework that finds a balance between incorporating the greatest proportion of sites within a high sensitivity zone while minimizing the number of sites within a low sensitivity zone. In all, 291 sites were used to test the model. However, the gain measurements for each iteration used a slightly different number of site occurrences that varied as the boundaries between the three sensitivity zones changed. One site might be considered two or three site occurrences if its boundary overlaps more than one sensitivity zone, depending on the zone iteration. Therefore, the number of site occurrences used to calculate the proportion of sites that fall into a particular zone (p_s) varied between 355 and 388 depending upon the where each iteration drew boundaries between high, medium, and low sensitivity areas.

Table 8-5 shows the percent of total area; percent of total site occurrences; and gain values for high, medium, low, and combination sensitivity zones for each iteration of zone divisions. The starting point for this examination was creating a first iteration of these divisions based on the Jenks natural breaks classification method available through the GIS modeling platform, the results of which are shown on the first row of Table 8-5. Additional iterations were made by adjusting the boundary between high and medium zones 0.2 on the composite model sensitivity gradient at each of four steps (Steps 1–4).

Table 8-5. Gain Function Values

Model Iteration	High % Area	Med % Area	Low % Area	High % of Sites	Med. % of Sites	Low % of Sites	High Gain	Med. Gain	Low Gain	High/Med. Gain	Med./Low Gain
Jenks	0.056	0.560	0.384	0.285	0.541	0.174	0.80	-0.03	-1.20	0.25	-0.32
Step 1	0.065	0.551	0.384	0.338	0.495	0.167	0.81	-0.11	-1.29	0.26	-0.41
Step 2	0.088	0.528	0.384	0.421	0.418	0.161	0.79	-0.26	-1.39	0.27	-0.58
Step 3	0.128	0.488	0.384	0.487	0.353	0.160	0.74	-0.38	-1.40	0.27	-0.70
Step 4	0.245	0.371	0.385	0.603	0.235	0.162	0.59	-0.58	-1.36	0.26	-0.90

In the Jenks iteration, the high sensitivity area is minimized, but a greater proportion of known sites consequently fall within the medium and low sensitivity areas. Increasing the proportion of King County classified as high sensitivity captures a larger proportion of sites, but the gain value for this zone only increases in the first iteration, Step 1, from 0.80 to 0.81. With further iterations away from the Jenks configuration, the gain value for the high sensitivity area decreases as its size grows to a point where accuracy (getting as many known sites as possible within the high sensitivity zone) overtakes precision (limiting the area designated as high sensitivity) and the model loses power. At the other end of the spectrum, gain values for the low sensitivity zone decrease from the Jenks configuration through Step 3, but then increase slightly in Step 4. The biggest decrease, considered to be an improvement in this specific aspect of the model, is between Steps 1 and 2, with only a very small improvement from Step 2 to Step 3. When separately considering the three zones, Step 1 provides the best gain value for the high sensitivity zone, and Steps 2 and 3 the best gain values for the low sensitivity zone.

Verhagen (2007:135) notes that the use of a medium sensitivity zone adds to the difficulty of assessing the effectiveness of the high sensitivity zone at maximizing the proportion of sites and minimizing its area, and the effectiveness of the low sensitivity zone in performing in the opposite fashion. Gain values for combined high/medium and medium/low zones are also shown in Table 8-5. Combining the medium and low sensitivity zones allows assessment of high sensitivity zone in isolation. Separating the high sensitivity category and combining the medium and low sensitivity categories results in coverages ranging from about 6 percent and 94 percent, respectively, in the Jenks iteration, to about 25 percent and 75 percent in the Step 4 iteration. Using these calculations, the gain of the medium/low category ranges from -0.32 (Jenks) to -0.90 (Step 4), with the biggest improvements between Steps 1 and 2, and Steps 3 and 4.

Conversely, the medium sensitivity zone can be combined with the high sensitivity zone to increase accuracy, but at the expense of precision and overall model gain. The area covered by the combined high and medium zones is about 62 percent in all iterations, and encompasses between 82 and 84 percent of the site occurrences. Consequently, the gain values do not change substantially between iterations—a maximum of 0.27 in Steps 2 and 3, and a minimum of 0.25 in the Jenks iteration.

The results of gain testing the different iterations of sensitivity zone definitions suggest that Step 2 provides the best balance between a precise and accurate high sensitivity zone and a minimized risk of sites falling within the low sensitivity zone. Figure 8-7 shows the sensitivity model run at the county-wide scale, using the Step 2 divisions to define sensitivity zones.

The testing results reflect the challenge of creating a model that is both precise and accurate for King County. Under the Step 2 iteration, 162 of the 291 sites, or about 56 percent, fall within the high sensitivity zone. Combining the high and medium zones, 229 of the 291 sites (77 percent) fall within this area. The combined area encompasses about 62 percent of the land area of King County, however, which impacts the precision of the model. An increase in the precision of the model may entail decreasing the size of the high sensitivity zone, but at the expense of accuracy, and vice versa. The primary consequence of defining an area of low archaeological site sensitivity from a cultural resource management perspective is that this area is more likely to go unassessed or under-assessed for archaeological material prior to development projects. The focus of this model as a county-wide management tool should therefore be on finding balance between accuracy and precision, and take advantage of additional site data for future testing and refinement of the model.

Implementing the Model

The resulting layers created for the GIS model provide gradational estimates of archaeological sensitivity for each 30-square-meter cell in King County. These numerical scores are aggregated into broader sensitivity categories to facilitate practical use of the model in cultural resource management contexts. Maps generated for sensitivity during each Analytic Period provide sensitivity values along a continuous scale between 0 and about 5.5. County-wide rendering of the GIS-based maps are shown in Figures 8-2 to 8-6. Figure 8-7 is a synthetic map of overall archaeological site sensitivity that combines data from the five Analytic Periods and aggregates sensitivity values into a three ordinal-scale categories. This simplification allows the King County HPP to provide clear management directives in terms of level of effort for archaeological surveys of a particular place on the landscape. The HPP will determine the implications for each sensitivity category within the management context; project areas corresponding with higher sensitivity will likely require a more rigorous field assessment of archaeological potential than those corresponding with less sensitive areas. The preservation axis must be considered in tandem with archaeological sensitivity values to determine acceptable depth of archaeological investigation in particular areas. The preservation axis mapped at a county-wide scale is shown in Figure 8-8.

The sensitivity estimates may also be utilized, explored, and transformed by archaeologists doing research within other contexts on their own computer platforms. In this regard, independent explanatory modeling that uses pre-contact King County archaeological data but emphasizes other aspects of Native American land use and social organization will find the model of use, as well as contribute to its future development.

SUMMARY

Sensitivity estimates have been made for King County during each Analytic Period using paleoenvironmental data summarized in Chapter 2 and given values and differentially weighted based on the explanatory model outlined in Chapter 7. Maps showing these estimates across the entire county are shown in Figures 8-2 to 8-7. They show differential intensity of land use by people during those times at a broad scale, constrained by both the physical limits of changing marine shorelines and river systems, as well as availability and distributions of biological resources.

Although somewhat of a truism, this model suggests level areas near water do tend to be more archaeologically sensitive relative to steeper slopes areas away from water. This model does, however, highlight variability in sensitivity estimates within particular landforms. During the more recent Analytic Periods, for example, sensitivity varies along the length of many river valleys based on the richness of salmon species and presence of suitable freshwater mussel habitat. In mountainous areas, often considered in broad terms to have lower sensitivity, this GIS model shows variability not just based on distribution of resources such as huckleberries and rock outcrops, but also based on topographic

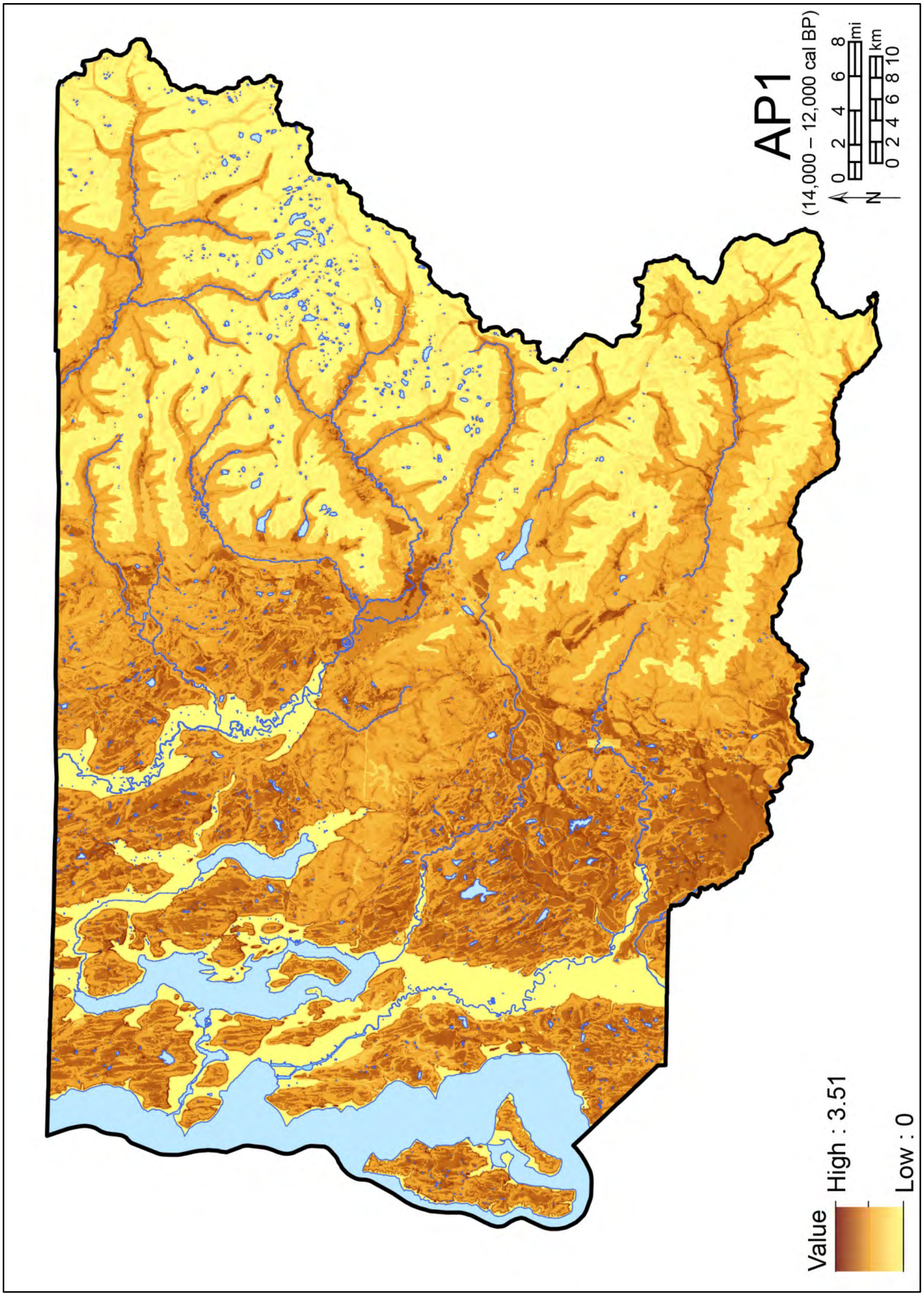


Figure 8-2. Sensitivity model for AP 1.

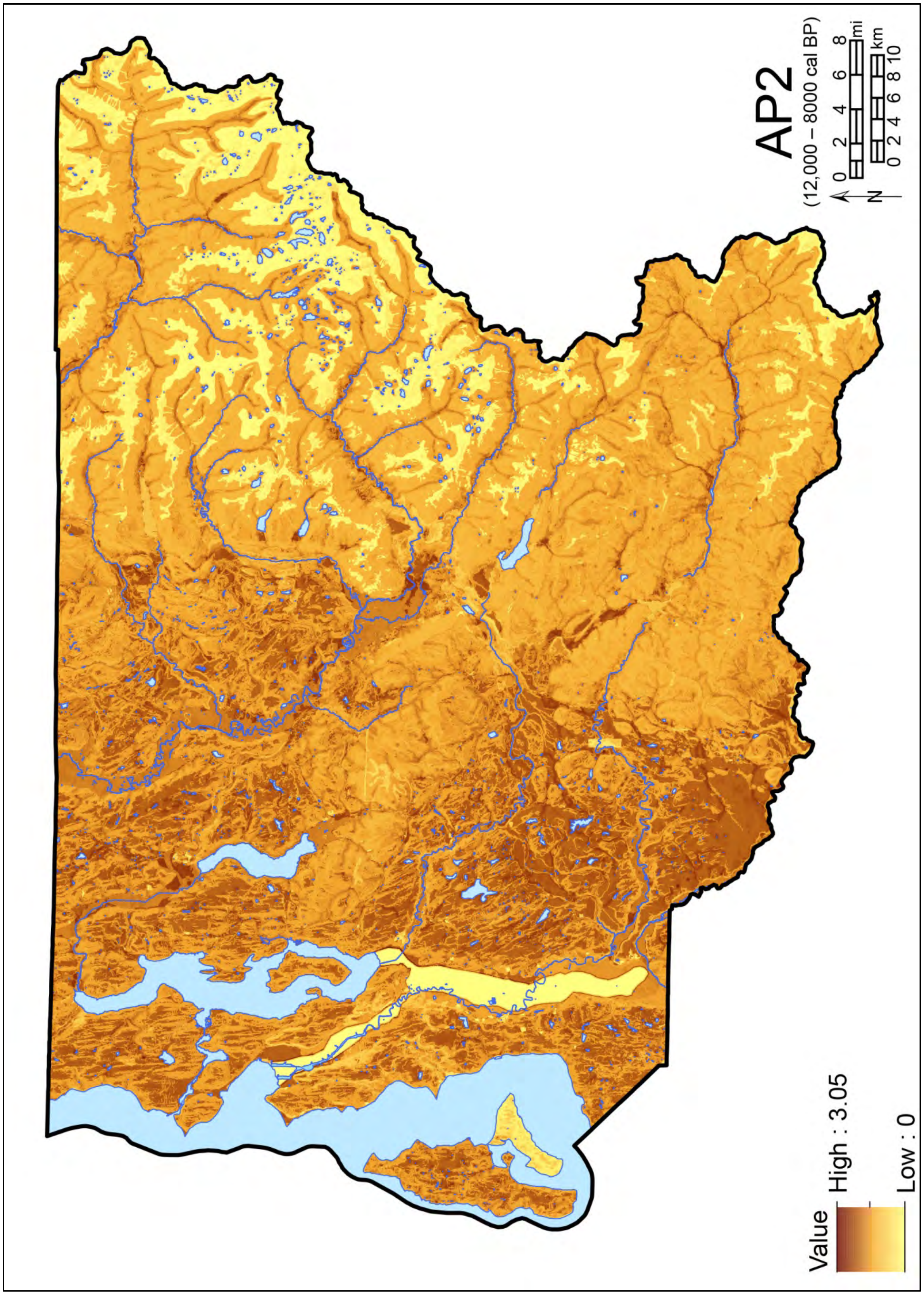


Figure 8-3. Sensitivity model for AP 2.

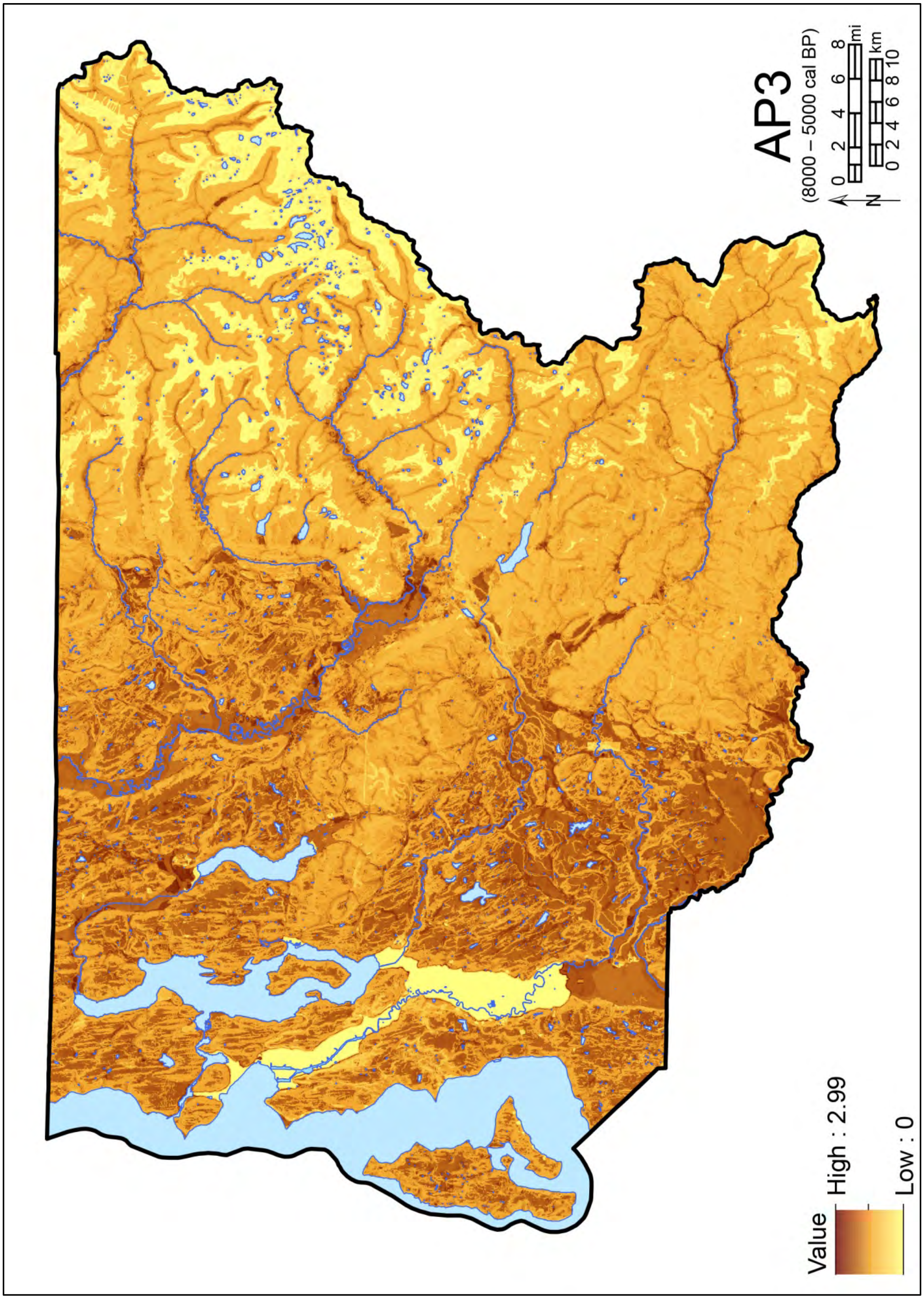


Figure 8-4. Sensitivity model for AP 3.

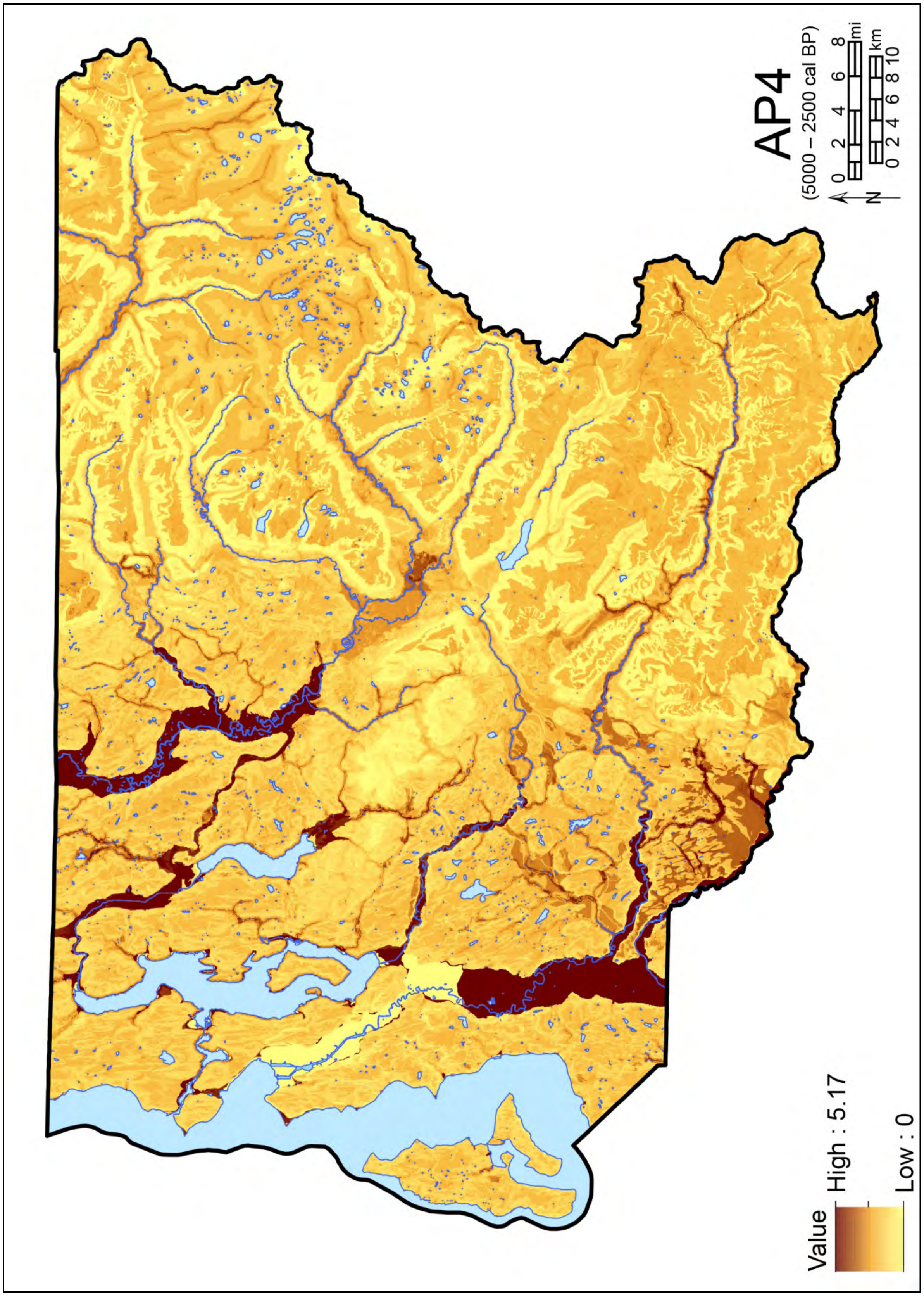


Figure 8-5. Sensitivity model for AP 4.

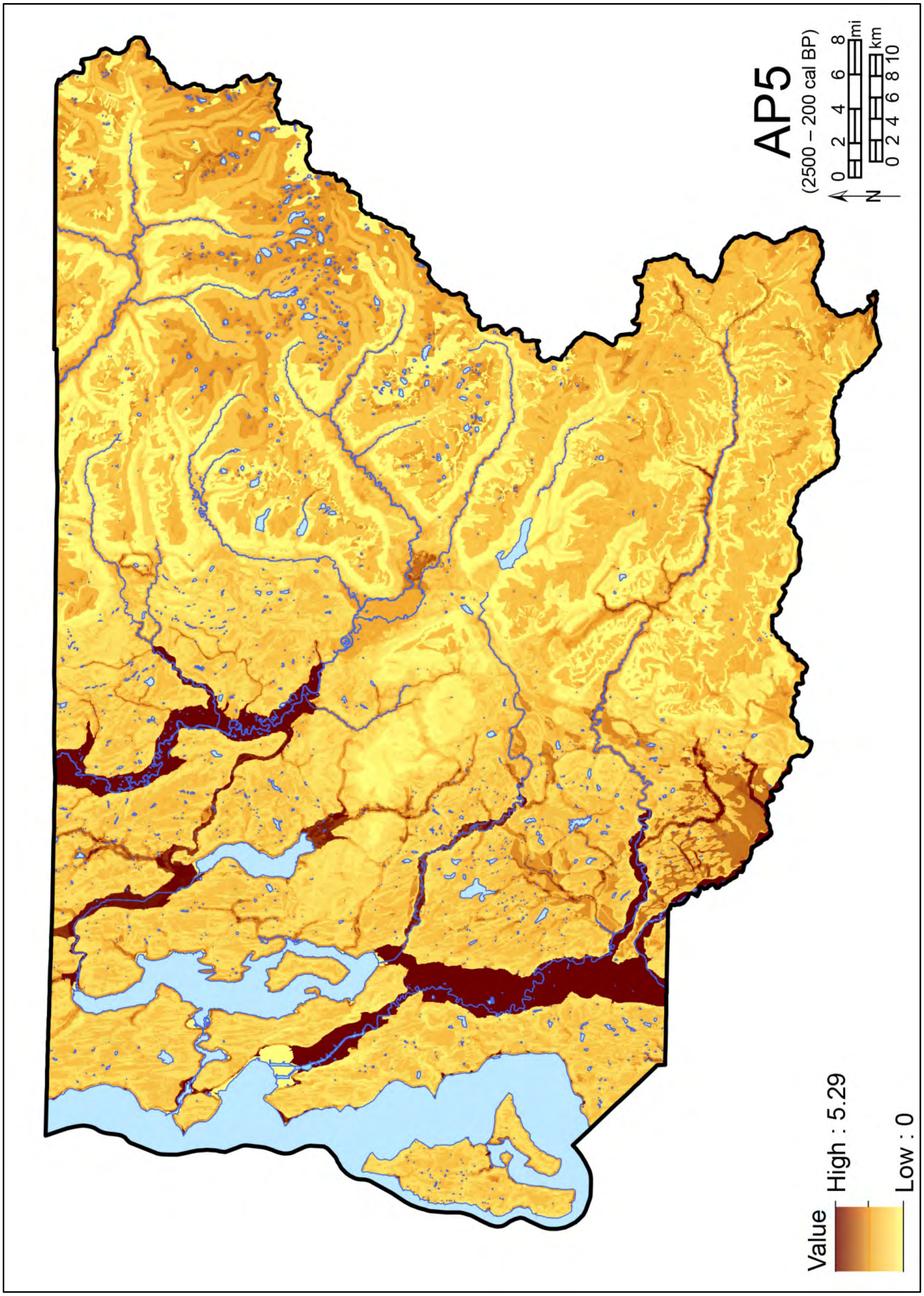


Figure 8-6. Sensitivity model for AP 5.

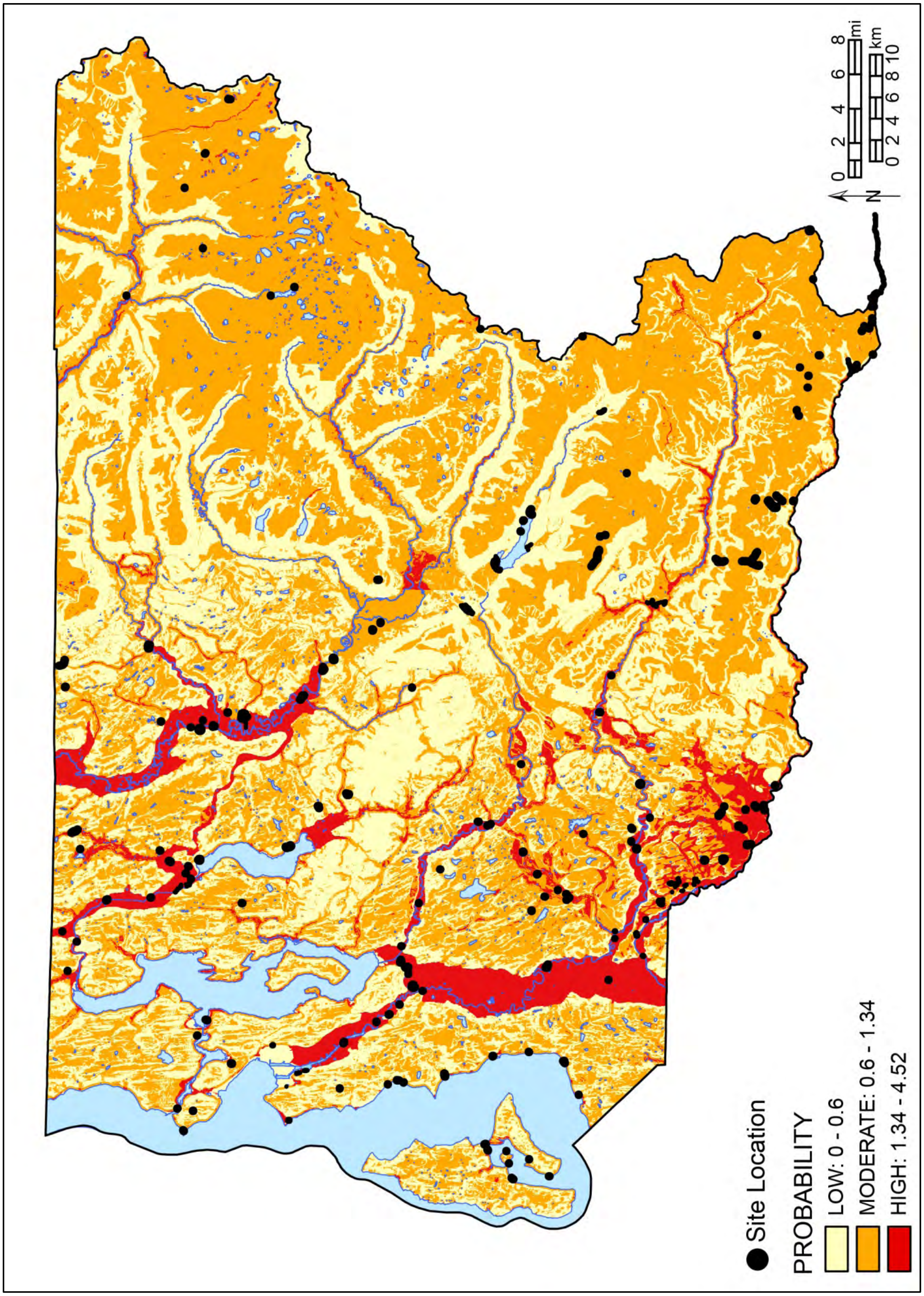


Figure 8-7. Composite sensitivity model showing high, medium, and low sensitivity in relation to recorded archaeological sites.

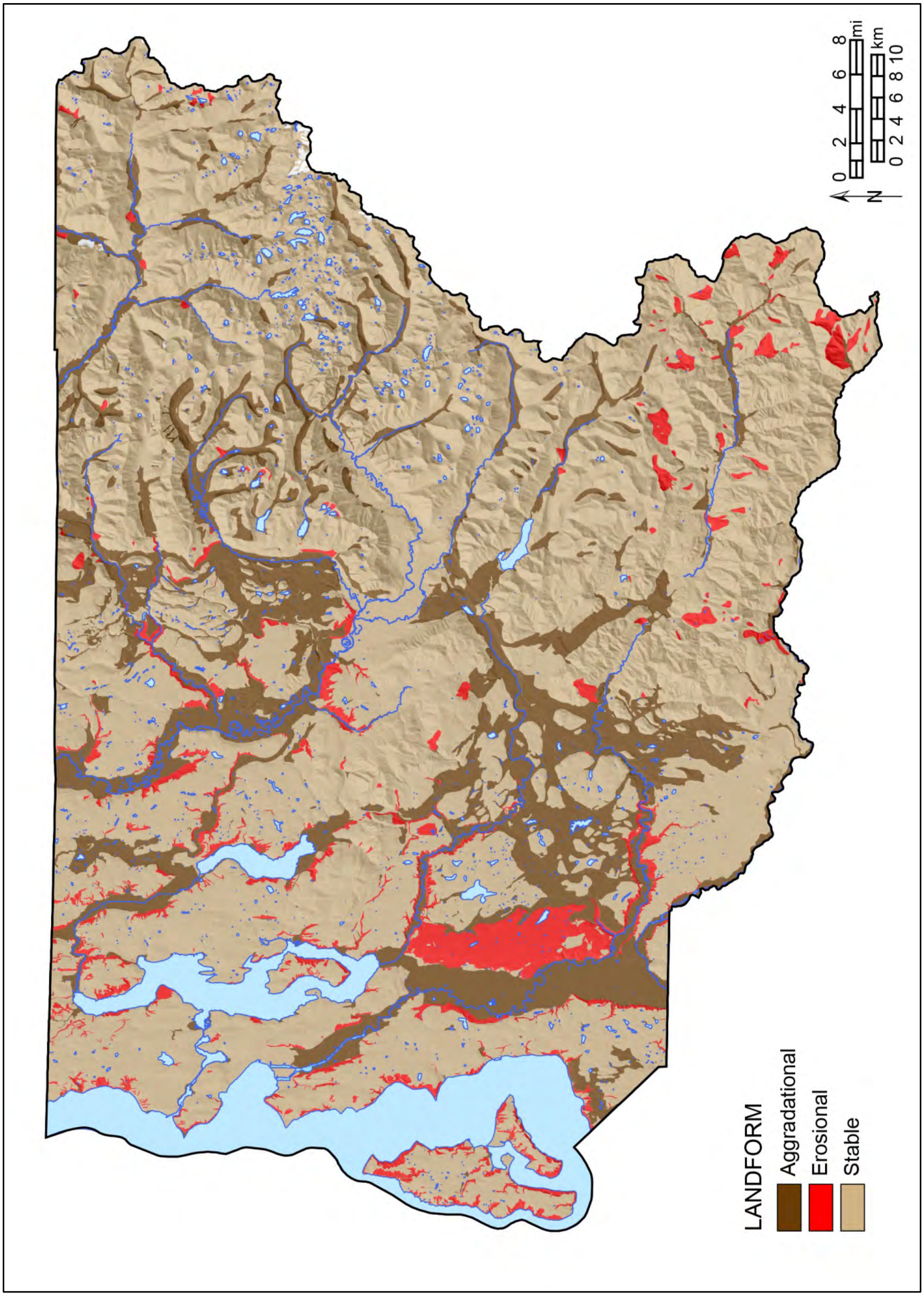


Figure 8-8. County-wide map of preservation axis (erosional, aggradational, and stable landforms).

configurations of mountain ridge systems—some ridgelines more than others allow easy access to resources in the mountains of eastern King County and travel corridors east of the Cascade Crest.

The King County site sensitivity model must be tested with additional archaeological and environmental data as they become available, and the model must be periodically updated to remain an accurate, relevant management and research tool. The King County HPP will compare the results of new site survey data, both positive and negative, as they become available to reevaluate the effectiveness of the model. In addition, the overall efficacy of the model, the ways in which it has been revised, and how it is being used will be summarized in update documents issued by the HPP at regular intervals.

CHAPTER 9. Recommendations and Future Tasks

This chapter briefly reviews the quality of existing King County archaeological data and pertinent environmental data, notes areas for improvement in relation to the explanatory and sensitivity models, describes several archaeological sites and site complexes investigated over the past several decades that serve important roles in evaluating the pre-contact archaeological record of King County, and suggests future tasks to improve data quality linked to several broad research domains. The research domains and specific questions derived from them serve as a context by which professional archaeologists may evaluate the significance of newly discovered archaeological resources in King County.

GAPS IN THE EXISTING KING COUNTY ARCHAEOLOGICAL RECORD

A total of 300 archaeological sites with pre-contact or contact-era Native American components in King County have been inventoried with DAHP as of fall 2015. Information in their inventory records includes general descriptive information and locational data. Review of those archaeological site records for this project, however, highlights considerable variation in the detail and quality of information collected. Three classes of information in particular affect our interpretations of patterns in the archaeological record and estimates of as-yet unknown archaeological sites: site-specific environmental data, site location information, and descriptions of artifact assemblages and features. Much of the inconsistency in treatment of these categories is a product of observation and recording techniques, as well as the forms themselves, evolving over the past half-century of professional archaeological practice in the region, although incomplete information in the inventory forms is still occasionally a problem today.

Environment and Assemblage Data on Site Forms

Information regarding the environment in the vicinity of a recorded site varies dramatically within the corpus of existing King County site forms. Most do not have descriptions of landforms, topography, aspect, soil type, contemporary vegetation, or other information to characterize the local environment. Site locations accompanying site forms are plotted on a wide range of maps of varying quality and detail. Most sites are plotted on U.S. Geological Survey 1:24,000 scale topographic maps, while USFS maps are often at a larger scale. Site locations relative to their positions plotted on site forms are accurate for all sites in the King County CRPP GIS layers, however the quality of site vicinity and sketch maps vary widely. Regarding descriptions of the archaeological contents of sites on inventory forms, few in King County have detailed descriptions of features or artifact classes. Small sites with a low density of artifacts usually have more detailed descriptions of assemblage characteristics than larger sites; however, the assemblages of the small sites usually have less than 50 artifacts, which limit quantitative analyses. Detailed excavation information describing assemblages, features, and special analyses, such as radiocarbon dates, is not available on most site forms. Investigators must extract detailed information from site reports, if reports have been completed and are available.

Archaeological Assemblage and Feature Data

Our understanding of the archaeological record of King County is biased in part by its physical environment and also by prevalent archaeological survey and excavation sampling methodologies. The vast majority of archaeological resources identified in King County are investigated as part of surveys using limited-volume subsurface excavations, little or no analysis of excavated material, and reporting conventions that do not synthesize the generated data with the broader body of research that has been undertaken in the region. Samples collected by archaeologists that are insufficient for making inferences with some statistical confidence limit the utility of the archaeological record and give us an inaccurate picture of site distributions and activities at those sites. One of the most obvious examples of this bias is the preponderance of archaeological sites classified as lithic or artifact scatters and the paucity of archaeological features identified in King County. Limited investigations outside of proposed areas of construction or other ground disturbance also creates substantial biases in the archaeological record and our attempts to generalize hunter-gatherer land use across the entire county. As discussed in Chapter 5, these various methodological issues must be addressed if we are to learn more meaningfully from the archaeological record.

Some intensive investigations of particular archaeological resources have been undertaken in King County and are described in Chapter 6, but their available documentation does not always yield a commensurate abundance of relevant archaeological data. Detailed information regarding assemblages and features is necessary for quantitative analyses to classify the ages and functions of archaeological components. One task to improve the existing archaeological database is to compile artifact assemblage and feature data currently available in published reports in a consistent manner. This would require development of additional fields and standard definitions for artifact data in the existing CRPP database to accommodate a wider range of artifact and feature classes. A second task to improve the information for some recorded sites is to conduct new laboratory analyses to code data in unanalyzed artifact collections from sites in King County that are held by the Burke Museum, Green River Community College, Mt. Baker-Snoqualmie National Forest, Seattle Public Utilities, Washington State University, and possibly other curation facilities. These tasks are obviously dependent upon the availability of funding and expertise, but should be considered by archaeologists, land managing agencies, and advanced degree-granting academic programs as new archaeological research proposals and mitigation plans are being developed.

Another direct method to address gaps in the existing archaeological record would be a program to relocate previously inventoried sites. If sites are extant, archaeologists can gather the requisite detailed information for quantitative analyses. A resurvey of recorded sites would also provide an accurate picture of the contemporary status of the archaeological resource base in King County, which is subject to natural and anthropogenic processes involving erosion and burial of archaeological deposits.

MODEL DEVELOPMENT

This context document has been developed using existing archaeological and environmental data, and should be revised as those two broad categories of data are refined with new research. The definitions of analytic units, including analytic time periods and site types, rely on the body of past research for their current structure and depend on closure of empirical data gaps for improvement. Just as the explanatory model evolves with additional archaeological and environmental data and testing derived from pertinent theoretical orientations, the site sensitivity model must be field tested and the values and weights of particular variables reassessed as the successes and limitations of the model become apparent.

Core Aspects of the Context Statement and Explanatory Model

Chronology is one of the most targeted research domains in both academic and compliance-based archaeology. Future investigations have the potential to improve upon the definitions of analytic time periods presented in this context document. Components that can be assigned dates based on radiocarbon analysis or other absolute dating techniques, relative dating from projectile point styles or other assemblage characteristics, or even limiting dates on tephra or peat deposits, will make substantial contributions to the periodization developed here. New discoveries are expected to result in adjustment of the boundaries of the existing Analytic Periods defined in Chapter 4, or creation of additional periods as necessary to interpret developing patterns in the archaeological record.

Future excavation of archaeological deposits and analysis of their artifacts, faunal remains, and other constituents will allow refinement of the site typology described in Chapter 5. The typology as developed in this document uses general dichotomies based on mobility and duration and intensity of use: archaeological deposits reflecting ongoing human activities (e.g., camps, resource procurement sites, etc.) versus single-episode remnants of cultural activity such as constructed trails, CMTs, and rock art; and archaeological deposits associated with residences (e.g., villages, campsites) versus those without (resource procurement sites). The present typology succeeds in classifying the existing inventory of King County archaeological sites given the kinds of information available for each one of them. A richer archaeological database will allow the typology to be given greater complexity, and in turn may facilitate derivation of more specific hypotheses and expectations in the explanatory model of pre-contact Native American land use in King County.

Field Testing the Site Sensitivity Model

Estimates of archaeological site locations in King County derived from the GIS site sensitivity model should be assessed as archaeological field investigations are conducted as part of the normal operations of King County and undergo regulatory review at the local, county, state, and federal level. An example of county-based opportunities for testing the GIS model would be comparison of site distribution estimates made by the model with the results of fieldwork conducted under KCRSD capital improvement projects. The GIS model has the potential to guide research designs and field methodology—landforms with different probabilities for archaeological materials would be sampled by archaeologists to evaluate the utility of estimates generated for a project area or area of potential effects by the GIS model.

As iterative model testing is accomplished through the cumulative completion of future academic and compliance-based archaeological investigations, opportunities will present themselves for filling in gaps in the archaeological record and, by extension, gaps in spatial coverage of the GIS sensitivity model. Survey of underrepresented locations within King County should be seen as a priority by King County, not necessarily as an immediate direction for survey efforts but as a consideration on a project-by-project basis when proposed projects and required archaeological surveys coincide with unsurveyed areas or underrepresented landforms. Large portions of the Snoqualmie River Valley and Cedar River Valley have not been surveyed for archaeological sites, particularly floodplains with high probabilities for archaeological materials. Although most areas in the mountainous eastern half of King County are considered to have low sensitivity for archaeological remains, certain microenvironments within this broad physiographic region are considered sensitive given co-location of suitable ground surfaces for occupation and site preservation, proximity of natural resources, and accessibility by communities with larger settlements to the west and east of the Cascade Range. The Alpine Lakes are an example of such microenvironments in a setting that has not been systematically surveyed for archaeological resources.

IMPORTANT SITE COMPLEXES

Although every archaeological resource inventoried in King County using professional methods to record at least basic provenience, content, and environmental information may be considered an important piece of the complex puzzle of King County pre-contact history, strategic placement of archaeological excavations and a “critical mass” of data collection is most often required to add the more substantial and significant pieces to the puzzle. When considering the body of archaeological research conducted in King County, it is important to reiterate that much of what we know and what we speculate upon is based on just a few archaeological deposits, site complexes that are often used to interpret the importance of other sites. The West Point Site Complex (45KI428 and 45KI429) in Seattle, sites on the Enumclaw Plateau, the Mule Spring Site (45KI435), and the Sammamish River/Bear Creek area are the primary examples of these unique site complexes in King County and the broader region. These examples are presented here in more detail below; sites such as *Stuwe'yuq*^{w} (45KI464) and Duwamish No. 1 (45KI23) are similar examples that condition the ways in which archaeologists often carry out their research designs in the region.

The West Point Site Complex (45KI428 and 45KI429) provides the only evidence of pre-2,500-year-old base camps on the marine littoral of the Southern Puget Sound basin (Larson and Lewarch 1995), and demonstrates the presence of shell midden sites below the contemporary surface elevation of Puget Sound. The importance of this site lies in its setting, the size of its deposits, and the amount of data collected by its investigators. Analyses of artifacts, food remains, and features at West Point indicate a generalized foraging adaptation with a focus on multi-season residential base camps through approximately 2,300 years ago. Information from geotechnical borings and observations of construction exposures at West Point suggests that hunter-gatherer shell midden deposits are still extant that are older than 4,200 years. These site deposits have also provided the best opportunity to date for testing hypotheses regarding localized adaptations to major tectonic events.

The suite of resource acquisition hunting sites, resource acquisition plant gathering sites, and field camps on the Enumclaw Plateau demonstrates long-term, intensive hunter-gatherer use of prairie habitats (Hedlund 1973, 1976, 1983; Kopperl 2006a, 2009; Lewarch et al. 2000a, 2000b). Research questions persist regarding just what constitutes the different kinds of prairies in the Puget Lowlands and their history of use by Native Americans. The prairie environment that characterizes the Enumclaw Plateau is an effect a laboratory to ask these questions, create models and expectations, and test those models in one of the most archaeologically data-rich areas of King County. Artifact assemblages, feature types, site distribution patterns, and soil matrix characteristics combine to indicate intensive hunter-gatherer land management practices over the past 5,000 years to maintain prairie habitats during a climatic period when evergreen forests dominated the regional vegetation pattern. Sparse but compelling archaeological evidence of pre-Osceola occupation on the Plateau suggests additional research avenues if sediments of adequate depth can be investigated.

Archaeological materials at the Mule Spring Site (45KI435) provide evidence for old and continuous hunter-gatherer use of relatively high elevation ridge and meadow environments (Miss and Nelson 1995). Evidence of huckleberry drying features demonstrates the importance of montane plant resources in the regional subsistence system. Identifying archaeological deposits in montane settings is difficult given slope, ground cover, and the expectation that many places in this particular environment would not draw substantial human activity nor be conducive to site preservation. The fact that significant sites such as Mule Spring have been identified and found to be very informative of an under-represented aspect of Native American settlement patterns in Western Washington reflects the importance of testing the explanatory and sensitivity models in relatively higher-elevation environments when such opportunities arise.

Several sites along the Sammamish River, including the Marymoor site complex at the outlet of Lake Sammamish, several large base camps and field camps in the Sammamish River valley, and a freshwater mussel shell midden along a major tributary of the Sammamish River, are indicative of intensive use of this area throughout much of the seasonal round for at least the past 3,000–4,000 years (e.g., Greengo 1966; Greengo and Houston 1970; Shantry et al. 2008; Shong, Miss, et al. 2007; Younger 2003). Artifact assemblages that include microblades of obsidian and quartz crystal and a diverse array of chipped stone projectile point forms are in marked contrast to assemblages found further inland, along the marine littoral, or on the glacial drift plain to the south within King County. In situ archaeological deposits beneath a buried late Pleistocene/early Holocene–aged peat near the confluence of the Sammamish River and Bear Creek reflects regular human use of this valley persisted here thousands of years earlier (Kopperl et al. 2015).

ASSESSING PRE-CONTACT ARCHAEOLOGICAL SITE SIGNIFICANCE IN KING COUNTY

The above review of data gaps, lingering questions, and areas on the King County landscape proven to be particularly noteworthy that were identified during formulation of this document highlights potential avenues of research to which the archaeological record of King County may contribute. New discoveries of archaeological resources must often be assessed in terms of their significance under state and/or federal law, dictating to some extent the research designs employed by archaeologists evaluating them. The research potential of particular archaeological resources may be evident in purely scholarly investigations; however, most field identifications and more detailed investigations in King County are done as part of the cultural resource management process that requires site significance and integrity to be explicitly addressed.

National Register of Historic Places Criteria as a Framework for Evaluating Significance

The regulatory contexts of cultural resource management investigations vary in terms of government agency involvement and applicable regulations that must be followed by archaeologists, project proponents, and those government agencies. Despite many formal differences, however, the goal of most of these regulations is to have cultural resources taken into account during the planning process of projects that require permits, funding, or more direct oversight by local, state, or federal government agencies.

The NHPA requires lead federal agencies of such undertakings to take into account the effects of projects on cultural resources, including archaeological sites, that are listed on or may be eligible for listing on the NRHP. Criteria for eligibility include four frameworks for evaluating the significance of a particular resource (Criteria A, B, C, and D), seven aspects of integrity that must be considered for a potential property, and a general age requirement exceeding 50 years. There is an abundant body of literature regarding the general process of complying with NRHP and its implementing regulations (36 CFR 800) and the specifics of evaluating archaeological site significance (e.g., Hardesty and Little 2000; King 2004; Little et al. 2000; NPS 1997, 2002). The federal guidelines provide a useful framework for assessing archaeological resources under Washington State laws such as the State Environmental Policy Act (SEPA) and Executive Order 05-05, since those regulations pertain to “significant” or “important” resources without offering specific criteria for significance.

Site Significance

Under federal guidelines, a cultural resource must meet at least one of four criteria of significance as well as demonstrate integrity and be older than 50 years to be eligible for listing on the NRHP, thereby attaining significance as an historic property. The four significance criteria are as follows:

A: Association with events that have made a significant contribution to the broad patterns of our history.

B: Association with the lives of persons significant in our past.

C: Embodiment of 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.

D: The potential to yield information important in history and prehistory.

A site or property may be evaluated under one or several of these criteria, and publications issued by the NPS offer detailed guidance for applying the criteria to a resource. Several points must be stressed, however, for application of these criteria to pre-contact archaeological sites in King County. First, most sites are evaluated by archaeologists in terms of Criterion D: their demonstrated and presumed data and the potential of that data to address important research questions. Criteria A and B may be equally applicable, however applying them usually requires close consultation with the group or groups to whom the events or people are important. This document, by providing background on the natural and cultural setting of King County and developing a model that attempts to outline the development of human adaptations to the landscape and the resulting archaeological record, is in effect a context to help consider a particular archaeological resource under Criterion D.

The second point to be stressed is that evaluation of significance of a particular archaeological resource is done relative to the known archaeological record, and the same holds true with the concept of integrity described below. One very clear lesson learned from the synthesis of existing data in King County is that the archaeological record here is biased towards particular site types, site ages, and associated landforms. The archaeological remnants of a hunting camp composed of a small, homogenous artifact assemblage with no features or datable organic material may not contribute new information about hunter-gatherer land use in some geographic areas, however in King County it may prove to be the only one of its kind yet discovered from a particular time or on a particular part of the landscape. Conversely, the kinds and condition of data found at the site may be redundant in terms of the ability of the site to contribute additional archaeological information, and therefore it may not be significant under Criterion D. In this regard, the significance criteria are only a bare framework from which further evaluation must be made with the knowledge that a context such as this document can provide.

Whether or not a site meets Criterion D depends upon the data categories that the site may contain, and the kinds of questions toward which that data may be applied. Addressing certain kinds of questions requires certain kinds of data. A faunal assemblage of suitable size, for example, is required to make statistical inferences about past subsistence. An archaeological lithic assemblage may contain several data categories, such as tools, debitage, blood protein residues on the tools, and representation of a range of lithic raw materials that may answer questions regarding tool manufacture technology, site function, and exchange. Any material that provides an absolute date (e.g., organic material for radiocarbon dating, or burned or buried material for thermolumiscence or optically stimulated luminescence dating) or a relative date (temporally diagnostic artifacts) contributes to the chronology of that particular site as well as the broader regional chronology. These are just a few examples of data classes that may be applicable when evaluating significance, often targeted for investigation during archaeological test excavations, along with the integrity of a site.

Research Domains

The other half of the significance equation is the research context toward which potential data from an archaeological site is applied. The evaluation of a site’s research potential involves systematically identifying data classes discovered at the site and linking them to appropriate questions or hypotheses within a research design. The research design may be formulated for a specific archaeological resource in order to address very specific questions, or the potential data drawn from the site may be examined in light of more general sets of research questions, or the data may be used to test hypotheses drawn from existing models and their archaeological predictions (e.g., this document; Burtchard 1988:154–155; Lewarch et al. 1995; Schalk 1988:123–162; Thompson 1978). Significance of a site may be demonstrated by retention of integrity and potential to address even a limited range of research questions considered important to prehistory or history. The general outline of research domains and specific questions given here provides guidance, but is not intended to limit considerations of all possible research questions.

Research questions are subsumed under broad research domains organized as general themes towards which different data categories may be applied. Themes such as site formation, subsistence, and technology vary in specificity and data requirements. Research directed towards addressing these domains contributes to the prehistory of King County and to broader consideration of human adaptation in the Pacific Northwest.

Site Formation

Site formation is a critical domain for understanding the context of archaeological materials (Stein and Farrand 2001; Wood and Johnson 1978), and is used to generate formation histories for archaeological sites based on the physical sequence of sediments and archaeological deposits. Since site formation processes operate in both the natural and cultural realms (Schiffer 1987), a site formation history includes identifying and interpreting archaeological materials in terms of 1) transport and transformation by human activities; 2) the effects of post-occupation, pre-burial taphonomic processes; and 3) changes imposed by post-depositional alterations.

Considerable variability exists in size, internal composition, function, and occupational history of archaeological sites in King County. Consequently, research questions under the domain of site formation may take many forms and specific hypotheses may be easily tested under a flexible research design. Since the specific history and function of sites varies across both space (function of location) and time (function of landform evolution), specific research questions under this domain are often addressed using basic site parameters and geoarchaeological analysis. Aspects of site structure, internal constituents, and spatial distribution of sediments and materials are used to address the site formation questions that may include the following:

- What are the horizontal and vertical boundaries of the site?
- What is the range of internal stratification expressed within the archaeological deposit?
- How much place-to-place variability is exhibited by the archaeological deposits, and can this be related to micro-habitat substrates on a particular landform?
- How old is the site and for how long was it occupied?
- What post-depositional processes have occurred at the site?

Data classes from a site that may be applied to these questions include physical site parameters, the stratigraphy of deposits, the character and content of the archaeological deposits, datable materials, spatial associations between materials and sediments within the site deposit, oral testimony, and historic and modern record of local land use.

Site Function

Site function is a basic research domain explored through the artifacts, features, and environmental data present at an archaeological site. Variability of site function in the King County archaeological record is addressed in earlier chapters of this document, and represents a productive area for testing hypotheses using an inclusive array of archaeological data. Even relatively small archaeological deposits with a limited range of artifacts may give an indication of site function, and may in turn be examined in light of broader regional models of settlement and subsistence (see below). Sound interpretations of site function require appropriate analyses of data categories and sufficient samples for statistical inferences, the scope of which may vary widely considering the variability of the King County archaeological record and of the extent of investigations that may occur at a site. Examples of site function questions are as follows:

- What function or functions did the site serve? Can it be situated within an existing site classification scheme?
- Did one or more than one economic pursuit dominate activity at the site, and did that change over time?
- Was the site occupied seasonally? Did seasonality at the site change over time?
- What are potential explanations of change in site function and seasonality? Are there cultural or environmental factors that may have played a role in such change?

Data classes that may be applied to these questions include structural remains, activity areas and spatial associations between materials and sediments within the site deposit, features, faunal and botanical remains, artifacts, artifact residues, and oral testimony.

Subsistence

The theme of subsistence is most frequently addressed in research questions asked of archaeological sites in which food remains have been preserved, although the environmental context of sites and their tool assemblages may allow some interpretation of subsistence. Inferences are obviously much more difficult to make from site deposits limited to non-functionally diagnostic lithic artifacts. This has led to a disproportionate number of subsistence studies incorporating shell midden sites in King County and the Puget Lowlands compared to inland sites at which subsistence was just as much of a focus yet the appropriate data classes were absent from the record. The basic questions of “what did the occupants of this site eat” may be expanded upon substantially with adequate preservation, analytic methods, and comparison with the regional subsistence record (e.g., Butler 1990b; Butler and Campbell 2004; Kopperl 2001; Larson 1995b). Examination of plant utilization and subsistence is drastically underrepresented in the body of existing archaeological research in King County, however, and even preliminary inferences drawn from plant remains and plant processing tools and features would prove worthwhile. The questions and data that address past subsistence have also recently been brought to bear on non-archaeological topics, demonstrating the value of archaeological data to a wider body of scientific research. Modern animal habitat restoration is one such debate in which archaeological evidence has been cited (e.g., Lyman 1998). Another is the contemporary public health arena—the traditional Native American diet, reconstructed in part by the archaeological record, is seen as one means of combating Type II diabetes in the Native American community (Kopperl et al. 2006).

The subsistence research domain is closely tied with other domains discussed here, especially site function and technology, and the boundary between them is blurred when taking into account all of the possible county-wide research avenues. Research questions derived from the theme of subsistence that focus directly on the archaeological record and past foodways include:

- What subsistence pursuits occurred at this site? How does this relate to the seasonal subsistence round of the site's occupants?
- Is there evidence of changing animal or plant habitat or population dynamics during the period of site occupation? If so, is an explanation for such a change evident?
- What means did people use to harvest and process subsistence resources at the site?
- What are food consumption patterns at the site? Is there evidence of food storage or other means of delayed consumption? Is there meaningful patterning in food disposal at the site?

The primary data classes used to examine subsistence questions are animal and plant remains from archaeological sites, as well as oral testimony and environmental data. Useful data from faunal assemblages include taxonomic and skeletal part representation and taphonomic indicators of butchery and processing. Some remains may be brought in to the archaeological deposit by other means, however, and are more indicative of site formation processes (e.g., Erlandson and Moss 2001). Analysis of faunal remains at a molecular level, including ancient DNA and stable isotope analysis, may be informative of past population structures and food web dynamics of subsistence resources. Along with the physical bones, shell, teeth, antler, and plant remains of past meals, other informative data classes include tools and features that are diagnostic of harvesting, processing, and cooking particular foods. Blood protein and plant starch residues on tools may also be informative of subsistence practices. Given preservation and recovery biases towards the remains of animals over plants in near-shore archaeological deposits, the potential presence of plant remains should add considerable weight in assessing the significance of a site with such preservation.

Technology

The research domain of technology is as wide-ranging as that of subsistence in terms of specific research questions; however, the data classes appropriate for investigating technological questions are more likely to be preserved in archaeological deposits throughout King County. Sites that retain some preservation of organic material may also contain bone and shell tools and tool fragments. Debitage, or lithic tool-making debris, is the most ubiquitous artifact class in pre-contact sites region-wide, and is informative of the tool reduction and manufacturing sequences that occurred at a site. Combined with analysis of the types of stone found in the assemblage, raw material procurement and tool manufacturing strategies can be elucidated. Raw material sourcing has mainly been through very precise x-ray fluorescence techniques (XRF) applied to obsidian, providing an indication of travel and exchange of lithic material from as far away as Oregon, Idaho, and British Columbia; however, this has often left sourcing of other materials not amenable to XRF such as coarser-grained volcanic rock and CCS found in King County archaeological sites to inconsistent speculation. Patterns of raw material procurement in the Puget Lowlands throughout the Holocene have proven more complex than early assertions by archaeologists of simple trade across the Cascades for fine-grained CCS when jasper, chalcedony, and petrified wood are identified in a lithic assemblage (e.g., Nelson 1990:494). Data from stone and bone tool assemblages found in King County can address a wide array of technology-oriented inquiries, and much rarer classes of data such as features and structural remains reflect technological innovation as well. The following very basic questions may be applied to most sites in King County with appropriate data classes:

- What parts of the tool manufacture and maintenance sequence are represented at the site?
- What raw materials were being used to make tools? Is there preference for particular materials to make certain tools? How far away from the site were raw materials acquired?
- How were tools being used at the site? Is there evidence of curation of particular tools or raw materials?
- How were tools disposed at the site? Are there consistent breakage patterns among tool types or raw material types?
- How were activities related to technological production organized, including raw material procurement, and tool production, distribution, and exchange?
- When and why did technological innovation occur?
- Is there other evidence of technology aside from stone and bone implements, such as the remains of dwellings, procurement features such as fish weirs or hunting blinds, processing features such as earth ovens or drying racks, or storage features such as pits or artifacts such as basketry?

The primary data classes used to address questions in the domain of technology include the parameters of the artifact assemblage, including tool and debitage types and measurements, raw materials, blood protein and plant starch residues and wear patterns on tools, and tool breakage patterns. Other data classes that are informative of technology, if available, are spatial associations between artifacts within the site deposit, environmental data regarding raw material sources, characteristics of features and architectural/structural remains, and oral testimony.

Social Organization and Belief Systems

This research domain is difficult to address with existing King County archaeological data given the preponderance of small artifact assemblage sample sizes from limited excavations, and contemporary treatment of burials in a manner that most often emphasizes respect and repatriation instead of scientific analysis. In this context, oral testimony is the strongest source of data on belief systems and archaeological data, when available, may play a supporting role. Archaeological site data that informs us of subsistence and technological activities certainly reflects on larger issues of social organization, however going beyond these domains to answer questions regarding social organization requires additional data. The other research domains discussed in this section may be more applicable to the theoretical framework and explanatory model developed for this document, however the importance of social organization and the possibility of addressing these questions with new data should not be ignored. Several general questions regarding social organization include the following:

- How was the household/households organized at this site?
- Can gender differences be ascribed to activities or household organization at the site?

- Can differential social status and ranking be inferred at the site?

- Can inferences be made about non-economic activity that occurred at the site?

Data classes that may address these questions include the spatial patterning of artifacts and features in relation to structural remains and inferred activity areas, decorative objects, exotic raw materials, and mortuary and burial data, as well as oral testimony.

Regional Syntheses

The questions under this research domain cover several broad topics in ways that place data from a particular site into a broader regional context. Questions that focus on settlement patterns, exchange and interaction among communities, and regional chronologies and tool typologies rely on data obtained from individual sites but require analysis at the inter-site scale, ranging from neighboring sites on the same landform to regional interactions and processes that cross modern international boundaries.

- Is this site a discernable part of a larger settlement system? Does it reflect a particular mobility strategy?

- Is there evidence of interaction such as trade between the community that occupied this site and people from more distant communities?

- Are there diagnostic artifacts from the site that fit into regional tool typologies?

- How do parameters of the site support or refute existing regional models of pre-contact settlement and subsistence?

- Is there evidence at this site of significant environmental changes that were occurring concurrently on the larger local or regional landscape, such as tectonic, alluvial, or mass-wasting processes, or sea-level or climate change?

Applicable data classes for questions at a regional scale are site and artifact assemblage parameters, raw material or stylistic aspects of artifacts indicative of long-distance travel or exchange with distant communities, local and regional environmental data, and oral testimony.

Site Integrity

Integrity of a site must be demonstrated along with significance under at least one of the criteria listed above in order for it to be eligible for listing on the NRHP. Several aspects of integrity are defined by the NPS for potential historic properties (Little et al. 2000:35–42; NPS 1997:44–49), and provide useful guidelines for evaluating the significance of King County archaeological sites under any regulatory context. In general, integrity of a cultural resource refers to the aspects of the property that allow it to convey its significance to interested constituencies. When significance of an archaeological site is considered in terms of data potential, sufficient integrity usually hinges on the physical condition of the site and whether or not spatial associations within its deposits allow sound inferences pertaining to at least some research domains and specific questions. As discussed below, however, evaluation of integrity must take into account the existing archaeological record, such as when the majority of inventoried sites within a management unit (e.g., county, national forest, etc.) consist of artifact scatters found in disturbed or partially disturbed contexts.

Like the concept of significance, integrity is relative and should be evaluated for a particular site with that in mind. Modern physical disturbances to archaeological site deposits often have substantial negative impacts on site integrity, yet such sites may still contain informative data classes and make important contributions to our knowledge of the past. Particular site types or sites on particular landforms may have undergone extensive disturbance and consideration of their importance should take this into account. For example, most archaeological sites that have been identified on the Enumclaw Plateau are on fertile parcels of land that have undergone agricultural activity for the better part of a century and have mixed deposits within the plowzone or upper 20–40 cm of sediment. These sites often retain deeper intact deposits with potential for discovery of pits, postmolds, and various other subsurface features (e.g., Lewarch, Forsman, et al. 2000) or may still provide important information about subsistence and technology despite thorough vertical mixing (e.g., Kopperl 2006a). Knowledge of historic and modern land use history and geological processes that have shaped the local landscape are essential to properly evaluate and contextualize the integrity of an archaeological site. Additionally, a site may be considered significant under other criteria, such as association with important events or people. In such cases, the integrity of a site may remain even if it has undergone disturbance to the extent that useful information is unlikely to be extracted under further scientific investigation.

CONCLUSIONS

The archaeological record of King County extends back well over 10,000 years, into the Pleistocene epoch when the environment of the Puget Sound region was dramatically different from today. Artifacts and archaeological features have been found on almost every landform that characterizes the county, from shell middens tectonically subsided into the intertidal zone to quarries of lithic raw material situated along mountain ridges. The variability of these resources extends across several scales, such as age, physical size and complexity, and inferred function or functions. Much of this variability may be attributed to the ways in which archaeologists undertake their investigations. Biases in where we look for the remains of past activity and how natural and anthropogenic processes preserve and destroy those remains will be persistent issues in the foreseeable future. Another persistent issue is sampling—how much of these deposits can we feasibly examine and still be able to draw our inferences about site-specific and regional Native American land use, and is it enough to be confident about those inferences?

The limitations of the archaeological record are offset by the commitment of archaeologists working in the region to find better ways to answer these questions. This has been demonstrated over the past half-century as new field and laboratory techniques are brought to bear, various theoretical frameworks are developed to pose research questions in novel ways, and the importance of Native American pre-contact history is embraced by the broader public through legislation requiring consideration of such resources in agency planning and development. Tribal collaboration in the process of identifying, interpreting, and preserving aspects of the archaeological record of King County has increased as well.

This context statement attempts to make the best use of the past half-century of archaeological research. Construction of chronological sequences and site typologies for geographic regions in the vicinity is not new, as discussed in Chapters 4 and 5. The sequence of five Analytic Periods defined in this document highlights periods of continuity and change over the past 14,000 years in both the archaeological record and environmental record of Western Washington. The site typology is a framework for effectively classifying the existing site inventory record, which is composed of forms with varying amounts of information. The typology will continue to be effective if it is refined as the number of identified sites and excavated and analyzed site deposit volumes increases. The explanatory model provides testable hypotheses regarding subsistence, settlement, and other aspects of pre-contact Native American land use. Persistence of some aspects of subsistence is expected, such as foraging in diverse terrestrial, riverine, and marine resource habitats. Change is expected as well, primarily during the later Holocene as some seasonal, specialized pursuits such as salmon fishing, berry picking, and shellfish gathering become more profitable and larger human populations and appropriate technology facilitated their harvest. As human population rose from the late Pleistocene through the Holocene to approach regional carrying capacity, settlement is hypothesized to have shifted from small residentially mobile groups and base camps to larger logistically mobile groups centered seasonally on winter villages and dispersed resource procurement camps. Although the framework is structured in terms of the chronology and site typology described in Chapters 4 and 5, it should be applicable to other regional culture historical frameworks as well. The choice and weighting of variables in the GIS-based sensitivity model was derived from the explanatory model and may be refined with better mapping of current and past distribution of particular biological resources. The necessity of refining the foundations of the explanatory model and the GIS site sensitivity model are therefore readily apparent, however we hope these tools prove to be a useful springboard for future interpretation and responsible management of the archaeological record of King County.

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APPENDIX A: Calibration and Other Issues of Absolute Dating

Radiocarbon age calibration is the process used to obtain the calendric age from a radiocarbon age estimate. Because of temporal fluctuations in the worldwide atmospheric reservoir of radioactive ^{14}C, radiocarbon ages are not directly correlated with calendric years (Stuiver et al. 1998). For example, a radiocarbon assay on a piece of wood charcoal will result in a conventional radiocarbon age given in radiocarbon years before present (often abbreviated rcybp) along with an error term of plus or minus a number of years representing one standard deviation of the estimate. The difference between the radiocarbon age range of the charcoal date and that same estimate in calendrical years fluctuates over time, a disparity that gradually increases farther back in time through the Holocene into the Pleistocene. The calibration methods used by archaeologists to account for this disparity employ correction factors calculated by comparing radiocarbon ages from small samples of wood taken from tree rings that had exact calendric ages measured in years. Archaeologists and other quaternary scientists rely upon calibration curves that have been repeatedly refined over the past several decades, and more recently make use of computer programs that are now easily accessible and calibrate conventional radiocarbon ages to calendrical dates. The complexity of calendrical age range estimates, in effect probability statements, increases for radiocarbon ages that intersect relatively “flat” portions of the calibration curve, often resulting in two or more calendar year intercepts with individual error terms. Despite most radiocarbon laboratories today providing both conventional and calibrated ages on samples that have undergone analysis, virtually all published and unpublished age estimates for time periods in the extant archaeological literature of Western Washington are based on uncorrected radiocarbon dates.

Table A-1 summarizes the differences between radiocarbon and calendar ages using the CALIB 5.0.1 computer program to convert radiocarbon ages of hypothetical dates in 500 year increments, from 14,500 radiocarbon years to 1,000 radiocarbon years, into calendric years (Reimer et al. 2004). CALIB 5.0.1 provides a statistical estimate of the most probable age or ages of each hypothetical radiocarbon sample in calibrated years before present (cal BP). The computer program also calculated the maximum (oldest) and minimum (youngest) ages relative to each hypothetical radiocarbon sample. One-sigma error terms for each radiocarbon age interval are ±50 years for those up to 10,000 cal BP, and ±100 for those greater than 10,000 cal BP. The ±50 figure for dates 10,000 cal BP or younger is based on radiocarbon results from the Bear Creek site (45KI839) in King County, where the error terms for accelerator mass-spectrometry (AMS) dates on charcoal samples increased slightly for dates older than 10,000 rcybp (Kopperl et al. 2010). The calibrated intercept represents the highest probability calibrated age estimate based on where the radiocarbon age intersects the calibration curve, sometimes with multiple results given the topography of the calibration curve at certain times. The maximum and minimum calibrated age ranges are based on intercepts on the calibration curve at one standard deviation on either side of the radiocarbon date, which once again may result in several age ranges and in which case the values given are those at either end of the combined ranges. The last column shows the difference between the radiocarbon age and the calibrated intercept, in a unit that admittedly is only roughly chronological since it measures the difference between two kinds of units but does give an idea of relative disparities in radiocarbon age and calendrical age throughout archaeological time. For radiocarbon ages with multiple calibrated intercepts, the intercepts are averaged prior to calculating the difference. It should be noted that the calibration curve utilized in CALIB 5.0.1 in many instances yields calibrated intercepts that are different by 10 to several hundred calendar years than those calculated from the earlier version of the program, especially for dates older than 10,000 rcybp (Lewarch and Larson 2003:Appendix 2).

Although the last column in Table A-1 generally shows a gradual increase in the difference between radiocarbon ages and dendrocorrected cal BP values as radiocarbon age increases, the rate of change is not consistent. Calibrated ages are generally *younger* than their corresponding radiocarbon ages more recent than about 2500 rcybp. Radiocarbon ages older than this time have calibrated ages that are *older* than their estimate, although the disparity plateaus between about 6000 and 8000 rcybp and between about 10,500 and 12,000 rcybp.

The differences between radiocarbon years and calendar years have several implications. The oldest, well-dated archaeological materials in Washington State have age estimates of approximately 11,200 rcybp (Mehringer 1989), however a dendrocorrected calendric date for the materials is over 13,000 years old. In Western Washington at the Bear Creek site, the earliest date on the peat deposit that overlies cultural material is 8800±50 rcybp, which has a one-sigma calibrated age range of 9910 to 9700 cal BP (Kopperl et al. 2010). Thus, the corrected calendric dates of the oldest archaeological materials have a bearing on estimates of initial colonization and early settlement of Puget Sound by hunter-gatherers after the retreat of the Cordilleran Ice Sheet. A precise calendric chronology allows us to infer the age of the earliest human occupations in King County and to estimate rates of population growth, important factors for any explanatory model of subsistence-settlement pattern change. In addition, the starting and ending points of some time periods in most proposed archaeological chronologies are older than initially formulated, with differences of more than 500 years for periods dating prior to about 4,000 years ago (Figure 4.1). Because rates of technological change and population increase, and other inferences regarding the archaeological record of Western Washington, hinge on correct and consistent temporal assignment, discussions of archaeological chronologies in this document include dendrocorrected calendric age estimates.

Other Factors Influencing the Results of Radiocarbon Dates

A radiocarbon date is influenced by several factors beyond the global level of radioactive carbon isotopes at the time the living organism dies and in effect starts the radiocarbon “clock” of a sample submitted for radiocarbon analysis. Useful general discussions of these issues include those of Taylor (1987) and Bradley (1999), which are touched on briefly here. Wood charcoal is by far the most common material used to obtain radiocarbon dates for archaeological deposits in the Puget Sound region, however the suitability of such samples depends in part upon the taxon and age of the plant material. Dates assayed from the wood of long-lived plant species such as western redcedar may be decades or centuries earlier than the date when that charcoal was incorporated into a cultural feature (presumably the target date)—a problem of “old wood” that may be compensated for in part by choosing charcoal from twigs or bark from these species, or wood from deciduous species such as alder or cottonwood if available. This issue highlights the importance of taxonomic identification of plant materials prior to radiocarbon analysis whenever possible.

Another factor affecting certain samples and their radiocarbon dates is the marine reservoir effect, which should be considered when drawing inferences from dates on marine shell or bone from marine mammals. The operating assumption in radiocarbon dating is that the concentration of radioactive carbon in the biosphere is uniform through space and time, that the death of an organism removes it from the carbon cycle, and that the date of death can be determined by measuring the ratio of radioactive and depleted carbon ($^{14}C/^{13}C$). However, radioactive carbon is not uniformly distributed throughout the biosphere; under certain conditions, radioactive carbon can become isolated and decompose before being consumed and incorporated into organic materials. Such carbon “reservoirs” sequester ^{14}C, inhibiting interaction with the atmospheric carbon cycle that normally allows depletion of ^{14}C through radioactive decay. The consequence of carbon reservoir effects is that organic samples that are radiocarbon dated yield older apparent ages. Carbon reservoirs can form in areas where carbon is isolated for long periods of time, usually on a scale of millennia. Marine and estuarine environments are two relevant examples of areas where carbon can be sequestered and be depleted. The magnitude of the marine reservoir effect varies with the environment in which particular organisms live. For example, the margins of oceanic continental shelves are often subject to substantial upwelling and currents that mix deeper ^{14}C-depleted waters with surface waters. Consequently, their biota will exhibit older apparent ages since the ratio of radioactive and depleted carbon will be lower than biota of similar calendar age living in areas without such reservoir effects (Hutchinson et al. 2004:194; Kennett et al. 1997).

Over the past several decades, marine reservoir correction (∆R) values have been estimated to offset this discrepancy by dating control samples in one of two ways: radiometric assay of organisms with known ages, or through paired dating of charcoal and bone or shell. Global marine reservoir correction [R(t)] is estimated as approximately 400 years (Reimer and Reimer 2001). However, as noted above, the marine reservoir age is not constant through space and time, especially when due to differential upwelling of deep ocean water. In addition, small-scale factors, such as the behavior of individual organisms and microenvironmental variation can significantly affect the composition of carbon in marine organisms. These large- and small-scale factors should be considered by archaeologists using marine shell to date archaeological deposits.

Focusing on the Pacific Northwest coast, Robinson and Thompson (1981) examined 13 molluscan museum specimens live-collected before 1950 to measure ∆R values along the west coast from the southern coast of Vancouver Island, British Columbia to San Diego, California. They found that, for shell specimens obtained from the coasts of Oregon, Washington, and southern British Columbia, a marine reservoir correction of 801±23 years should be subtracted from marine sample standard radiocarbon ages to render them comparable to terrestrial dates. In contrast, they calculated a correction of 680±15 years for the California coast. Deo et al. (2004) analyzed 18 paired charcoal-shell samples from five archaeological sites from the Puget Sound and Gulf of Georgia region and found ∆R values substantially fluctuated over the past few millennia, from 400 years in the period from 0 to 500 cal BP, down to almost zero between 500 cal BP and 1200 cal BP, and back to 400 years between 1200 cal BP and 3000 cal BP. They suggest that the decrease in ∆R identified for the period from 500 cal BP to 1200 cal BP reflected a decrease in offshore upwelling. Analysis of paired shell and charcoal samples from additional Puget Sound and Gulf of Georgia sites supports that suggestion, indicating a period of reduced offshore upwelling from 600 cal BP to 1000 cal BP (Daniels 2009:79) and demonstrating the value of such studies not only to radiometric dating methodology but also paleoenvironmental reconstruction. Archaeologists obtaining or interpreting dates from shell and other marine organisms recovered from King County archaeological sites should bear in mind that marine reservoir corrections must be considered, but also that they are not static “silver bullets” and change over time and across space.

Other Methods of Absolute Dating Archaeological Deposits in Western Washington

Although radiocarbon dates provide the vast majority of data points in absolute date chronologies in the Puget Sound region, several other methods may prove fruitful in the future. Given the lack of suitable organic material for radiocarbon dating in many archaeological contexts in the region, especially from older sites, luminescence dating techniques provide an alternative that have recently been tested at several sites to answer a variety of questions. Thermoluminescence (TL) dating on fire-modified rocks provides an estimate of the age in which those rocks were last exposed to intense heat such as that found in a hearth or earth oven—a target date that is actually closer to the event of interest to archaeologists than radiocarbon dates, which provide age estimates of an organism’s death. Although more expensive and time consuming than even AMS radiometric dating, and generating much larger error terms that accompany each age estimate, dates on fire-modified rock from site deposits without datable organic material were obtained at 45KI717 (Willis 2008), and early Holocene archaeological sites in Jefferson and Snohomish Counties that could not otherwise be dated have been given a chronological context with reasonable confidence (Kiers and Feathers 2010). Another luminescence method that may address specific chronological questions is optically-stimulated luminescence (OSL), for which the target date is a burial event that shields it from light and in effect starts a “clock” measured as a luminesce signal. At a site along the Skagit River near the town of Hamilton, OSL dates on non-archaeological sediments were obtained to determine the age of the landform, which corresponded with a Glacier Peak lahar about 3,000 years ago that likely covered the river valley and provided the most recent stable surface upon which the archaeological features and materials were deposited (Kopperl et al. 2008).

Table A-1. Correspondence Between Radiocarbon and Calendrical Years Using Calib 5.0.1

Radiocarbon Age (rcybp)	Standard Deviation (±)	Calibrated Intercept (cal years BP)	Maximum of Cal Age Ranges (one sigma)	Minimum of Cal Age Ranges (one sigma)	Difference Between cal BP and rcybp
14,500	100	17,550	17,731	17,200	3050
14,000	100	16,700	16,915	16,464	2700
13,500	100	16,020	16,263	15,817	2520
13,000	100	15,310	15,531	15,165	2310
12,500	100	14,660	14,870	14,356	2160
12,000	100	13,835	13,965	13,764	1835
11,500	100	13,330	13,434	13,250	1830
11,000	100	12,915	13,022	12,865	1915
10,500	100	12,590; 12,430; 12,400	12,688	12,240	1973
10,000	50	11,400	11,605	11,336	1400
9500	50	10,736	11,066	10,678	1236
9000	50	10,195	10,235	9973	1195
8500	50	9525, 9507	9532	9483	1016
8000	50	8986, 8825	8997	8777	906
7500	50	8341	8382	8215	841
7000	50	7840	7929	7787	840
6500	50	7425	7464	7329	925
6000	50	6850, 6838, 6824, 6800	6899	6754	828
5500	50	6291	6393	6218	791
5000	50	5728	5875	5656	728
4500	50	5172, 5123, 5108, 5068	5287	5052	618
4000	50	4500, 4490, 4440	4522	4420	477
3500	50	3825, 3791, 3761, 3748, 3727	3834	3706	270
3000	50	3208, 3179	3319	3080	194
2500	50	2710, 2629, 2617, 2562, 2542, 2518, 2513	2719	2490	84
2000	50	1948	1997	1890	-52
1500	50	1388	1480	1315	-112
1000	50	929	963	800	-71

APPENDIX B: Soils and Landform Classification

Table B-1. Soil Series of King County Arranged by Soil Order

Alfisols	Andisols	Entisols	Histosols	Inceptisols	Mollisols	Spodosols
Christoff	Barneston	Alluvial land	Borohemists	Alderwood	Newberg	Alkridge
Klaber	Bellicum	Arents	Cryohemists	Andic Cryumbrepts	Nooksack	Altapeak
Mashel	Blethen	Belfast	Mukilteo	Beausite	Puyallup	Cattcreek
Scamman	Bromo	Briscot	Orcas	Beausite		Chinkmin
Voight	Chuckanut	Cryofluvents	Reggad	Bellingham		Cotteral
Wilkeson	Cinebar	Earlmont	Seattle	Buckley		Crinker
	Dobbs	Greenwater	Shalcar	Cayuse		Ethania
	Elwell	Indianola	Tukwila	Edgewick		Foss
	Getchell	Neilton		Everett		Gallup
	Jonas	Oridia		Humaquepts		Grotto
	National	Orthents		Kapowsin		Hartnit
	Oakes	Pilchuck		Kitsap		Haywire
	Ogarty	Puget		Lemolo		Hinker
	Olomount	Renton		Norma		Humods
	Pastik	Si		Ohop		Index
	Rober	Snohomish		Ovall		Kaleetan
	Sauk	Snohomish variant		Pheeney		Kanaskat
	Skykomish	Snoqualmie		Pierking		Kindy
	Stahl	Typic Udifluvents		Ragnar		Klapatche
	Tokul	Udifluvents		Reichel		Klaus
	Treen			Rugles		Larrupin
	Vailton			Salal		Littlejohn
	Zynbar			Sammamish		Lynnwood
				Sulsavar		Marblemount
				Sultan		Melakwa
				Winston		Mowich
						Nagrom
						Nargar
						Nimue
						Persis
						Philippa
						Pitcher
						Playco
						Serene
						Spukwash
						Teneriffe
						Tusip
						Typic Haplorthods
						Welcome
N= 6	**23**	**20**	**8**	**26**	**3**	**39**

Table B-2. Soil Series Classified by Aquic Moisture Regimes

Aqualfs (Order Alfisols)	Aquents (Order Entisols)	Aquepts (Order Inceptisols)	Order Histosols
Klaber	Briscot	Bellingham	Borohemists
	Earlmont	Buckley	Cryohemists
	Oridia	Humaquepts	Mukilteo
	Puget	Lemolo	Orcas
	Renton	Norma	Reggad
	Snohomish	Norma	Seattle
	Snohomish variant	Pierking	Shalcar
		Sammamish	Tukwila
N= 1	**7**	**8**	**8**

Table B-3. Landform Classification for King County

Landform	Code	Description	Archaeological Preservation Value	Source/Map Comments
Alluvial fan	af	Includes small coalescent fans at mouths of multiple channels, gullies, and ravines; includes areas of foot slopes too small to be mapped.	1	See Haugerud 2009. Accumulation space.
Alluvial flat	al	Discrete form of fluvial origin. May include paleodeltas along streams draining into Puget Sound, “trimmed” alluvial fans at tributary junctions (fan terraces) or possible paleoterraces along glacial drainage systems.	1	Accumulation space.
Older alluvial flat	alo	Elevated; may be eroded remnant of larger older terraces, and may include highly eroded delta tops.	1	
Beach	be	Backshore zones if mappable; often included as base of bluffs	variable	
Bluff	bl	Steep, actively eroding slopes facing Puget Sound.	0	Shipman 2008. Important source areas for shoreline features.
Channel	ch	Includes gullies and ravines as well as drainages with recent evidence for mass movement on drainage walls; includes gullied slopes but are of much lower relief and smaller extent than the class of rilled/gullied slopes.	0	See Haugerud 2009. Narrow; these include the floors of most of the active gullies and ravines.
Cirque	cq	Includes cirque basin complexes	1	Only for later Holocene.
Delta	de		1	Accumulation surface
Fan-delta	f-d	Elevated fan-like surfaces graded to former lake levels	1	Though modified by subsequent Holocene erosion, should harbor oldest surface record in county.
Flood plain	fp	Broad valley bottom in mainstem tributaries in Puget Lowland portion of county	1	Approximately comparable to Qal surface geology map unit.
Glaciated surface	g	Undifferentiated glaciated surface in drift lowlands of Puget Lowlands.	1	Where undisturbed represents one of older surfaces in county.
Glacial drainage	gd	Includes anything that looks like part of a glacial meltwater system. May include areas of ice contact features that are now obscured by modern land use or land sculpting. Sometimes there may be alluvial flats, channel bars, and other megafeatures discernible within their confines.	1	Approximately equivalent to "ch" in Haugerud 2009; from Geomorphic Description System (NCRS).
Fluted glacial upland	gf	Trough-and-ridge glaciated surface that characterizes much of the central and northern portion of county in Puget Lowland.	variable	Follows Haugerud 2009; variable because troughs and ridges not mapped separately.
Rippled glacial surface	gfr	Glaciated surface characterized by smaller ripples oriented transverse to alignment of flutes.	variable	Follows Haugerud 2009.
Glacier	gl	Active glaciers	0	
Glacial till	gt	An isolated fragment of the drift upland surface, or a "till hill"; common in the south county area of the Osceola Mudflow.	1	
Ice-contact feature	ic	General category for various landforms associated with dead ice areas during deglaciation; broken down into kames, kame terraces, and kame-and-kettle topography where reasonable at map scale.	1	
Kettle	k	Discrete, typically ovoid-shaped, depression;	1	Mapped variously by King County

Table B-3. Landform Classification for King County

Landform	Code	Description	Archaeological Preservation Value	Source/Map Comments
		usually expressed as lake, wetland or bog.		surface geology map, soil survey, and DNR water bodies maps. Sensitive area is buffer around margins.
Kame-and-kettle terrain	kk	Hummocky surface, no well-developed drainage network except for Holocene (and most likely very recent) ravines and gullies cutting across the landform. A good expression may be in the area north-adjacent to Lake Washington.	1	From Haugerud 2009.
Kame terrace	kt	Linear terrace feature graded to former higher level (against ice).	1	
Lagoon	lag	Coastal feature marked by shore barrier enclosing either an area of open water or discernible wetlands.	1	
Landslide	ls	Discrete landslides in otherwise stable areas.	0	
Modified land	m	Inclusive of any disturbance through grading or filling.	variable	
Moraine	mor	Linear feature oriented either perpendicularly across foothills or mountain valley, or linear break in slope at base of valley slopes.	variable	
Mass wasting	mw	Slopes characterized by clear evidence for movement marked by well-defined scarps, hummocky ground or runout toes; includes complexes in unstable regions where there is evidence for multiple mass wasting events.		
Osceola Mudflow	om	Flat, weakly dissected topography in south county	variable	Follows county surface geology map units.
Paleoterrace	pt	Level expansive features high on valley walls in foothills and mountains that appear clearly related to deglaciation period.	1	
Ridge	rd	Limited to gently sloping broad ridges in mountains.	1	Mapped mostly using soil map unit delineations.
Rilled/gullied slope	sr	Includes gullied slopes in areas that have undergone mass movement, either recent or ancient. Watercourses may be present because groundwater aquifers are intersecting the face of the slope (and were probably a major cause of the inherent instability of these slopes in the first place).	0	Modified from Haugerud 2009.
Saddle	sa	Any low, relatively wide area along ridge; includes passes.	1	
Bedrock slope	sb	Mountain slope underlain by bedrock and covered with thin rocky soil or sediment cover.	0	
Drift-mantled slope	sd	Typically in foothills and mountainous areas; captures slopes characterized by stable alpine glacial deposits.	0	
Eroded slope	se	Exhibits weak dissection, but not to same degree as rilled/gullied slopes or channels/channel complexes.	0	
Footslope	sf	Accumulation point at base of slope; may include small fans; most commonly mapped in foothills and mountains.	1	Accumulation space; approximately equivalent to af in the lowlands.
Slope	sl	Undifferentiated slope. May include some ice-contact features that have been substantially modified by land use or have been greatly subdued by natural erosion processes.	0	
Spit	spi	Shoreline barrier feature.	1	Late Holocene
Steep slope	ss	Typically steep, apparently stable, slopes that	0	May combine with general slope

Table B-3. Landform Classification for King County

Landform	Code	Description	Archaeological Preservation Value	Source/Map Comments
		appear to be affected only by soil creep.		category.
Talus cone	tc	Steep straight-sided chute in mountains; includes snow avalanche chutes.	0	Tend to be dominated by high energy debris flow, rock slides, etc.
Valley bottom	vb	Mountain valley bottom characterized by stored sediment transported by mass wasting off valley slopes; lacking well-developed channel or flood plains; mostly in 2^{nd} order or higher streams; upper limit grades into and includes footslope areas.	1	Mostly accumulation surfaces with little apparent transport.
Valley floor	vf	Channel with no or a very narrow flood plain.	1	More stable valley bottoms in larger ravines, gullies, and higher-order streams.
Wet	wet	Areas of open water, wetlands or seasonal wetlands.	1	Various mapping sources.

APPENDIX C: Archaeologically and Ethnographically Documented Subsistence Resources

Table C-1. Archaeologically and Ethnographically Documented Subsistence Resources

Taxon – Latin	Common Name	Present in Archaeological Record*	Cited in Ethnographic Record**
FISH			
Elasmobranchii			
Squalus acanthias	spiny dogfish	X	X
Raja sp.	skates	X	X
Chimaeriformes			
Hydrolagus colliei	spotted ratfish	X	
Acipenseriformes			
Acipenser sp.	sturgeon	X	X
Clupeiformes			
Clupeidae	herring	X	
Clupea harengus pallasi	Pacific herring	X	X
Engraulis mordax	northern anchovy	X	
Salmoniformes			
Salmonidae	salmon/ trout	X	
Salmo salar	Atlantic Salmon	X	
Prosopium williamsoni	mountain whitefish	X	
Oncorhynchus sp.	salmon	X	X
Oncorhynchus clarkii	cutthroat trout		X
O. mykiss	rainbow/steelhead trout		X
O. keta	chum salmon		X
O. kisutch/O. tshawytscha	coho or chinook	X	X
O. *kisutch/O. nerka*	coho or sockeye	X	X
Salvelinus malma	dolly varden		X
Osmeriformes			
Osmeridae	smelt	X	X
Spirinchus thaleichthys	longfin smelt		X
Cypriniformes			
Cyprinidae	minnows	X	
Ptychocheilus oregonensis	northern pike minnow	X	
Mylocheilus caurinus	peamouth	X	
Catostomidae	suckers	X	
Catostomus sp.	suckers	X	X
Catostomus macrocheilus	largescale sucker	X	
Gadiformes			
Gadidae	codfishes	X	X
Gadus macrocephalus	Pacific cod	X	
Microgadus proximus	Pacific tomcod	X	X
Theragra chalcogramma	walleye pollock	X	X
Merluccius productus	Pacific hake	X	
Batrachoidiformes			
Porichthys notatus	plainfin midshipman	X	X
Scorpaeniformes			
Scorpaenidae	scorpionfishes and rockfishes	X	X
Sebastes sp.	rockfish	X	
Anoplopoma fimbria	sablefish	X	
Hexagrammos sp.	greenling	X	
Ophiodon elongatus	lingcod	X	X
Cottidae	sculpins	X	X
Enophrys bison	buffalo sculpin	X	
Leptocottus armatus	Pacific staghorn sculpin	X	
Chitonotus pugetensis	roughback sculpin	X	

Table C-1. Archaeologically and Ethnographically Documented Subsistence Resources

Taxon – Latin	Common Name	Present in Archaeological Record*	Cited in Ethnographic Record**
Myoxocephalus polyacanthocephalus	great sculpin	X	
Scorpaenichthys marmoratus	cabezon	X	
Hemilepidotus hemilepidotus	red Irish lord	X	
Agonidae	poachers	X	
Perciformes			
Embiotocidae	surfperch	X	X
Embiotoca lateralis	striped seaperch	X	
Taeniotoca lateralis	blue seaperch	X	
Rhacochilus vacca	pile perch	X	
Cymatogaster aggregata	shiner perch	X	X
Anarrhichthys ocellatus	wolf eel	X	
Pleuronectiformes	flatfish/ flounders		X
Paralichthyidae	lefteye flounder	X	
Citharichthys sordidus	Pacific sanddab	X	
Pleuronectidae	righteye flounder	X	
Lepidopsetta bilineata	rock sole	X	
Microstomus pacificus	Dover sole	X	
Parophrys vetulus	English sole	X	X
Platichthys	flounder	X	
Platichthys stellatus	starry flounder	X	
Pleuronichthys decurrens	curlfin sole	X	
Pleuronichthys coenosus	C-O Sole	X	
Hippoglossus stenolepis	Pacific halibut	X	X
INVERTEBRATES			
ANNELIDA			
Serpulidae			
Serpula vermicularis	serpulid worm	X	
ECHINODERMATA			
Holothuroidea	sea cucumber		X
MOLLUSCA			
Bivalvia	unidentified bivalves		
Mytilidae			
Mytilus sp.	mussel	X	
Mytilus californianus	California mussel	X	
Mytilus edulis	blue mussel	X	X
Ostreidae			
Crassostrea gigas	Japanese oyster (I)	X	
Crassostrea virginica	Atlantic oyster (I)	X	
Ostrea lurida	Olympia oyster	X	X
Pectinidae			
Patinopecten caurinus	giant pacific scallop	X	X
Hinnites multirugosus	rock scallop	X	
Chlamys rubida	Hind's or pink scallop	X	
Anomiidae			
Pododesmus macrochisma	Alaska jingle	X	
Cardiidae			
Clinocardium sp.	cockles	X	
Clinocardium nuttalli	basket cockle	X	X
Veneridae			
Protothaca staminea	native littleneck clam	X	X
Tapes japonica	Japanese littleneck clam (I)	X	

Table C-1. Archaeologically and Ethnographically Documented Subsistence Resources

Taxon – Latin	**Common Name**	**Present in Archaeological Record***	**Cited in Ethnographic Record****
Saxidomus sp.	butterclam	X	X
Saxidomus gigantea	Washington butterclam	X	
Saxidomus nutalli	California butterclam	X	
Mactridae			
Tresus spp.	horse and gaper clams	X	
Tresus (=Schizothaerus) capax	horse clam	X	X
Tellinidae			
Macoma sp.	Macoma	X	
Macoma nasuta	bent-nose clam	X	X
Macoma inconspicua	inconspicuous clam	X	
Macoma secta	sand clam	X	
Myidae			
Mya arenaria	softshell clam	X	
Hiatellidae			
Panope generosa	geoduck	X	X
Glycymerididae			
Glycymeris subobsoleta	Pacific Coast glycymeris	X	
Unionidae			
Unio margartifera	freshwater clam	X	
Margaritiferidae			
Margartifera margartifera	freshwater mussel	X	
Gastropoda			
Trochidae			
Margarites sp.	snails	X	
Lottidae	limpets	X	
Acmaeidae			
Acmea spp.	limpets	X	
Mesogastropoda	snails	X	
Littorinidae			
Littorina sp./ *Bitium* sp.	periwinkles	X	
Littorina sp.	periwinkles	X	
Littorina scutulata	checkered periwinkle	X	
Littorina sitkana	Sitka periwinkle	X	
Vitrinellidae			
Episcynia spp.	vitrinella	X	
Calyptraeidae			
Crepidula adunca	hooked slipper-shell	X	X
Crepidula lingulata	wrinkled slipper shell	X	
Naticidae			
Polinices spp.	moon snails	X	
Polinices lewisii	moon snail	X	X
Muricidae/ Thaididae			
Ocenebra sp.	oyster drill	X	
Nucella sp. (= *Thais* sp.)	rock snail/ dog whelk	X	
Nucella (= *Thais*) *canaliculata*	channeled dogwinkle; purple whelk	X	
Nucella (= *Thais*) *emarginata*	emarginate dogwinkle; short-spired purple whelk	X	
Nucella (= *Thais) lamellosa*	frilled dogwinkle; wrinkled purple whelk	X	
Buccinidae			
Searlesia dira	dire whelk	X	
Columbellidae			
Amphissa sp.	amphissa	X	
Polyplacophora			

Table C-1. Archaeologically and Ethnographically Documented Subsistence Resources

Taxon – Latin	Common Name	Present in Archaeological Record*	Cited in Ethnographic Record**
Cryptochiton stelleri	gumboot chiton	X	
Cephalpoda			
Enteroctopus dofleini	North Pacific Giant Octopus		X
ARTHROPODA			
Balanus spp.	acorn barnacles	X	X
Balanus crenatus	barnacle	X	
Semibalanus cariosus	thatched barnacle	X	
Cancer spp.	crabs	X	X
Caridea	shrimp	X	X
Teuthida	squid		X
ECHINODERMATA			
Dendraster spp.	sand dollars	X	
Dendraster excentricus	sand dollar	X	
Strongylocentrotus spp.	sea urchins	X	X
MAMMALS			
Insectivora			
Scapanus orarius	coast mole	X	
Leporidae			
Lepus cf. *americana*	snowshoe hare	X	X
Sylvilagus cf. *floridanus*	Eastern cottontail (I)	X	
Rodentia	unidentified rodents	X	
Aplodontiidae			
Aplodontia rufa	mountain beaver	X	
Sciuridae			
Tamias townsendii	Townsend chipmunk	X	X
Sciurus or *Tamiasciurus*	squirrel	X	X
Marmota flaviventris	yellow-bellied marmot		X
Geomyidae			
Thomomys sp.	pocket gophers	X	
Castoridae			
Castor canadensis	American beaver	X	X
Muridae			
Rattus sp.	rat (I)	X	
Sigmodontinae	New World rats and mice	X	
Peromyscus sp.	deer mice	X	
Arvicolinae	mice, voles, muskrat	X	
Clethrionomys gapperi	Southern red-backed vole	X	
Microtus sp.	meadow vole	X	
Ondatra zibethica	muskrat	X	X
Erethizontidae			
Erethizon dorsatum	American porcupine		X
Cetacea			
Cetacea	whale	X	X
delphinidae	dolphin	X	
Phocoena or *Phoceoenoides*	porpoise	X	X
Phocoenoides dalli	Dall porpoise	X	
Canidae			
Canis sp.	wolf, coyote, dog	X	
Canis latrans	coyote		X
Canis lupus	Wolf	X	
Canis cf. *familiaris*	domestic dog	X	X

Table C-1. Archaeologically and Ethnographically Documented Subsistence Resources

Taxon – Latin	**Common Name**	**Present in Archaeological Record***	**Cited in Ethnographic Record****
cf. *Vulpes vulpes*	fox	X	
Ursidae			
Ursus sp.	bear	X	
Ursus americanus	black bear	X	X
Ursus arctos	brown bear		X
Procyonidae			
Procyon lotor	racoon	X	X
Mustelidae			
Martes sp.	marten		X
Mustela ermina	ermine		X
Martes pennanti	fisher	X	X
Mustela sp.	weasel or mink	X	
Mustela frenata	weasel	X	X
Gulo luscus	wolverine		X
Mephitis mephitis	striped skunk	X	X
Lontra canadensis	northern river otter	X	X
Felidae			
Felis condor	cougar	X	X
Felis cf. *canadensis*	Canadian lynx	X	
Felis domesticus	domestic cat (I)	X	
Lynx rufus	bobcat	X	X
Lynx sp.	bocat or lynx	X	
Otariidae			
Eumetopias jubata	Steller sea lion	X	
Phocidae			
Phoca vitulina	harbor seal	X	X
Perissodactyla			
Equis caballus	domestic horse (I)	X	X
Artiodactyla			
Sus scrofa	domestic pig (I)	X	
Cervidae	elk, moose, caribou, deer	X	
Cervus elaphus	elk/ wapiti	X	X
Odocoileus sp.	deer	X	X
Bovidae	cattle, sheep, goats	X	
Bos taurus	domestic cattle (I)	X	
Oreamnos americanus	mountain goat		X
Ovis aries	domestic sheep (I)	X	
Ovis canadensis	bighorn/mountain sheep		X
Ovis sp.		X	
"Sea mammal"	unidientified sea mammal	X	
REPTILE			
Emydidae			
Clemmys marmorata	western pond turtle	X	
BIRDS			
Anseriformes			
Anatidae	swans, geese, ducks	X	X
Anserini	goose	X	
Branta canadensis	Canada Goose	X	
Anatinae	duck	X	
Anas sp.	dabbling duck	X	
Anas platyrhynchos	Mallard	X	X

Table C-1. Archaeologically and Ethnographically Documented Subsistence Resources

Taxon – Latin	Common Name	Present in Archaeological Record*	Cited in Ethnographic Record**
Anas acuta	Northern Pintail	X	
Anas americana	American Wigeon	X	
cf. *Anas americana*	American Wigeon (=Baldplate)	X	
Aythya sp.	diving duck	X	
Aythya valisineria	Canvasback	X	
Aythya affinis	Lesser Scaup	X	
Melanitta sp.	scoter	X	
Melanitta perspcillata	Surf Scoter	X	
Melanitta nigra	Black Scoter	X	
Melanitta fusca	White-winged Scoter	X	
Bucephala albeola	Bufflehead	X	
Bucephala islandica	Barrow's Goldeneye	X	
Bucephala clangula	Common Goldeneye	X	
Mergus sp.	merganser	X	
Mergus merganser	Common Merganser	X	
Mergus serrator	Red-breasted Merganser	X	
Oxyura jamaicensis	Ruddy Duck	X	
Galliformes			
Bonasa umbellus	Ruffed Grouse	X	X
Dendragapus obscurus	Blue Grouse	X	X
Dendragapus fuliginosus	Sooty Grouse		X
Centrocercus urophasianus	Sage grouse		X
Tympanuchus phasianellus	Sharp-tailed grouse		X
Phasianinae	Pheasant (brush, China, ring-neck)		X
Gallus gallus	Domestic Chicken (I)	X	
Meleagris gallopavo	Turkey (I)	X	
Callipepla californica	California Quail (I?)	X	X
Gaviiformes			
Gavidae			X
Gavia immer	Common Loon	X	
Gavia stellata	Red-throated Loon	X	
Gavia cf. adamsii	Yellow-billed Loon	X	
Podicipediformes			
Podilymbus podiceps	Pie-billed Grebe	X	
Podiceps sp.	grebe	X	
Podiceps auritus	Horned Grebe	X	
Podiceps nigricollis	Eared Grebe	X	
Aechmophorus occidentalis	Western Grebe	X	
Procellariiformes		X	
Pelecaniformes			
Phalacrocorax sp.	cormorant	X	
Ciconiiformes			
Ardea cinerea	Great Blue Heron	X	
Falconiformes			
Accipitridae	hawks, kits, harriers, eagles	X	
Buteo spp.	Hawk	X	
Buteo jamaicensis	Red-tailed hawk		X
Haliaeetus leucocephalus	Bald Eagle	X	X
Gruiformes			
Fulica americana	American Coot	X	X
Charadriiformes			

Table C-1. Archaeologically and Ethnographically Documented Subsistence Resources

Taxon – Latin	Common Name	Present in Archaeological Record*	Cited in Ethnographic Record**
Larus sp.	gulls	X	
Alcidae	alcids	X	
Uria aalge	Common Murre	X	
Brachyramphus marmoratus	Marbled Murrelet	X	
Fratercula cirrhata	Tufted Puffin	X	
Columbiformes	pigeons, doves	X	
Strigiformes	owls	X	
Coraciiformes			
Ceryle alcyon	Belted Kingfisher	X	
Piciformes			X
Dryocopus pileatus	Pileated Woodpecker	X	
Colaptes cafer	Northern flicker		X
Passeriformes			X
Ixoreus naevius	Varied thrush		X
Corvus brachyrhynchos	American Crow	X	
Trochiliformes			
Selasphorus rufus	Rufous hummingbird		X
PLANTS and FUNGI			
Nuts			
Plant edible tissue, starchy	possible nutmeat	X	
Corylus cornuta	hazelnut	X	X
Quercus garryana	acorn	X	X
Fruits/ Berries			
Plant edible tissue, fruity	berries	X	
Plant edible tissue, fruity (Ericaceae)	likely salal or blueberry	X	
Gaultheria shallon	salal	X	X
Vaccinium sp.	blueberry/huckleberry	X	
Vaccinium caespitosum	dwarf blueberry/dwarf huckleberry		X
Vaccinium ovalifolium	blue huckleberry/blueberry		X
Vaccinium membranaceum	black mountain huckleberry		X
Vaccinium ovatum	evergreen huckleberry		X
Vaccinium parvifolium	red huckleberry		X
Vaccinium oxycoccus	bog cranberry		X
Arctostaphylos uva-ursi	kinnikinnick (bearberry)	X	X
Sambucus racemosa	elderberry, red	X	X
Sambucus glauca	elderberry, blue		X
Osmaronia cerasiformis	Indian plum	X	X
Rosa sp.	wild rose	X	X
Rubus sp.	blackberry/raspberry/salmonberry/thimbleberry	X	X
Malus fusca	crabapple	X	X
Prunus sp.	cherry or plum	X	
Prunus cf. *virginiana*	chokecherry	X	X
Prunus emarginata	bitter cherry	X	X
Prunus cf. *domestica*	domesticated/ Italian Plum (I)	X	
Cornus stolonifera	dogwood	X	
Sorbus sitchensis	mountain ash	X	
Fragaria cf. *vesca*	wild strawberry	X	X
Vitis sp.	grape (I)	X	
Ribes divaricatum	gooseberry		X
Ribes bracteosum	skunk currant		X

Table C-1. Archaeologically and Ethnographically Documented Subsistence Resources

Taxon – Latin	Common Name	Present in Archaeological Record*	Cited in Ethnographic Record**
Barberis spp.	Oregon grape		X
Amelanchier alnifolia	serviceberry		X
Symphoricarpos alubus	snowberry		X
Empetrum nigrum	crowberry	X	
Roots/Bulbs			
Plant edible tissue, starchy	e.g. wapato (*Sagittaria latifolia)*	X	X
Allium sp.	wild onion	X	X
Lomatium sp.	biscuit root/ wild carrot	X	X
Camas	camas	X	X
Lilium columbianum	tiger lily		X
Scirpus sp.	bulrush/ tule	X	X
Heuchera spp.	alum/alumroot		X
Daucus carota	wild carrot		X
Other (Edible/Medicinal/Raw Material/Fuel)			
Trifolium sp.	clover	X	
Chenopodium sp.	goosefoot/ lamb's quarters	X	
Cruciferae (=Brassicaceae)	mustard	X	
*Plantago*sp.	plantain	X	X
Stellaria cf. *graminea*	chickweed	X	
Xerophyllum tenax	beargrass		X
Galium sp.	bedstraw	X	X
Polygonum cf. *erectum* (=*P. aviculare*)	knotweed	X	
Suaeda maritima	seablite	X	
Vicia sp.	vetch	X	X
Solanum	nightshade	X	
Celtis sp.	hackberry	X	
Dicentra formosa	bleeding heart		X
Arctium minus	burdock		X
Rhamnus purshiana	cascara		X
Typha latifolia	cattail		X
Oplopanax horridum	devil's club		X
Epilobium angustifolium	fireweed		X
Hesperonio retrorsa	four o'clock		X
Lonicera sp.	honeysuckle		X
Leptotaeinia multifida	Indian balsam		X
Nereocystis leutkeana	kelp		X
Ledum groenlandicum	Labrador tea		X
Claytonia perfoliata	miner's lettuce		X
Philadelphus lewisii	mockorange	X	X
Stachys ciliata	hedge nettle		X
Urtica dioica	stinging nettle		X
Equistum spp.	horsetail		X
Conium maculatum	poison hemlock		X
Oxalis organa	redwood sorrel		X
Prunella vulgaris	self-heal		X
Helenium autumnale	mountain sneezeweed		X
Lysichiton americanum	skunk cabbage		X
Balsamorhiza deltoidea	sunflower		X
Trillium ovatum	trillium		X

Table C-1. Archaeologically and Ethnographically Documented Subsistence Resources

Taxon – Latin	Common Name	Present in Archaeological Record*	Cited in Ethnographic Record**
Linnea borealis	twinflower		X
Valerian spp.	valerian		X
Oenanthe sarmentosa	Pacific water-parsley		X
Achillea millefolium	yarrow		X
Geum macrophylum	yellow avens		X
Juniperis scopulorum	Rocky Mountain juniper	X	X
Thuja plicata	western redcedar	X	X
Callitropsis nootkatensis	Alaska cedar/yellow cedar/Nootka cypress	X	
Picea spp.	spruce	X	
Abies lasiocarpa	balsam fir		X
Abies grandis	grand/white fir		X
Pseudotsuga menziesii	Douglas fir	X	X
Tsuga heterophylla	western hemlock	X	X
Pinus contorta	shore/lodgepole pine	X	
Pinus monticola	western white pine		X
Chimaphila umbellata	prince's pine		X
Taxus brevifolia	Pacific yew	X	X
Holodiscus discolor	ironwood/oceanspray	X	X
Acer spp.	maple	X	
Acer macrophyllum	bigleaf maple	X	X
Acer circinatum	vine maple	X	X
Physocarpus capitatus	Pacific ninebark		X
Arbutus menziesii	madrone	X	
Fraxinus latifolia	Oregon ash	X	X
Alnus spp.	alder	X	X
Betula spp.	birch	X	
Salix spp.	willow	X	X
Populus spp.	polar/cottonwood	X	
Populus trichocarpa	black cottonwood		X
Cornus nuttalii	Nuttall's dogwood		X
Pteridophyta	ferns	X	
Pteridium aquilinum	bracken fern		X
Blechnum spicant	deerfern		X
Athyrium filix-femina	lady fern		X
Polypodium glycyrrhiza	licorice fern		X
Adiantum pedatum	maidenhair fern		X
Polystichum munitum	sword fern		X
Dryopteris dilatata	wood fern		X
Fomes spp.	bracket fungus		X

* Presence in archaeological record includes mention in all site reports from King, Kitsap, and Snohomish County submitted to DAHP in 2015 and earlier (Kopperl et al. 2006 and updated online database at http://faculty.washington.edu/plape/tradfoods/tradfoodresearch.htm).

** Mentioned in Ballard (1951, 1957); Carpenter (1981); Duwamish et al. (1933); Gunther (1981); Haeberlin and Gunther (1930); James and Martino (1984); Lane (1987); Larson (1993); Larson and Forsman (2001); A. Smith (1964, 2006); M. Smith (1940a); Turner (1976); Tweddell (1953); Waterman (ca. 1920, 1922).

APPENDIX D: Archaeological Site Index

Table D-1. Selected Assemblages in the Puget Sound Basin by Analytic Time Period

Assemblage and Location	Smithsonian Number	Site Class	Landform
Analytic Period 1: 14,000–12,000 cal BP			
Manis Mastadon Site, Sequim Vicinity	45CA218	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Glacial Outwash Drift Plain, Kettle Lake/Bog
Ayer Pond Bison Site, Orcas Island	None	Specific-Resource Procurement/Processing Site (Hunting)	Glacial Drift Upland, Peat Bog
Whidbey Island, Penn Cove Vicinity	None	Isolate (Fluted Point)	Glacial Outwash Drift Plain
Hamilton Bog Site, Maple Valley	45KI215	Isolate (Fluted Point)	Glacial Outwash Drift Plain, Kettle Lake/Bog
Chehalis River Terrace, Chehalis Vicinity	None	Isolate (Fluted Point)	Glacial Outwash Drift Plain, River Terrace
Luckey Clovis Site	45KP139	Isolate (Fluted Point)	Glacial Outwash Drift Plain, Kettle Lake/Bog
Lake Cle Elum, Kittitas County	None	Isolate (Fluted Point)	Mountain Lake
Analytic Period 2: 12,000–8000 cal BP			
Cedar River Outlet Channel, Chester Morse Lake	45KI25	Specific-Resource Field Camp (Hunting)	Mountain Lake, Outlet and Beach
Manis Mastadon Site, Sequim Vicinity	45CA218	Specific-Resource Field Camp (Hunting)	Glacial Outwash Drift Plain, Kettle Lake/Bog
Ross Lake, North Cascades	45WH232	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Fan, Intermittent Stream
Slab Camp, Olympic Peninsula	USFS 6092-1	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Mountain Valley, Stream Terrace
Lake Cushman, Upper Skokomish River Drainage	45MS100	Specific-Resource Field Camp (Hunting)	Foothill Valley, River Terrace, Confluence of River and Stream
Bear Creek, Sammamish River valley	45KI839	Multiple Resource Field Camp or Procurement/Processing Site (Hunting)	Foothill Valley, River Terrace, Confluence of River and Stream
Analytic Period 3: 8000–5000 cal BP			
Buck Lake, Mount Rainier NP	45PI438	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Mountain Lake
Cedar River Outlet Channel, Chester Morse Lake	45KI25	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Mountain Lake, Outlet and Beach
Cedar River Outlet Channel, Chester Morse Lake	45KI32	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Mountain Lake, Outlet and Beach
Chambers Creek Sites, Steilacoom	Multiple Sites	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Glacial Outwash Drift Plain, Bluff above Marine Littoral
Howard Hanson Site, Upper Green River Drainage	45KI269	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Terrace, River Confluence
Howard Hanson Site, Upper Green River Drainage	45KI273	Specific-Resource Field Camp (Hunting)	River Terrace, River Confluence
Howard Hanson Site, Upper Green River Drainage	45KI277	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Terrace, River Confluence
Howard Hanson Site, Upper Green River Drainage	45KI279	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Terrace, River Confluence
Howard Hanson Site, Upper Green River Drainage	45KI280	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Terrace, River Confluence
Lake Cushman, Upper Skokomish River Drainage	45MS100	Specific-Resource Field Camp (Hunting)	Foothill Valley, River Terrace, Confluence of River and Stream
Du Pont Southwest Site, Bluff above the Nisqually River Delta	45PI72	Specific-Resource Field Camp or Procurement/Processing Site (Shellfishing)	Glacial Outwash Drift Plain, Bluff above River Delta
Jokumsen Site, Southern Enumclaw Plateau	45KI5	Specific-Resource Field Camp (Hunting)	Glacial Outwash Drift Plain
Manette Site, Bremerton	45KP9	Specific-Resource Field Camp (Hunting/Fishing)	Marine Littoral, Mouth of Stream

Table D-1. Selected Assemblages in the Puget Sound Basin by Analytic Time Period

Assemblage and Location	Smithsonian Number	Site Class	Landform
Marymoor Site, Redmond	45KI9	Specific-Resource Field Camp (Hunting)	Alluvial Floodplain, River and Stream Confluence
Mossyrock Reservoir Sites, Lewis County	Multiple Sites	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Terrace
Mule Springs Site, Huckleberry Mountain	45KI435	Specific-Resource Field Camp (Plant Gathering)	Mountain Ridge, Meadow
Ross Lake, North Cascades	45WH79	Multiple-Resource Field Camp or Procurement/Processing Site (Hunting/Lithic Quarry)	Alluvial Fan, Stream
Ross Lake, North Cascades	45WH262	Procurement/Processing Site (Quarry)	Terrace
Ross Lake, North Cascades	45WH277	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Fan, Stream
Ross Lake, North Cascades	45WH281	Procurement/Processing Site (Lithic Quarry)	Alluvial Fan, Intermittent Stream
Ross Lake, North Cascades	45WH286	Base Camp	Alluvial Fan, Stream
Quilcene Site, Olympic Peninsula	45JE18	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Glacial Outwash Drift Plain
Sequim, Olympic Peninsula	45CA426	Specific-Resource Field Camp (Hunting)	Glacial Outwash Drift Plain, River Terrace
Stuwe'yuq[w], Tolt River Drainage	45KI464	Specific-Resource Field Camp (Hunting)	Glacial Outwash Drift Plain
Stillaguamish/Pilchuck River Terrace Sites, Snohomish County	Multiple Sites	Multiple-Resource Field Camps and Procurement/Processing Sites (Hunting/Lithic Quarry)	Glacial Outwash Drift Plains, River Terraces
Sequim, The John Heyer Farm Site	45CA433	Specific-Resource Field Camp (Hunting)	Glacial Outwash Drift Plain, River Terrace
Analytic Period 4: 5000–2500 cal BP			
Buck Lake, Mount Rainier NP	45PI438	Specific-Resource Field Camp (Hunting)	Mountain Lake
Dupont Southwest Site, Bluff above Nisqually River Delta	45PI72	Specific-Resource Field Camp or Procurement/Processing Site (Shellfishing)	Glacial Outwash Drift Plain, Bluff above River Delta
Harbour Pointe, Edmonds	45SN93	Specific-Resource Field Camp or Procurement/Processing Site (Shellfishing)	Glacial Outwash Drift Plain, Bluff above Marine Littoral
Howard Hanson Site, Upper Green River Drainage	45KI269	Specific-Resource Field Camp (Hunting)	River Terrace, River Confluence
Howard Hanson Site, Upper Green River Drainage	45KI271	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Terrace, River Confluence
Howard Hanson Site, Upper Green River Drainage	45KI273	Multiple-Resource Field Camp or Procurement/Processing Site (Hunting/Lithic Quarry)	River Terrace, River Confluence
Howard Hanson Site, Upper Green River Drainage	45KI275	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Terrace, River Confluence
Howard Hanson Site, Upper Green River Drainage	45KI277	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Terrace, River Confluence
Howard Hanson Site, Upper Green River Drainage	45KI280	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Terrace, River Confluence
Imhoff Site, Connell's Prairie Vicinity	45PI44	Specific-Resource Field Camp (Plant Gathering)	Glacial Outwash Drift Plain, Enumclaw Plateau
Koapk Site, Cowlitz Falls	45LE209	Specific-Resource Field Camp (Hunting)	River Terrace, River Falls
Marymoor Site, Redmond	45KI9	Specific-Resource Field Camp (Hunting)	Alluvial Floodplain, River and Stream Confluence
Mule Springs Site, Huckleberry Mountain	45KI435	Specific-Resource Field Camp (Plant Gathering)	Mountain Ridge, Meadow
Ross Lake, North Cascades	45WH79	Procurement/Processing Site (Hunting/Lithic Quarry)	Alluvial Fan, Stream

Table D-1. Selected Assemblages in the Puget Sound Basin by Analytic Time Period

Assemblage and Location	Smithsonian Number	Site Class	Landform
Ross Lake, North Cascades	45WH227	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Fan, Stream
Ross Lake, North Cascades	45WH229	Specific-Resource Field Camp (Hunting)	River Terrace
Ross Lake, North Cascades	45WH247	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Glacial Outwash Terrace, River Valley
Ross Lake, North Cascades	45WH262	Procurement/Processing Site (Lithic Quarry)	River Terrace
Ross Lake, North Cascades	45WH268	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Bedrock Bench
Ross Lake, North Cascades	45WH273	Procurement/Processing Site (Lithic Quarry)	Bedrock Bench, River Valley
Ross Lake, North Cascades	45WH286	Base Camp	Alluvial Fan, Stream
Ross Lake, North Cascades	45WH303	Base Camp	Floodplain Terrace
Ross Lake, North Cascades	45WH496	Procurement/Processing Site (Lithic Quarry)	Glacial Terrace
Quadrant Site, Bothell	45KI72	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Floodplain
Sequim, Olympic Peninsula	45CA426	Base Camp	Alluvial Floodplain
Stuwe'yuq^{w}, Tolt River Drainage	45KI464	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Glacial Outwash Drift Plain
West Point Site Complex, Seattle	45KI428, 45KI429	Base Camp (several discrete components)	Bluff and Marine Littoral
Woodville	45KI11	Multiple-Resource Field Camp	River Terrace
Analytic Period 5: 2500 - 200 cal BP			
Allentown Site, Tukwila	456KI431	Specific-Resource Field Camp or Procurement/Processing Site (Fishing)	Alluvial Floodplain, Stream Confluence
Babak^{w}ob Site, Downtown Seattle	45KI456	Village	Marine Littoral, Mouth of Ravine
Bay Street Shell Midden, Port Orchard	45KP115	Specific-Resource Field Camp (Shellfishing)	Marine Littoral, Mouth of Stream, Mouth of Ravine
Biederbost Site, Duvall	45SN100	Base Camp	Alluvial Floodplain, River and Stream Confluence
Bugge Spit Site, Indian Island	45JE6	Specific-Resource Field Camp (Shellfishing)	Marine Littoral, Sandspit, Tidal Marsh
Burton Acres Site, Vashon Island	45KI437	Specific-Resource Field Camp or Procurement/Processing Site (Fishing)	Marine Littoral, Spring
Carlson Spit Site, SUBASE Bangor	45KP108	Procurement/Processing Site (Shellfishing)	Marine Littoral, Sandspit
Cedar River Outlet Channel, Chester Morse Lake	45KI32	Specific-Resource Field Camp (Hunting)	Mountain Lake, Outlet and Beach
Cedar River Outlet Channel, Chester Morse Lake	45KI25	Specific-Resource Field Camp (Hunting)	Mountain Lake, Outlet and Beach
Cedar River Delta, Chester Morse Lake	45KI299	Procurement/Processing Site (Lithic Quarry)	Mountain Lake, River Delta
Chambers Creek Sites, Steilacoom	Multiple Sites	Village	Marine Littoral, Confluence of Stream and Marine Embayment
Duwamish No. 1 Site, West Seattle	45KI23	Multiple-Resource Field Camp (Fish and Shellfish)	Stream Terrace, Marine Littoral
Evergreen Park Site, Bremerton	45KP121	Specific-Resource Field Camp (Shellfishing)	Marine Littoral
Fall City Site, Snoqualmie River	45KI263	Village	River Terrace, Alluvial Floodplain, Stream and River Confluence
George Nelson Allotment Site, Enumclaw Plateau	45KI450	Specific-Resource Field Camp (Plant Gathering)	Osceola Mudflow, Prairie
Health Clinic Site, Enumclaw Plateau	45KI494	Specific-Resource Field Camp (Plant Gathering)	Osceola Mudflow, Prairie

Table D-1. Selected Assemblages in the Puget Sound Basin by Analytic Time Period

Assemblage and Location	Smithsonian Number	Site Class	Landform
Imhoff Site, Connell's Prairie Vicinity	45PI44	Specific-Resource Field Camp (Plant Gathering)	Enumclaw Plateau
Jokumsen Site, Enumclaw Plateau	45KI5	Specific-Resource Field Camp (Plant Gathering)	Glacial Outwash Drift Plain
Koapk Site, Cowlitz Falls	45LE209	Specific-Resource Field Camp or Procurement/Processing Site (Fishing)	River Terrace, River Falls
Marymoor Site, Redmond	45KI9	Multiple Resource Field Camp (Fishing and Hunting)	Alluvial Floodplain, Confluence
Muckleshoot Amphitheater Site, Enumclaw Plateau	45KI445	Specific-Resource Field Camp (Plant Gathering)	Osceola Mudflow, Prairie
Muckleshoot Library Site, Enumclaw Plateau	45KI842	Specific-Resource Field Camp or Procurement/Processing Site (Fishing)	Osceola Mudflow, Prairie
Mule Springs Site, Huckleberry Mountain	45KI435	Base Camp	Mountain Ridge, Meadow
Naches Lithic Scatter	USFS CR05-07-31	Multiple-Resource Field Camp (Hunting and Lithic Quarry)	Mountain Ridge Crest Meadow
Old Man House, Suquamish	45KP2	Village	Marine Littoral
Port Madison Reservation	45KP43	Procurement/Processing Site (Shellfishing)	Marine Littoral
Port Madison Reservation	45KP47	Procurement/Processing Site (Shellfishing)	Marine Littoral
Renton High School Indian Site, Renton	45KI501	Procurement/Processing Site (Fishing)	Alluvial Floodplain, Old River Channel
Ross Lake, North Cascades	45WH79	Procurement/Processing Site (Hunting/Lithic Quarry)	Alluvial Fan, Stream
Ross Lake, North Cascades	45WH227	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Fan, Stream
Ross Lake, North Cascades	45WH228	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Fan, Stream
Ross Lake, North Cascades	45WH229	Specific-Resource Field Camp (Hunting)	River Terrace
Ross Lake, North Cascades	45WH230	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Glacial Terrace
Ross Lake, North Cascades	45WH232	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Fan, Intermittent Stream
Ross Lake, North Cascades	45WH237	Procurement/Processing Site (Lithic Quarry)	Glacial Terrace
Ross Lake, North Cascades	45WH239	Procurement/Processing Site (Lithic Quarry)	Alluvial Fan, Intermittent Stream
Ross Lake, North Cascades	45WH241	Procurement/Processing Site (Hunting/Lithic Quarry)	Alluvial Fan, Stream
Ross Lake, North Cascades	45WH253	Procurement/Processing Site (Lithic Quarry)	Glacial Terrace, Stream
Ross Lake, North Cascades	45WH255	Procurement/Processing Site (Hunting/Lithic Quarry)	Glacial Terrace, Stream
Ross Lake, North Cascades	45WH262	Procurement/Processing Site (Lithic Quarry)	River Terrace
Ross Lake, North Cascades	45WH264	Procurement/Processing Site (Hunting/Lithic Quarry)	River Terrace
Ross Lake, North Cascades	45WH268	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Bedrock Bench
Ross Lake, North Cascades	45WH277	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Fan, Stream
Ross Lake, North Cascades	45WH283	Specific-Resource Field Camp (Hunting)	Bedrock Bench
Ross Lake, North Cascades	45WH296	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Floodplain
Ross Lake, North Cascades	45WH300	Base Camp	Glacial Terrace

Table D-1. Selected Assemblages in the Puget Sound Basin by Analytic Time Period

Assemblage and Location	Smithsonian Number	Site Class	Landform
Ross Lake, North Cascades	45WH302	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Fan
Ross Lake, North Cascades	45WH303	Specific-Resource Field Camp (Hunting)	Floodplain Terrace, Abandoned River Channel
Ross Lake, North Cascades	45WH304	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	River Floodplain
Ross Lake, North Cascades	45WH473	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Glacial Terrace
Port Blakely Site, Bainbridge Island	45KP104	Specific-Resource Field Camp or Procurement/Processing Site (Shellfishing)	Marine Littoral, Stream Delta
Sbabadid, Renton	45KI51	Specific-Resource Field Camp or Procurement/Processing Site (Fishing)	Alluvial Floodplain, River Channel
Schodde-Anderson Site, Connell's Prairie Vicinity	45PI45	Specific-Resource Field Camp (Plant Gathering)	Enumclaw Plateau
Sequim	45CA426	Specific-Resource Field Camp or Procurement/Processing Site (Hunting)	Alluvial Floodplain
Tualdad Altu, Renton	45KI59	Specific-Resource Field Camp or Procurement/Processing Site (Fishing)	Alluvial Floodplain, River Channel
Walan Point Site, Indian Island	45JE16	Specific-Resource Field Camp (Shellfishing)	Marine Littoral
West Point Site Complex, Seattle	45KI428, 45KI429	Specific-Resource Field Camp or Procurement/Processing Site (Shellfishing)	Marine Littoral, Sandspit, Tidal Marsh
White Lake Site, Tukwila	45KI438	Specific-Resource Field Camp or Procurement/Processing Site (Plant Gathering)	Alluvial Floodplain, Floodplain, Lake, River Confluence

Table D-2. King County Archaeological Sites with Native American Components, Washington State Department of Archaeology and Historic Preservation Inventory Forms

Site No.	Common Name (s)	Primary References*	Site Type as Recorded	KC Context Site Type**	Age(s) (^{14}C dates uncalib.)	Observed Contents and Character
45KI1	-	Burroughs 1950*; Greengo 1958*	Camp or Refuge	Resource Procurement – General	Unknown	Surface collection of bone and stone tools near Ft. Lawton
45KI2	-	Bryan (1950?)*	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Thin and disturbed layer of shell and fire-modified rock (FMR)
45KI3	-	Bryan 1953*; Moura 1981	Shell Midden and Campsite or Village	Village	Unknown	Shell midden layers, one or more burials near Redondo Beach
45KI4	Pedersen Site	Esther 1962*	Artifact Collection	Resource Procurement – General	Unknown	Variety of chipped and ground stone tools, beads, and debitage observed and collected on Enumclaw Plateau
45KI5 (AP 3)	Jokumsen Site	Esther 1962*; Hedlund 1983	Camp or Village	Resource Procurement – General	Pre-Osceola Mudflow (5600 cal BP)	Sparse lithics in pre-Osceola component on Enumclaw Plateau
45KI5 (AP 4–5)	Jokumsen Site	Esther 1962*; Hedlund 1983	Camp or Village	Multiple-Resource Field Camp	Post-Osceola Mudflow (5600 cal BP)	Abundant lithic artifacts, FMR, and "house pits" in post-Osceola component on Enumclaw Plateau
45KI6	-	Holmes 1963*	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Buried shell midden along Green River near Orillia
45KI7	-	Holmes 1963*	"Open"	N/C	Unknown	A few lithics associated with a mound near Big Soos Creek

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Site No.	Common Name (s)	Primary References*	Site Type as Recorded	KC Context Site Type**	Age(s) (^{14}C dates uncalib.)	Observed Contents and Character
45KI8	-	Greengo 1966*	Presumably Occupation	Resource Procurement – General	Unknown, but one reported fluted point	Lithics collected from both sides of Sammamish River near Redmond
45KI9	Marymoor Site	Greengo 1966; Greengo and Houston 1970; Hodges 2004	Occupation Site	Multiple-Resource Field Camp	2500±150 1860±110 Olcott-style Lithics	Extensive and stratified charcoal-stained deposits, abundant lithic artifacts near Sammamish River in Marymoor Park
45KI10	-	Greengo and Houston 1970; Norman 2000a	Prehistoric Lithic Scatter	Resource Procurement – General	Unknown	Sparse lithics in upper meter of sediment along Sammamish River in Marymoor Park
45KI11	-	Greengo 1964*; Earley 2006; Shong, Miss, et al. 2007; Shantry et al. 2008	Occupation; Pre-Contact Camp	Base Camp	2600±40	Extensive deposits of non-shell midden, lithics including microblades and sourced obsidian, calcined bone, FMR, botanical remains, human burial
45KI12	Bridge Site; Sammamish Slough	Thomas 1978	Artifact and FMR Scatter	Resource Procurement – General	Unknown	Buried deposit of FMR, charcoal, and a few undiagnostic lithics under an ash layer (sampled but not analyzed) near Bothell
45KI13	Mahler Park Site	Sanger and Kidd 1965*; Hedlund 1983	Artifact Collection	Resource Procurement – General	Unknown	Surface collection of debitage and some stone tools near Enumclaw
45KI18	-	Deane 1966*	Artifact Collection	N/C	Unknown	Report of artifacts by I5 construction workers along east side of Duwamish valley
45KI19	Tokul Creek	Onat and Bennett 1968	Camp	Specific-Resource Field Camp	Unknown	Lithic artifacts, some faunal remains, and several hearth feature along Snoqualmie River near Fall City
45KI20	-	Onat 1967*; Anon. 1974*	Possible Village	Base Camp	Unknown	Diverse lithic artifacts, beads, and faunal remains from surface collection near Fall City
45KI21	Bohn Site	Hedlund 1972*; Hedlund 1983	Possible Village	Resource Procurement – General	Post-Osceola Mudflow (5600 cal BP)	Extensive scatter of chipped and ground stone artifacts on Enumclaw Plateau
45KI22	Bear Creek Shell Midden	Robinson 1973 and 1987*; Heller n.d.*; Younger 1993*; Weber 1994*	Freshwater Shell Midden	Resource Procurement – Shellfish	Unknown	Freshwater mussel shell midden deposits, FMR, sparse flaked and ground stone tools along upper Bear Creek
45KI23	Duwamish No. 1	Munsell 1975*; Campbell 1981; URS and BOAS 1987	Shell Midden	Multiple-Resource Field Camp	15 ^{14}C dates between 1980±120 and 110±80	Extensive shell midden deposit with FMR, several posthole and hearth features along the west side of Duwamish River
45KI25	Cedar River Outlet Site	Lewarch 1978; Samuels 1993	Seasonal Camp	Multiple-Resource Field Camp	6 ^{14}C dates between 8540±110 and 700 ±90	Deflated beach deposit of numerous FMR concentrations, abundant lithic debitage and tools, and at least one buried organic feature along shore of Chester Morse Lake
45KI27	-	Lewarch 1978; Samuels 1993	Artifact Scatter	Resource Procurement – Hunting	Unknown	Sparse scatter of chipped stone artifacts and debitage along shore of Chester Morse Lake
45KI29	-	Lewarch 1978; Samuels 1993	Artifact and FMR Scatter	Resource Procurement – Hunting	Unknown	Sparse scatter of FMR and chipped stone artifacts and debitage along shore of Chester Morse Lake

Table D-2. King County Archaeological Sites with Native American Components, Washington State Department of Archaeology and Historic Preservation Inventory Forms

Site No.	Common Name (s)	Primary References*	Site Type as Recorded	KC Context Site Type**	Age(s) (^{14}C dates uncalib.)	Observed Contents and Character
45KI30	-	Lewarch 1978; Samuels 1993	Artifact and FMR Scatter	Specific-Resource Field Camp	Unknown	Sparse clusters of FMR and chipped stone artifacts and debitage along shore of Chester Morse Lake
45KI31	-	Lewarch 1978; Samuels 1993	Artifact and FMR Scatter	Multiple-Resource Field Camp	Unknown	Clusters of FMR, chipped and ground stone artifacts and debitage along shore of Chester Morse Lake
45KI32	-	Lewarch 1978; Samuels 1993	Artifact Scatter	Multiple-Resource Field Camp	1595±100 1210±90	Deflated beach deposit of several FMR concentrations and abundant lithic debitage and tools along shore of Chester Morse Lake
45KI33	Pheasant Farm	Hedlund 1977*; Hedlund 1983	Artifact Scatter	Resource Procurement – General	Post-Osceola Mudflow (5600 cal BP)	Scatter of lithic debitage, a few chipped and ground stone tools on Enumclaw Plateau
45KI34	Fitch Site	Hedlund 1977*	Artifact Scatter	Resource Procurement – General	Unknown	Scatter of lithic debitage and a few chipped stone tools near Naches Pass
45KI35	Twin Camps Lithic Scatter	Hedlund 1977*; Eggler 1989*	Artifact Scatter	N/C	Unknown	Scatter of lithic debitage near headwaters of Twin Camps Creek
45KI36	Government Meadows Camp	Hedlund 1977*; McDonald and Coughlin 1989*	Summer Camp	N/C	Unknown	Scatter of lithic debitage near Naches Pass
45KI37	Meadow Creek Site	Hedlund 1977*	Quarry and Summer Camp	Resource Procurement – Lithic Quarry	Unknown	Scatter of cores and debitage near Naches Pass
45KI38	Lizard Lake Site	Hedlund 1977*	Summer Camp	Specific-Resource Field Camp	Unknown	Lithic debitage, one lithic tool, and hearth features near Stampede Pass
45KI39	Elliott Bay Petroglyph	McClure 1978*	Petroglyph	Petroglyph	Unknown	Reported petroglyph on boulder in Elliott Bay
45KI40	Green River Petroglyph	McClure 1977*	Petroglyph	Petroglyph	Unknown	Petroglyph on bedrock outcrop in Green River Gorge
45KI41	-	Holmes and Possehl 1963*	Canoe	N/C	Proto-contact	Dugout canoe exposed in clay riverbank deposit along Green River
45KI42	-	Beyer 1976; Storey 2010*	Temporary Camp	Resource Procurement – Shellfish/Fish	Unknown	Shell midden deposits near Seahurst Park
45KI43	-	Beyer 1976	Temporary Camp	Resource Procurement – Shellfish/Fish	Unknown	Shell midden deposits near Seahurst Park
45KI50	-	Onat 1968*	Village or Camp	N/C	Proto-contact and possibly earlier	Ethnohistoric account of Indian settlement and landowner artifact collections near Fall City and across Snoqualmie River from 45KI19
45KI51	Sbabadid Site; Earlington Woods Site	Hanley 1979*; Chatters 1981; Butler 1990	Early historic village	Multiple-Resource Field Camp	AD 1790–1865 from historic artifacts and documents	Extensive deposit of burnt shell midden, FMR, a variety of features, debitage, faunal remains, human burial along former Black River channel in Renton
45KI52	-	Waterman 1920; Hanley 1979*	Winter village	Village	Proto-contact	Reported village location along west side of Duwamish River based on Waterman's work
45KI53	-	Hartman 1980*	Temporary camp	Resource Procurement – General	Unknown	Scatter of debitage (incl. obsidian) and a few chipped stone tools near east end of Huckleberry Mountain

Table D-2. King County Archaeological Sites with Native American Components, Washington State Department of Archaeology and Historic Preservation Inventory Forms

Site No.	Common Name (s)	Primary References*	Site Type as Recorded	KC Context Site Type**	Age(s) (^{14}C dates uncalib.)	Observed Contents and Character
45KI54	-	Hartman 1980*; Carter 1980*; Wall 1980*	Temporary Camp	Resource Procurement – General	Unknown	Scatter of debitage and a few chipped stone tools near east end of Huckleberry Mountain
45KI55	McDevitt Site	Mattson 1980*; Stump and Stone 2000; Williams 2006*; LeTourneau 2008*	Village	Base Camp	Possible Olcott component based on weathering on some debitage	Extensive development of anthropogenic prairie soil and associated lithic debitage (incl. obsidian) along lower Griffin Creek
45KI58	-	Moura 1980	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Thin shell midden stratum and core between Dash Point and Redondo Beach
45KI59	Tualdad Altu; Earlington Woods	Vance 1980*; Chatters 1988; Butler 1990	Seasonal Fishing and Hunting Camp	Multiple-Resource Field Camp	1570±90 1560±50	Extensive deposit of mussel shell lenses, numerous features including postmolds, abundant artifacts and faunal remains
45KI62	Muckleshoo t	Hedlund 1981*; Hedlund 1983	Undetermined	N/C	Unknown	Sparse artifact scatter
45KI63	Flaming Geyser Petroglyph	Hedlund 1981*	Petroglyph	Petroglyph	Unknown	Petroglyph along Green River, probably the same as 45KI40
45KI64	Noble-Smith Site	Hedlund 1981*; Hedlund 1983; Parvey and Hodges 2004	Fishing Camp (1981); Lithic Scatter (2004)	Resource Procurement – General	Unknown	Relatively dense concentration of lithic tools and debitage along Newaukum Creek on the Emumclaw Plateau
45KI65	Southwood Elementary Site	Hedlund 1981*; Hedlund 1983	Temporary Camp	Resource Procurement – General	Unknown	Sparse scatter of debitage and chipped stone tools near Boise Creek on Enumclaw Plateau
45KI66	Moergeli Site	Hedlund 1981*; Hedlund 1983	Lithic Scatter	Resource Procurement – General	Unknown	Debitage and chipped and ground stone tools from private collections made near Boise Creek on Enumclaw Plateau
45KI67	Cumberland Sod Farm	Hedlund 1981*; Hedlund 1983	Possible Winter Village	Resource Procurement – General	Unknown	Debitage and chipped and ground stone tools from private collections made along White River on Enumclaw Plateau
45KI68	White River Bank Site	Hedlund 1981*; Hedlund 1983	Possible Winter Village	Resource Procurement – General	Unknown	Debitage and chipped and ground stone tools along White River on Enumclaw Plateau
45KI69	Tacoma Water Pipe Site	Hedlund 1981*; Hedlund 1983	Lithic Scatter	Resource Procurement – General	Unknown	Debitage and chipped stone tools near Boise Creek and White River on Enumclaw Plateau
45KI70	Boise Creek Site	Hedlund 1981*; Hedlund 1983	Possible Temporary Camp	Resource Procurement – General	Unknown	Unspecified lithic artifacts near confluence of Boise Creek and White River on Enumclaw Plateau
45KI71	Cooper's Corner	Hedlund 1981*; Hedlund 1983; Kopperl 2006b	Possible Winter Village	Resource Procurement – General	Unknown	Abundant chipped stone tools on Enumclaw Plateau
45KI72	Quadrant Site	Chatters 1981; Chatters 1982*	Temporary Camp	Specific-Resource Field Camp	2660 [no error term given in documentation] ; Olcott-style lithics	Concentrations of FMR and charcoal-rich sediments and sparse chipped stone tools in North Creek valley near Bothell
45KI207H	White River Massacre Site	Hansen 1971*	Ethnohistoric Site	N/C	AD 1855	Location recorded based on historic documentation, along west side of Green River near Kent
45KI215	Hamilton Bog	Meltzer and Dunnell 1987	Isolated projectile point	N/C	Paleoindian	Fluted Point found in peat bog near Maple Valley

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45KI263	Fall City Riverfront Park Site	Buck 1982; Rhode 1985; Nelson 1998a, 2000a; Schumacher and Burns 2005	Possible Village	Village	100±60 380±60 400±40 450±40 460±60 490±40	Extensive stratified occupation surfaces, numerous features, abundant lithic artifacts, FMR, and faunal remains on Snoqualmie River floodplain near Fall City
45KI264	Hubers Site	Larson 1985*	Seasonal Plant Processing Camp and Indian Homestead	Specific-Resource Field Camp	Pre-contact and early historic components	FMR and historic debris near Newaukum on Enumclaw Plateau
45KI265	Brant Site	Larson 1985*	Seasonal Plant Processing Camp	Specific-Resource Field Camp	Unknown	Dense and extensive concentration of FMR, sparse lithic debitage near Newaukum on Enumclaw Plateau
45KI266	-	Elridge 1984*	Artifact Scatter	N/C	Unknown	Buried artifact scatter reported by local informants in eastern portion of Marymoor Park
45KI267	*Swa'wa tix təd* ; Surge Tank Hill	Kennedy 1985a	Artifact Scatter	Resource Procurement – General	Possibly Olcott	Several expedient chipped stone tools on bedrock island in valley near confluence of Green and Black Rivers, may be associated with Waterman place name
45KI268	-	Benson 1985*; Benson 1986	Artifact and FMR Scatter	N/C	Unknown	Scatter of lithic debitage and FMR on deflated terrace along Howard Hanson Reservoir
45KI269	-	Benson 1985*; Benson 1986	Artifact and FMR Scatter	N/C	Unknown	Scatter of lithic debitage and FMR on deflated terrace along Howard Hanson Reservoir
45KI270	-	Benson 1985*; Benson 1986	Artifact scatter and hearth	Specific-Resource Field Camp	Unknown	A few lithics associated with FMR concentration on deflated terrace along Howard Hansen Reservoir
45KI271	-	Benson and Moura 1985*; Benson 1986	Artifact Scatter	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and tools on deflated terrace along Howard Hansen Reservoir
45KI272	-	Moura 1985*; Benson 1986	Artifact Scatter	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and tools on deflated terrace along Howard Hansen Reservoir
45KI273	-	Moura 1985*; Benson 1986	Artifact Scatter	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and tools on deflated terrace along Howard Hansen Reservoir
45KI274	-	Moura and Benson 1985*; Benson 1986	Artifact Scatter	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and tools on deflated terrace along Howard Hansen Reservoir
45KI275	-	Moura and Benson 1985*; Benson 1986	Artifact Scatter	N/C	Unknown	Scatter of lithic debitage on deflated terrace along Howard Hansen Reservoir
45KI276	-	Moura 1985*; Benson 1986	Artifact Scatter	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and tools on deflated terrace along Howard Hansen Reservoir
45KI277	-	Benson and Moura 1985*; Benson 1986	Artifact Scatter	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and tools on deflated terrace along Howard Hansen Reservoir
45KI278	-	Moura 1985*; Benson 1986	Possible Habitation Site	Specific-Resource Field Camp	Unknown	Possible hearth and scatter of lithic debitage and tools on deflated terrace along Howard Hansen Reservoir

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Site No.	Common Name (s)	Primary References*	Site Type as Recorded	KC Context Site Type**	Age(s) (^{14}C dates uncalib.)	Observed Contents and Character
45KI279	-	Benson and Moura 1985*; Benson 1986	Artifact Scatter	N/C	Unknown	Scatter of lithic debitage on deflated terrace along Howard Hansen Reservoir
45KI280	-	Benson and Moura 1985*; Benson 1986; Walker et al. 2009	Artifact Scatter	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and tools on deflated terrace along Howard Hansen Reservoir
45KI281	-	Moura 1985*; Benson 1986; Walker et al. 2009	Habitation Site	Specific-Resource Field Camp	Unknown	FMR concentration and scatter of lithic debitage and tools on deflated terrace along Howard Hansen Reservoir
45KI290	Cedar River Rockshelter	Robinson 1986*	Artifact scatter in rockshelter	N/C	Unknown	Two lithic flakes (one obsidian) in rockshelter along south side of Cedar River near Landsburg
45KI291	Skykomish Rockshelter	Gough 1986*; Gough 1987*	Rockshelter occupation	Resource Procurement – Fishing	90±50	Stacked rock wall feature, hearth feature, faunal remains, and sparse lithic debitage and tools in rockshelter along north side of Skykomish River near Miller River
45KI293	Pit Site	Miss 1987*	Pit Feature	Resource Procurement – General	Unknown	Pit filled with charcoal, burned cobbles (some flaked) and FMR on terrace above Big Soos Creek
45KI296	FMR & Lithic Scatter	Miss 1987*	Lithic and FMR Scatter	Resource Procurement – Shellfish	Unknown	Sparse scatter of FMR and lithic debitage and one freshwater mussel shell on terrace along Covington Creek
45KI298	Rex River Delta	Taylor 1987*; Samuels 1993	Undetermined	N/C	Unknown	Sparse debitage scatter at edge of delta along Chester Morse Lake
45KI299	Cedar River Levee	Taylor 1987*; Samuels 1993	Temporary Plant Processing Camp	Specific-Resource Field Camp	Unknown	Lithic debitage and sparse lithic tools interspersed with numerous FMR concentrations along Cedar River near head of Chester Morse Lake
45KI300	Green Point Creek	Taylor 1987*; Samuels 1993	Temporary Camp	Resource Procurement – General	Post-2000 BP based on projectile point styles	Sparse debitage and projectile points along north shore of Chester Morse Lake
45KI422/ 45KI423	Salish Lake Canoe	Walker 1989*	Canoe	N/C	Unknown	Mostly complete cedar dugout canoe near west end of Angle Lake
45KI428/45KI429 (AP4)	West Point Site Complex	Larson and Lewarch 1995	Base Camp or Village	Base Camp	36 of 68 ^{14}C dates (Components 1–2) range between 5000 and 2500 cal BP	Horizontally and vertically extensive shell midden deposits with features, abundant faunal remains, and artifacts
45KI428/45KI429 (AP5)	West Point Site Complex	Larson and Lewarch 1995	Base Camp or Village	Multiple-Resource Field Camp	32 of 68 ^{14}C dates (Components 3–5) range between 2500 cal BP and contact	Horizontally and vertically extensive shell midden deposits with features, abundant faunal remains, and artifacts
45KI430	Tradition Lake Peeled Cedar	Robinson and Rice 1992	Culturally Modified Trees	Culturally Modified Tree	Unknown	Grove of peeled cedars near Tradition Lake on Tiger Mountain

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45KI431	Allentown Shell Midden	Lewarch, Larson, et al. 1996	Fishing and Hunting Camp	Multiple-Resource Field Camp	15 C14 dates between 570±50 and Modern	Small but diverse lithic and bone artifact assemblage, abundant faunal remains, and one historic-period Native American pit feature along Duwamish River
45KI432	Harbor Avenue Shell Midden	Solimano et al. 1993	Shell Midden	Resource Procurement – Shellfish/Fish	620±50	Partially disturbed shell midden deposit with faunal remains and FMR along western edge of former Duwamish delta front
45KI434	Rainy Season Lake	Hicks et al. 1994	Temporary Camp	Multiple-Resource Field Camp	Projectile point styles ranging from Late Cascade to Late Cayuse phase	FMR concentrations, scatters of lithic debitage (incl. obsidian) and chipped and ground tools along shoreline of Rattlesnake Lake near Cedar River
45KI435	Mule Spring	Miss and Nelson 1995	Temporary hunting/berry collecting camp	Multiple-Resource Field Camp	880±70 1690±80 2510±60 3830±70 4320±90 Tephra and projectile point chronologies	Dense concentrations of debitage (including obsidian) and some chipped stone tools, possible berry processing trenches, near spring on Huckleberry Mountain
45KI436	Salt Water State Park Shell Midden	Solimano 1994*; Smith 2009	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Shell midden deposit with FMR, faunal remains, sparse lithic debitage at Saltwater State Park north of Redondo Beach
45KI437	Burton Acres Shell Midden	Stein and Phillips 2002; Kopperl 2001	Shell Midden	Resource Procurement – Shellfish/Fish	14 ^{14}C dates between 1200±40 and 70±50, as well as historic-era artifacts in uppermost intact midden	Highly eroded shell midden deposit with chipped stone and bone tools, abundant faunal remains, along Quartermaster Harbor on Vashon Island
45KI438	White Lake Site	Lewarch, Larson, et al. 1996	Temporary camp	Specific-Resource Field Camp	30±50 70±50 130±50 340±50	Thin, stratified occupation strata with low densities of artifacts and faunal remains, near confluence of Green and former Black Rivers
45KI439	Renton Sears-Fred Meyer Store Site	Lewarch 1994	Temporary fishing and hunting camp	Specific-Resource Field Camp	Unknown	Buried organic sheet midden strata, FMR concentrations and hearth features, calcined bone, and very sparse lithic debitage at base of channel fill deposit along former Black River
45KI443	Smith-Parker Petroglyph	Robinson 1995	Petroglyph	Petroglyph	Unknown	Fish and rayed-disc imaged pecked on boulder along Raging River near Fall City
45KI444	Miller Creek Site	Lewarch 1996*	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Shell, charcoal, and FMR fragments observed on the surface of terrace of Miller Creek south of Three Tree Point
45KI445	Muckleshoot Amphitheatre Site	Lewarch, Robbins, et al. 2000	Plant Gathering Site	N/C	<800 BP based on projectile point similar to 45KI23 points	Scatter of FMR and lithic debitage and tools on the Enumclaw Plateau
45KI446	M. Jordan Perrine Shell Midden	Leeds 1996	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Thin unstratified shell midden deposit with organic sediments and some FMR midway down bluff embankment behind Normandy Beach Park

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Site No.	Common Name (s)	Primary References*	Site Type as Recorded	KC Context Site Type**	Age(s) (^{14}C dates uncalib.)	Observed Contents and Character
45KI448	Tonga Ridge Meadow Site	Huelsbeck and Ritchie 1995*	Resource Procurement Site	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and tools identified in trail tread along saddle north of Alpine Lakes Wilderness Area
45KI449	Des Moines Midden	Wessen 1997*; Iversen et al. 2000; Chatters 2001b	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Disturbed (and disputed) shell midden deposits with fish bone, FMR, and charcoal near mouth of Des Moines Creek
45KI450	George Nelson Allotment	Lewarch, Forsman, et al. 2000	Field Camp	Base Camp	<1000 BP based on small triangular and side-notched projectile points	Dense concentration of lithic debitage and tools, FMR, and features including postmolds on the Enumclaw Plateau
45KI454	Tollgate Farm Site	Podzorski and Blukis Onat 1998	Artifact Scatter	Multiple-Resource Field Camp	<1000 BP based on projectile point style	Scatter of FMR, lithic debitage, and some chipped stone tools on terrace of South Fork Snoqualmie River near North Bend
45KI455	Tollgate Farm	Lockwood and Hoyt 2013	Pre-Contact Camp	N/C	Unknown	Sparse lithic artifacts and FMR in primarily an historic archaeological deposit
45KI456	*Baba'k^{w}ob*	Lewarch et al. 2002	Shell Midden and Possible Ethnohistoric Village	Multiple-Resource Field Camp	Proto-contact based on ethnohistoric documentation	Disturbed shell midden deposits with historic faunal remains, charcoal, and at least one thermal feature in downtown Seattle
45KI457	-	Nelson 1998b	Lithic Scatter, possible hunting camp	Multiple-Resource Field Camp	Unknown	Lithic debitage and tool scatter with one FMR concentration along North Fork Issaquah Creek
45KI458	Meadow-brook Farm Site	Podzorski 1998*	Lithic and FMR Scatter	N/C	Unknown	Scatter of lithic debitage and FMR on a terrace near South Fork Snoqualmie River
45KI459	Bone Lake Trail	Nelson 1993; Hollenbeck 1996*	Ethnographic Trail	Trail	Unknown	Segments of unmaintained trail tread on Huckleberry Mountain, historic documentation
45KI460	Christoff Trail	Nelson 1993; Hollenbeck 1996*	Ethnographic Trail	Trail	Unknown	Segments of unmaintained trail tread on Huckleberry Mountain, historic documentation
45KI461	Section 18 Trail	Nelson 1993; Hollenbeck 1996*	Ethnographic Trail	Trail	Unknown	Segments of unmaintained trail tread near Huckleberry Mountain, historic documentation
45KI462	Twin Creeks Trail	Nelson 1993; Hollenbeck 1996*	Ethnographic Trail	Trail	Unknown	Segments of unmaintained trail tread near Huckleberry Mountain, historic documentation
45KI463	Divide Trail	Nelson 1993; Hollenbeck 1996*	Ethnographic Trail	Trail	Unknown	Segments of unmaintained trail tread near Huckleberry Mountain, historic documentation
45KI464	*Stuwe'yuq^{w}*	Blukis Onat et al. 2001	Camp	Resource Procurement – Hunting	Holocene ^{14}C dates range from 6107±178 to 600±60; Weathering rind dates on lithics range from 7100 to 3600 BP	Horizontally extensive distribution of lithic debitage and tools (incl. sourced obsidian), ground stone tools, sparse faunal remains on glacial terrace above Tolt River
45KI465	Sawmill Ridge Lithic Scatter	Miller 1998	Lithic Scatter	N/C	Unknown	Sparse scatter of lithic debitage and a few tools near spring above Sawmill Creek
45KI466	Bear/Evans Creek Site	Norman 1998	Possible camp	N/C	Unknown	Sparse lithic debitage mixed with historic artifacts along Bear Creek in Redmond

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45KI467	Union Hill Road Site	Norman 1998	Lithic Scatter	Resource Procurement – Hunting	<2000 BP based on projectile point style	One lanceolate projectile point and one lithic flake on terrace of Bear Creek in Redmond
45KI471	-	Burtchard and Miss 1998	Isolated lithic artifact	N/C	Unknown	Single lithic flake on ridge above Greenwater River valley
45KI476	Williams Hole Boulder Shelter	Burtchard and Miss 1998	Rockshelter occupation	Resource Procurement – Hunting	Unknown	Lithic artifacts under boulder overhang on ridge above Greenwater River valley
45KI477	Divide Saddle Lithic Scatter	Burtchard and Miss 1998	Lithic reduction area	N/C	Unknown	Sparse lithic debitage near ridge saddle above Greenwater River valley
45KI481	Tradition Lake Site	Schablitsky et al. 1999	Lithic Scatter	N/C	Unknown	Three pieces of lithic debitage along Tradition Lake on Tiger Mountain
45KI483	South Lindsay Ridge Site	Hamilton 1999*	Raw Material Procurement Site	Resource Procurement – Lithic Quarry	Unknown	Scatter of lithic debitage along ridge dividing Chester Morse Lake and Howard Hansen Reservoir basins
45KI484	North Fork Site	Hamilton 1999*	Raw Material Procurement Site	Resource Procurement – Lithic Quarry	Unknown	Lithic debitage associated with chert outcrop along ridge dividing Chester Morse Lake and Howard Hansen Reservoir basins
45KI485	Deer Antler Site	Hamilton 1999*	Raw Material Procurement Site	Resource Procurement – Lithic Quarry	Unknown	Lithic debitage and point fragment associated with chert outcrop along ridge dividing Chester Morse Lake and Howard Hansen Reservoir basins
45KI486	Upper Rex Basin Site	Hamilton 1999*	Lithic Scatter	N/C	Unknown	Sparse scatter of lithic debitage along ridge dividing Chester Morse Lake and Howard Hansen Reservoir basins
45KI487	Root Wad Site	Hamilton 1999*	Lithic Scatter	N/C	Unknown	Sparse scatter of lithic debitage along ridge dividing Chester Morse Lake and Howard Hansen Reservoir basins
45KI488	-	Norman 1999	Lithic Scatter	Resource Procurement – Hunting	Possibly Olcott based on projectile point and surface weathering on artifacts	Sparse scatter of lithic debitage and a few tools along east shore of Lake Sammamish
45KI489	Jerre's Landing	Stone 1999*	Lithic Scatter	N/C	Unknown	Small scatter of lithic debitage on glacial terrace above Tolt River
45KI490	Phillip Starr Allotment	Murphy and Larson 2001; Herbel and Schalk 2002	Temporary Camp	Multiple-Resource Field Camp	Unknown	Extensive scatter of lithic artifacts and FMR on Enumclaw Plateau
45KI491	-	Robbins and Dugas 2000	Campsite	Multiple-Resource Field Camp	Possibly ethnohistoric	FMR and charcoal concentration near confluence of Snoqualmie and Tolt Rivers
45KI492	Marymoor Trench B	Nelson 2000b; Nelson 2000c	Camp	Multiple-Resource Field Camp	3140±80	Charcoal and FMR concentrations and a few pieces of lithic debitage in Marymoor Park
45KI493	Marymoor Trench F	Nelson 2000b; Nelson 2000c	Camp	Multiple-Resource Field Camp	2300±70 2530±70	Charcoal and FMR concentrations and a few pieces of lithic debitage in Marymoor Park

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45KI494	Health Clinic Site	Murphy 2003	Lithic Scatter	N/C	Unknown	Sparse scatter of lithic debitage on Enumclaw Plateau
45KI495	Swanson Homes Site	Stone 2000	Lithic Scatter	N/C	Unknown	Sparse scatter of lithic debitage on Enumclaw Plateau
45KI497	Lower Griffin Creek Site	Davis 2000*	Lithic Scatter	N/C	Unknown	Sparse lithic debitage and ground slate projectile point mixed with historic debris in Snoqualmie River valley south of Carnation
45KI498	Auburn Station Garage Site	LeTourneau 2001	Lithic Scatter	N/C	Unknown	Sparse lithic debitage mixed with historic debris in Auburn
45KI499	Kanaskat-Palmer No. 01 Site	Luttrell 2001	Temporary Camp	Specific-Resource Field Camp	Unknown	Low-density scatter of lithic debitage, FMR, and faunal remains on terrace of Green River
45KI500	Red Barn Site	Crisson et al. 2001	Temporary Camp	Specific-Resource Field Camp	Unknown	Scatter of lithic debitage and tools , FMR, and calcined bone fragments near a spring adjacent to Jenkins Creek
45KI501	Renton High School Indian Site	Kramer et al. 2001; Lewarch 2006	Multiple resource procurement campsite	Resource Procurement – Fishing	160±70 290±60 340±50 340±50 440±80 460±60	Well-stratified organic midden with numerous hearth, pit, and postmold features, FMR, faunal remains, and stone and bone tools and debitage along former channel of Cedar River
45KI505	Tolt-McDonald	Schalk and Schwarzmiller 2002	Burial	Burial	Mid-19th century based on presence of glass beads	Historic period human burial associated with several glass beads on high terrace of Snoqualmie River
45KI506	-	Nelson 2001	Lithic scatter	N/C	Unknown	Sparse scatter of lithic debitage along Cedar River near Maple Valley
45KI507	-	Nelson 2001	Lithic scatter	N/C	Unknown	Sparse scatter of lithic debitage along Cedar River near Maple Valley
45KI508	Snoqualmie Falls	Garfield 1992*	Ethnographic Landscape/ Traditional Cultural Property	N/C	N/A	Snoqualmie Falls and surrounding landscape
45KI511	Holgate Site	Cooper 2002	Lithic Scatter/Camp	Resource Procurement – General	Unknown	Scatter of lithic debitage and tools on bluff above confluence of Green River and Big Soos Creek
45KI512	-	Crisson 2002	Camp	Resource Procurement – General	Unknown	Sparse scatter of lithic tools and debitage on terrace of Green River near Maple Valley
45KI513	-	Herbel 2001*	Isolate	N/C	Unknown	Chalcedony basal-notched project point found on glacial outwash terrace along Cedar River
45KI514	-	Herbel 2001*	Isolate	N/C	Unknown	Single lithic flake on outwash terrace along Cedar River
45KI516	Joseph Foster Site	Roedel et al. 2002	Artifact scatter	N/C	Unknown, possibly historic period	Buried deposit of lithic debitage and FMR as well as historic artifacts on slight knoll along Duwamish River channel
45KI528	Head of Naches Trail Site	Lewarch 2002*	Resource Procurement Site	N/C	Unknown	Sparse scatter of lithic debitage on Enumclaw Plateau

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45KI550	*K^w ilut* Village Shell Midden	Murphy and Trudel 2003*	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Buried shell midden deposit with faunal remains, FMR, and a few pieces of lithic debitage along Quartermaster Harbor on Vashon Island
45KI551	Marguerite Court	Juell 2002*	Burial	Burial	AD 1840–1880	Ethnohistoric human burial and associated funerary items near Alki Point
45KI567	-	Shong 2003*	Lithic Scatter	N/C	Unknown	Several pieces of lithic debitage along Jem Creek on the eastern edge of Cedar River valley near Maple Valley
45KI570	-	Shong and Juell 2004	Camp	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and burned faunal remains near Jenkins Creek north of Big Soos Creek
45KI577	-	Kopperl 2004a, 2004b	Lithic Scatter	N/C	Unknown	Several pieces of lithic debitage along kettle lake near Cottage Lake
45KI587	*Dexudidew*; Little Cedar River Fishing Site	Lewarch 2004*	Fishing Site	Multiple-Resource Field Camp	500–200 BP based on geoarchaeological inference	Stratified occupation surfaces with FMR, charcoal, calcined fishbone and shell, and sparse lithic debitage along former channel of Cedar River in Renton
45KI610	610 Road Tip-Up Lithic Scatter	Schwarzmiller 2005	Lithic Scatter	N/C	Earlier than 300 BP based on estimate of downed tree	Lithic debitage found in root ball of tree-tip along ridge near headwaters of Seattle Creek
45KI680	Jeffs Farm	Nelson 2003*	Artifact scatter	N/C	19th-early 20th century based on presence of historic artifacts	Lithic flake, shell, FMR, and possible trade bead associated with historic deposit adjacent to Green River channel near Kent.
45KI686	Henry Moses Aquatic Center Site	Kaehler et al. 2004	Temporary Camp	Multiple-Resource Field Camp	200±70	Two hearth features with FMR and charcoal, one with hazlenut shells, buried near former side channel of Cedar River in Renton
45KI692	-	Schalk et al. 2005; Hodges and Carrilho 2007	Residential site, possible village	Multiple-Resource Field Camp	1170±60 1860±80	Buried substantial organic sheet midden, pockets of oxidized sediments, at least one FMR hearth feature, abundant chipped and ground stone tools and debitage, calcined faunal remains on terrace above Snoqualmie River and slough of Tolt River
45KI694	Meridian Valley Flume Site	Kent 2004*	Temporary Camp	Multiple-Resource Field Camp	Unknown	Scatter of flaked stone tools and debitage, possible ground stone tool, and FMR concentrations at mouth of ravine along Big Soos Creek valley
45KI697	Auburn Narrows Hearth	Shong et al. 2011	FMR Feature	N/C	<1000 BP based on geologic setting	FMR feature on floodplain of Green River near confluence with Big Soos Creek
45KI702	-	Luttrell and Ives 2004	Camp	Multiple-Resource Field Camp	5600–3500 BP based on projectile point style and deposition atop Osceola mudflow deposits	Low-density scatter of lithic debitage and some chipped stone tools on the Enumclaw Plateau

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45KI703	-	Blukis Onat et al. 2010; Lockwood et al. 2013	Multiple resource procurement site and occupation	Multiple-Resource Field Camp	12 ^{14}C dates ranging from 950±40 to 390±40	Complex of large buried thermal features and FMR concentrations, flaked and ground stone tools, calcined faunal remains and charred botanical remains adjacent to the Duwamish River channel
45KI705	Mt. Si Manuports	Stilson 2004*	Rock Features/ Cairns	Cairn/Earthworks	Unknown	River cobble concentrations and one stacked rock feature atop Mt. Si
45KI717	-	Willis 2008	Temporary Camp	Multiple-Resource Field Camp	One accepted TL date of 1822±140 cal BP	Buried deposit of lithic debitage (incl. obsidian), tools, and FMR on the Enumclaw Plateau
45KI718	Eastside Terrace Site	Jones & Stokes 2005	Lithic Scatter	Resource Procurement – Hunting	5000–2500 BP based on projectile point styles	Chipped stone tools, including a Cascade-style projectile point, along Kelsey Creek wetland in Bellevue
45KI723	-	LeTourneau et al. 2006	Isolated Artifact	N/C	Unknown	Lithic core associated with deeply buried soil horizon on floodplain of Snoqualmie River near Carnation
45KI724	-	LeTourneau et al. 2006	Stratified multicomponent site	Multiple-Resource Field Camp	Unknown	Buried strata of charcoal stained sediment, some FMR, calcined mammal bone, and lithic debitage on floodplain of Snoqualmie River near Carnation
45KI732	Shimer Shell Midden	Shong and Miss 2012	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Thin shell midden deposit with FMR and faunal remains on Puget Sound beach near Dumas Bay and Dash Point
45KI733	-	Kopperl 2006a, 2006b	Camp	Multiple-Resource Field Camp	Unknown	Extensive scatter of lithic tools and debitage (incl. obsidian) and FMR with several denser concentrations on the Enumclaw Plateau
45KI745	-	Cooper 2006*	Lithic Scatter	N/C	Unknown	Lithic debitage scatter along shore of Howard Hanson Reservoir
45KI746	-	Demuth et al. 2006	Isolated Artifact	N/C	Unknown	Report of a stemmed projectile point found along Tramp Harbor Beach, Vashon Island
45KI747	-	Demuth et al. 2006	Shell midden and possible settlement	Multiple-Resource Field Camp	Unknown	Eroding shell midden deposit at north end of Quartermaster Harbor on Vashon Island with one possible hearth feature, faunal remains, and sparse debitage associated with ethnographic account of nearby village site and a substantial number of artifacts collected by a landowner
45KI753	Yakima Pass Projectile Point	Naess 2007*	Isolated projectile point	Resource Procurement – Hunting	Unknown	Single lanceolate projectile point found on Yakima Pass at headwater of Cedar River
45KI756	Juanita Creek Prehistoric Isolate	Kanaby 2007*	Isolated Artifact	N/C	Unknown	Single lithic flake associated with a buried mixed deposits of historic debris on glacial drift plain southeast of Bothell
45KI757	East Norway Hill Lithic Scatter	Kanaby 2007*; Rooke and Chatters 2009	Lithic Scatter	N/C	Unknown	Two flaked lithic artifacts found buried in single shovel probe on glacial drift plain above Sammamish River valley near Bothell

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45KI782	*si?abalRu?*; Chief's Water	Taylor 2007	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Severely eroded shell midden near Magnolia Beach, along Quartermaster Harbor on Vashon Island, with one piece of lithic debitage observed on beach
45KI783	Dockton Park	Taylor 2007	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Reworked shell midden deposits and modified bone artifacts noted on beach along Quartermaster Harbor on Maury Island
45KI784	Portage Shell Midden	Taylor 2007; Taylor et al. 2009	Shell Midden	Resource Procurement – Shellfish/Fish	1090±40	Shell midden deposits and sparse lithic artifacts near the Portage wetlands between Vashon and Maury Islands and on the adjoining Maury Island uplands
45KI804	-	Hoyt et al. 2008	Culturally Modified Tree	Culturally Modified Tree	Unknown	Fir tree inscribed with a design partially covered with newer growth in the Green River floodplain southwest of Black Diamond
45KI805	-	Hoyt et al. 2008	Culturally Modified Tree	Culturally Modified Tree	Unknown	Maple tree exhibiting modified branch growth, identified as CMT by Muckleshoot Tribe informant
45KI806	Ocepek	Sundberg 2008*	Lithic Scatter	N/C	Unknown	Fragment of concave-based projectile point and lithic flake with weathering characteristic of Olcott sites, found on surface on Enumclaw Plateau
45KI807	-	Root and Ferguson 2009	Artifact Scatter	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and informant accounts of formed lithic tools on an upper terrace of the Green River gorge near Black Diamond
45KI808	-	Root and Ferguson 2009	Artifact Scatter	Resource Procurement – Hunting	Unknown	Lithic tools and debitage and FMR on an upper terrace of the Green River gorge near Black Diamond
45KI810	-	Gilpin 2008*	Isolated Artifact	N/C	Unknown	Buried lithic flake fragment near Black Diamond Lake
45KI812	Black Diamond Lake Lithic Scatter	Gilpin 2008*	Artifact Scatter	N/C	Unknown	Sparse lithic debitage near Black Diamond Lake
45KI813	West Option Parcel Site	McKillop et al. 2008*	Artifact Scatter	N/C	Unknown	Lithic debitage and FMR scatter along glacial outwash terrace above Green River southwest of Black Diamond
45KI815	*Lwalb* Old Channel One	Demuth et al. 2008; Silverman et al. 2010; Schultze et al. 2013	Shell Midden	Resource Procurement – Shellfish/Fish	8 radiocarbon dates on shell, bone, and charcoal suggest occupation spanning the last 300 years	Buried shell midden deposit with FMR, ground antler, and possible ground stone tool on southwest bank of current Duwamish River channel
45KI816	*Lwalb* Old Channel Two	Demuth et al. 2008	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Buried shell midden deposit with charcoal, faunal remains, and one feature on southwest bank of current Duwamish River channel
45KI817	Site Three	Demuth et al. 2008	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Buried midden deposit with highly fragmented shell, bone, and charcoal on southwest bank of current Duwamish River channel

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45KI818	-	Hoyt and Johnson 2009	Feature	Specific-Resource Field Camp	1950±40	Deeply buried concentration of FMR, charcoal rich sediments, and lithic debitage in Sammamish River floodplain
45KI828	Keta Hatchery Site	Chobot et al. 2008	Feature	Resource Procurement – Lithic Quarry	Unknown	Buried burned clay concentration and thermal feature, several lithic flakes and red ochre fragments associated with a nearby ethnographic ochre procurement location
45KI829	Campbell Lumber Company Mill	White et al. 2008	Lithic Scatter	N/C	Unknown	Two pieces of lithic debitage and biface fragment found mixed with historic sawmill deposits along northeast shore of Lake Sammamish
45KI830	-	White et al. 2008	Isolated Artifact	N/C	Unknown	Two pieces of lithic debitage found within a fill deposit associated with an historic sawmill site on the northeast shore of Lake Sammamish
45KI834	-	AMEC 2007; Ferris et al. 2010	Lithic Scatter	N/C	Possibly mid-Holocene based on raw material weathering and landform association	Lithic flakes and cores (incl. obsidian) on an old terrace on the edge of Bear Creek valley
45KI835	-	Hoffman 2008*	Isolated Artifact	N/C	Unknown	Chipped stone unifacially retouched tool on a terrace above Bear Creek east of Redmond
45KI836	-	Hoffman 2008*	Isolated Artifact	N/C	Unknown	Lithic flake on a terrace above Bear Creek east of Redmond
45KI837	-	Hoffman 2008*	Isolated Artifact	N/C	Unknown	Lithic flake found in Bear Creek valley east of Redmond
45KI838	-	Nelson 2008	Isolated Artifact	N/C	Unknown	Possible lithic flake near summit of Snoqualmie Summit ski area
45KI839	Bear Creek Site	Hodges et al. 2009; Kopperl et al. 2010; Kenmostsu 2014; Boersema et al. 2014; Kopperl et al. 2015	Occupation Site	Multiple-Resource Field Camp	Intact paleoarchaic component ~12,500–10,000 cal BP based on projectile point styles, ^{14}C dates, and luminescence dates	Lithic artifacts, including stemmed and concave-based projectile points, and debitage deeply buried under Late Pleistocene/Early Holocene peat deposits and later diatomaceous earth strata near present-day mouth of Bear Creek in Redmond
45KI840	-	Root and Ferguson 2009	Artifact Scatter	N/C	Unknown	One lithic flake and one flake tool on an upper terrace of the Green River gorge near Black Diamond
45KI841	-	Derenick and Nelson 2006	Isolated Artifact	N/C	Unknown	Isolated biface found atop glacial drift plain near Lake Tapps
45KI842	Muckleshoot Library Site	Kopperl 2009	Camp	Multiple-Resource Field Camp	1220±40	Lithic debitage and tool scatter with one small pit feature containing FMR, charcoal and other botanical remains, and lithic debitage on the Enumclaw Plateau

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45KI843	*qebqebaXad*; Manzanita Beach Site	Deppen et al. 2014	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Shell midden deposit with abundant FMR and faunal materials buried under Manzanita Beach Road along Quartermaster Harbor on Maury Island
45KI926	Meadow Creek Lithic 3	Swain 2008*	Lithic Scatter	Resource Procurement – Hunting	Unknown	Scatter of lithic debitage and small contracting-stem projectile point on ridgetop above Meadow Creek and Government Meadow
45KI927	Meadow Creek Lithic 4	Swain 2008*	Lithic Scatter	N/C	Unknown	Sparse scatter of lithic debitage on ridgetop above Meadow Creek and Government Meadow
45KI928	Meadow Creek Lithic 5	Swain 2008*	Lithic Scatter	N/C	Unknown	Two lithic flakes on ridgetop above Meadow Creek and Government Meadow
45KI929	Meadow Creek Isolate 1	Swain 2008*	Isolated Artifact	N/C	Unknown	One lithic flake on ridgetop above Meadow Creek and Government Meadow
45KI930	Essency Creek Site	Piper et al. 2009	FMR Scatter	N/C	Unknown	Buried scatter of FMR on terrace atop Essency Creek ravine and overlooking Snoqualmie River valley
45KI934	-	Kelly 2009*	Lithic Scatter	N/C	Unknown	Lithic artifacts mixed with historic debris in Snoqualmie River floodplain near confluence of Middle and North Forks Snoqualmie River
45KI935	Flaming Geyser State Park Burial	Sharley 2009	Burial	Burial	Late pre-contact or early historic period based on condition of remains	Single human burial on Green River floodplain in Flaming Geyser State Park
45KI936	-	Shong and Miss 2009	Lithic Scatter	N/C	Unknown	Sparse scatter of lithic debitage and FMR on Enumclaw Plateau
45KI937	-	Gilpin et al. 2009	Lithic Artifact	N/C	Unknown	Single lithic flake mixed with historic debris on high terrace above Snoqualmie Falls
45KI938	Pussyfoot Creek Site	Earley 2009*	Camp	Multiple-Resource Field Camp	Unknown	Extensive deposit of lithic tools and debitage, FMR, and calcined bone atop Pussyfoot Creek ravine on Enumclaw Plateau
45KI941	Marymoor Pet Garden	Hoyt and Johnson 2009*	Lithic Scatter	N/C	Unknown	Sparse lithic debitage and animal bone fragment in Marymoor Park
45KI953	Seahurst Park Site	Earley 2010	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Shell midden deposit with FMR and sparse lithic debitage along Puget Sound near mouth of Salmon Creek in Seahurst Park
45KI954	-	Earley 2010	Isolated Artifact	N/C	Unknown	Single lithic flake on beach along Puget Sound near mouth of Salmon Creek in Seahurst Park
45KI956	-	Carrilho 2010*	Isolated Artifact	N/C	Unknown	Lithic flake found in Marymoor Park
45KI957	UW Greenhouse Site	Louderback and Jolivette 2009*	Lithic Scatter	N/C	Unknown	Side-notched projectile point and two lithic flakes found in disturbed deposits along Burke-Gilman Trail on University of Washington campus

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45KI958	SDOT Maintenanc e Yard Site	Van Galder 2010*	Lithic Scatter	N/C	Unknown	One ground stone tool associated with Denny Regrade fill deposit and another ground stone tool associated with deeper intact peat deposits in Denny Regrade area of Seattle
45KI963	-	Elder 2010*	Isolated Artifact	N/C	Unknown	Small barbed cryptocrystalline silicate (CCS) projectile point found Roberts Site #1 along Quartermaster Harbor on Vashon Island
45KI964	Cherry Valley Lithics	Stilson 2010*	Pre-Contact Lithic Material	Resource Procurement – Lithic Quarry	Unknown	Scatter of red jasper debitage and tools near known CCS/jasper outcrops
45KI967	Culturally Modified Trees Tiger Mt. State Forest 1000 Road	Stilson 2010*	Culturally Modified Tree	Culturally Modified Tree	Unknown, Possibly as recent as 1960s	Six western redcedar showing evidence of bark removal on Tiger Mountain
45KI972	Meadow Creek Isolate 2	Swain 2008*	Isolated Artifact	N/C	Unknown	White CCS flake found on surface near Government Meadow in Cascades, USFS
45KI988	-	Ferris and Zuccotti 2010*	Isolated Artifact	N/C	Unknown	Basalt tertiary flake found in probe 80–85 cm below surface (cmbs) near Redmond
45KI997	-	Smith and Komen 2010*	Isolated Artifact	N/C	Unknown	Tertiary flake of volcanic material found on surface in Flaming Geyser State Park, Green River valley floor
45KI998	-	Smith and Komen 2010*	Isolated Artifact	N/C	Unknown	CCS tertiary flake found on surface in Flaming Geyser State Park, Green River valley floor
45KI1000	Salmon Bay Midden	Major 2010*	Shell Midden	Resource Procurement – Shellfish/Fish	Unknown	Marine shell and fire cracked rock exposed in cutbank, as well as in intertidal zone and beach below
45KI1006	-	Elder 2010*	Isolated Artifact	N/C	Unknown	Red CCS biface fragment found buried in secondary fill deposit on Foster Island
45KI1000 7	-	Elder 2010*	Isolated Artifact	N/C	Unknown	Fine-grained volcanic stemmed projectile point found buried in secondary fill deposit on Foster Island
45KI1010	Renton High School Ball Field Site	Shong and Rinck 2011	Temporary Camp	Specific-Resource Field Camp	Unknown, possibly 600-400 cal BP based on nearby site formation data	Two separate loci of lithic artifacts and FMR buried as deep as 220 cmbs in alluvium near former Black River channel in Renton, near 45KI501 and ethnographic *skah-TELBSH* location.
45KI1014	Courville-Moses Site	Earley 2011*	Pre-Contact Lithic Material	N/C	Post-Osceola mudflow	Two flakes and an edge-modified piece buried in A-horizon on Enumclaw Plateau above the confluence of Pussyfoot Creek and White River
45KI1015	-	Earley 2011*	Isolated Artifact	N/C	Post-Osceola mudflow	Edge-modified piece on surface of Enumclaw Plateau
45KI1022	-	Bush and Smart 2011*	Isolated Artifact	N/C	Unknown	Metasediment cobble tool found ~50 cmbs in probe near Green River in Ravensdale

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45KI1024	-	Nelson et al. 2011	Isolated Artifact	N/C	Unknown	Possible edge-modified piece buried near surface in parking strip in Seattle High Point neighborhood
45KI1031	NHWC-1	Zuccotti et al. 2011*	Pre-Contact Lithic Material	N/C	Unknown	Two buried flakes found in probes along Novelty Hill Road near Redmond
45KI1040	-	Cascella 2010*	Isolated Artifact	N/C	Unknown	Flake of red fine-grained volcanic material found in probe within fill deposit along Des Moines Memorial Dr in Burien
45KI1052	-	Cooper 2012	Isolated Artifact	N/C	Unknown	FMR concentration eroding from a terrace on Howard Hanson Reservoir
45KI1053	-	Cooper 2012	Isolated Artifact	N/C	Unknown	Volcanic primary flake eroding from slope near Howard Hanson Reservoir
45KI1055	-	Cooper 2012	Isolated Artifact	N/C	Unknown	Tested CCS cobble near edge of Howard Hanson Reservoir
45KI1074	Eagle Gorge Terrace Site II	Cooper 2012	Pre-Contact Lithic Material	N/C	Unknown	Lithic debitage and tools, calcined bone fragments, FMR within upper meter of probes and TUs on terrace above Howard Hanson Reservoir
45KI1076	Narrow Gorge Site III	Cooper 2012	Pre-Contact Lithic Material	N/C	Unknown	Two lithic flakes on eroding terrace of Howard Hanson Reservoir
45KI1077	Narrow Gorge Site II	Cooper 2012	Pre-Contact Lithic Material	N/C	Unknown	15 pieces of CCS debitage and pumice on eroding terrace of Howard Hanson Reservoir
45KI1078	Narrow Gorge Site I	Cooper 2012	Pre-Contact Lithic Material	N/C	Unknown	4 CCS debitage and 1 volcanic core on eroding terrace of Howard Hanson Reservoir
45KI1079	Overlook Site	Cooper 2012	Pre-Contact Lithic Material	N/C	Unknown	15 pieces of debitage and FMR above terrace of Howard Hanson Reservoir
45KI1080	Sand Bar Site	Cooper 2012	Pre-Contact Camp and Lithic Material	Resource Procurement – Hunting	Archaic, based on stylistic characteristics of artifacts	Dense lithic debitage and tool concentration on former terrace within draw-down zone of Howard Hanson Reservoir
45KI1082	Reservoir's Edge Site	Cooper 2012	Pre-Contact Lithic Material	N/C	Unknown	Sparse volcanic debitage and FMR scatter on terrace at edge of Howard Hanson Reservoir
45KI1083	Eagle Gorge Terrace Site I	Cooper 2012	Pre-Contact Camp and Lithic Material	Multiple-Resource Field Camp	Last 2000 years based on stylistic characteristics of artifacts	FMR, abundant lithic debitage and tools and calcined bone indicating mammal processing and features indicative of plant processing
45KI1090	-	Earley 2012	Pre-Contact Lithic Material	N/C	Unknown	Five lithic flakes in four shovel probes generally within upper 20 cmbs, on Enumclaw Plateau
45KI1091	-	Earley 2012	Pre-Contact Lithic Material	N/C	Unknown	12 lithics in 8 shovel probes generally within upper 20 cmbs, on Enumclaw Plateau
45KI1095	-	Ferris and Zuccotti 2012*	Isolated Artifact	N/C	Unknown	Basalt flake fragment in probe 60 cmbs, along Fifteenmile Creek south of Issaquah
45KI1098	-	Gilpin 2012*	Isolated Artifact	N/C	Unknown	CCS shatter fragment found in probe associated with peat 62-70 cmbs, along Swamp Creek valley north of Kenmore

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45KI1101	-	Zuccotti 2010*	Pre-Contact Lithic Material	N/C	Unknown	Two basalt flakes found in two probes, 0-20 cmbs mixed with modern debris, west of 196th Ave NE
45KI1103	Anderson Site	Daugherty 2008*	"Buried lens of fire-blackened earth plus recent bottles thrown over bank as trash"	N/C	Unknown	Recorded as a thin layer of fire-blackened soil exposed near the base of a cut bank along the shore of Quartermaster Harbor on Vashon Island
45KI1108	Cherry Creek Falls Fish Camp	Stilson 2012*	Pre-Contact Camp	Resource Procurement – Fish	Unknown	Organic-rich sediments, ground and flaked stone artifacts, CMTs, and stone weir on creek flat below water fall, near King-Snohomish County line
45KI1114	-	Earley 2012*	Isolated Artifact	N/C	Unknown	CCS flake found 0–20 cmbs in probe on Muckleshoot Reservation
45KI1115	Muckleshoot Smokehouse Site	Earley 2012*	Pre-Contact Lithic Material	N/C	Unknown	Four lithics (three flakes and one perforator) found in two probes, within upper 40 cm, on Muckleshoot Reservation
45KI1116	-	Cascaella and Elder 2012*	Isolated Artifact	N/C	Unknown	Single CCS flake found in "overbank alluvium" near Cedar River channel
45KI1150	Dominick West Lithic Scatter I	Earley 2013*	Pre-Contact Lithic Material	N/C	Unknown	Two lithic flakes found in two shovel probes, 10–30 cmbs, on bluff overlooking White River valley, Muckleshoot Reservation
45KI1151	-	Earley 2013*	Isolated Artifact	N/C	Unknown	Volcanic rock edge-modified piece, found in probe 30–40 cmbs, on bluff overlooking White River valley, Muckleshoot Reservation
45KI1152	Dominick West Lithic Scatter II	Earley 2013*	Pre-Contact Lithic Material	N/C	Unknown	Two flakes of volcanic material found in two probes, 0–30 cmbs, on Muckleshoot Reservation
45KI1153	-	Earley 2013*	Isolated Artifact	N/C	Unknown	CCS core found in a probe, 0–10 cmbs, on Muckleshoot Reservation
45KI1168	-	Marcotte 2012*	Isolated Artifact	N/C	Unknwon	Flake of volcanic rock found in backdirt from spoils dug 10-50 cmbs in planting strip along street in Westwood neighborhood of southwest Seattle
45KI1172	-	Lockwood 2012*	Isolated Artifact	N/C	Unknown	CCS flaked pebble observed during monitoring along East Lake Sammamish Trail north of Issaquah
45KI1176	Maclean Site	Shantry et al. 2014, Shantry, Parvey, et al. 2015	Pre-Contact Camp	Resource Procurement – Hunting	Last 8000 years based on stylistic characteristics of artifacts; ^{14}C date on feature	A variety of lithic tools and debitage, FMR, including intact deposits up to 100 cmbs, and feature found during monitoring, along Issaquah-Fall City Road and North Fork Issaquah Creek
45KI1181	-	Stevenson 2013*	Isolated Artifact	N/C	Unknown	Basalt flake recovered from probe in fill near contact with glacial sediment, along Burke-Gilman Trail near UW campus
45KI1193	-	Ferris 2014*	Pre-Contact Lithic Material	N/C	Unknown	Two flakes, one modified flake, one ground stone fragment, and two FMR found in two probes within disturbed fill layer along Kent-Black Diamond Rd near Berrydale

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45KI1208	Foster Island Site	Lockwood et al. 2014	Pre-Contact Lithic Material	Resource Procurement – General	4000-1500 BP based on projectile point	Low-density scatter of FMR, lithic debitage, several formed tools and one small stemmed projectile point, within upper 20 cm of mixed historic deposit on Foster Island south of SR520
45KI1211	-	Pickrell 2014*	Pre-Contact Shell Midden	N/C	Unknown	Thin (7 cm) exposure of charcoal-rich silt and shell fragments from various taxa of marine shell observed during monitoring on Maury Island, spoils associated with mixed modern debris, ~1/2 mile from nearest shoreline
45KI1216	-	Yorck 2014*	Pre-Contact Lithic Material	N/C	Unknown	5 lithic flakes, scraper, point fragment, FMR, and mammal bone fragments observed during monitoring in exposed intact shoreline deposit below fill along East Lake Sammamish Trail
45KI1217	-	Lockwood 2014*	Pre-Contact Lithic Material	N/C	Unknown	FMR and 12 flakes comprising pre-contact component of multi-component site, recovered within and below plowzone in probes along Mercer Slough in Bellevue
45KI1224	-	Shantry, Rinck, et al. 2015	Pre-Contact Lithic Material	N/C	Unknown	Lithic debitage, primarily from disturbed near-surface deposits, on terrace of White River adjacent to Pinnacle Peak
45KI1227	East Lake Sammamish Lithic Scatter	Hayman 2014*	Pre-Contact Camp	Resource Procurement – General	6670-6500 BP (unclear context)	Charcoal-rich sediment, FMR, mammal bone, and lithic artifacts exposed in a buried A-horizon, along East Lake Sammamish Trail near north end of Lake Sammamish
45KI1228	East Lake Sammamish Lithic Scatter	Hoyt 2014*	Pre-Contact Lithic Material	N/C	Unknown	FMR and lithic flake and scraper associated with buried A-horizon exposed along East Lake Sammamish Trail
45KI1232	Allotment 31 Site	Earley 2015*	Pre-Contact Lithic Material	Resource Procurement – General	Unknown	Widely-dispersed scatter of lithic artifacts (n=154), including a biface fragment, scraper, two cores, and debitage, and bone and shell, found within 48 probes on the Muckleshoot Prairie
45KI1246	-	Nelson 2015*	Isolated Artifact	N/C	Unknown	Jasper flake found on graveled surface at BPA substation near Covington
45KI1247	-	Nelson 2015*	Isolated Artifact	N/C	Unknown	Metasediment core found on ground surface on stream terrace along Jenkins Creek
45KI1248	-	Nelson 2015*	Isolated Artifact	N/C	Unknown	Possible flake or road gravel found on ground surface on stream terrace along Jenkins Creek
45KI1252	-	Shantry, Rinck, et al. 2015	Pre-Contact Lithic Material	N/C	Unknown	Lithic flake and core found in a shovel probe, within disturbed near-surface deposits, on terrace of White River adjacent to Pinnacle Peak
45KI1255	-	Burdick 2014*	Isolated Artifact	N/C	Unknown	Tertiary lithic flake found in probe, 0-20 cmbs, on south side of US 2 near Alpine Falls, east of Skykomish

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45KI1257	-	Stipe 2015*	Pre-Contact Lithic Material	N/C	Unknown	Two flakes and charcoal found ~18 cmbs in probe south of I-90 and west of Tibbets Creek near Issaquah
45KI1261		Costa 2015"	Pre-Contact Lithic Material	N/C	Unknown	Six proximal flakes, 1 shatter, and 1 modified flakes found in probes in disturbed sediments in Redmond, 0.5 mile north of Lake Sammamish
45KI1262		Stegner 2015*	Isolated Artifact	N/C	Unknown	One late biface reduction flake found in probe, 10–20 cmbs, near Maple Valley

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**N/C - Not Classified, too little information

Table D-3. King County Archaeological Sites with Native American Components, U.S. Forest Service Inventory Forms

Site Number	Common Name (s)	Primary References*	Site Type as Recorded	KC Context Site Type**	Age(s) (^{14}C dates uncalib.)	Observed Contents and Character
MB26/ CR 05-05-02	Hi Ho Site	Peter 1978*	Culturally Modified Tree	Culturally Modified Tree	Unknown	Cedar trees with stripped cambium at confluence of North and South Fork Cedar River, near headwaters
MB5/ CR 05-05-013	Mt. Lindsay Site	Fletcher 1981*	Temporary Camp	N/C	Unknown	Scatter of lithic debitage, projectile point, and adze blade along ridge of Mt. Lindsay between Cedar and Green River drainages
WF297	Naches Trail	Schafer 1976*; Carter and McDonald 1990*	Trail	Trail	Unknown	Segments of trail tread through Cascade Range over Naches Pass
WF343/ 06-17-03-58	Missile Launch Lithic Scatter	Reid and Zweifel 1987*	Temporary Camp	N/C	Unknown	Sparse scatter of lithic debitage along a ridge saddle above Lizard Lake
WF345/ 06-17-03-59	Blowout Huckleberry Lithic Scatter	Reid and Zweifel 1987*	Temporary Camp	N/C	Unknown	Sparse scatter of lithic debitage along ridge of Blowout Mountain
MB207	Snow Lake Lithic Site	Hollenbeck 1984*	Temporary Camp	Resource Procurement - Hunting	Unknown	Sparse scatter of lithic debitage and projectile points along shore of Snow Lake northwest of Snoqualmie Pass
MB227	Naches Lithic Scatter	Moss and Coughlin 1986*	Temporary Camp	Resource Procurement - Lithic Quarry	Unknown	Scatter of lithic debitage and sparse lithic tools exposed on Naches Trail along ridgeline near Naches Pass
FS1343	Tonga Ridge Ponds	Gitch and Huelsbeck 1994*	Resource Procurement Site	Resource Procurement - Hunting	Unknown	Scatter of lithic debitage, lithic tools, and possible bone fragment along Tonga Ridge in Alpine Lakes Wilderness

Table D-3. King County Archaeological Sites with Native American Components, U.S. Forest Service Inventory Forms

Site Number	Common Name (s)	Primary References*	Site Type as Recorded	KC Context Site Type**	Age(s) (^{14}C dates uncalib.)	Observed Contents and Character
FS1434	Greenwater Quarry and Stripped Cedar	Moss 1986*	Quarry and Culturally Modified Tree	Resource Procurement - Lithic Quarry and Culturally Modified Tree	Unknown	Lithic cores and flakes associated with jasper outcrop adjacent to two stripped cedars along Greenwater River valley
FS1721	Tonga Ridge Junction Site	Bonnifield and Ritchie 1994*	Resource Procurement Site	N/C	Unknown	Scatter of lithic debitage along Tonga Ridge in Alpine Lakes Wilderness
FS1722	Deception Lakes Campsite #1	Anthony et al. 1994*	Resource Procurement Site	Resource Procurement - Hunting	Unknown	Sparse scatter of lithic debitage and projectile point on narrow bench along Deception lakes in Alpine Lakes Wilderness
FS1723	Deception Lakes Campsite #2	Holland and Huelsbeck 1995*	Game Processing Site	Resource Procurement - Hunting	Unknown	Sparse scatter of lithic debitage and projectile point on narrow bench between lakes in Alpine Lakes Wilderness
FS1724	Tonga Ridge Meadow East	McLarney et al. 1995*	Resource Procurement Site	N/C	Unknown	Sparse scatter of lithic debitage on saddle along Tonga Ridge in Alpine Lakes Wilderness
FS1726	Tonga Ridgetop Camp	Anthony et al. 1994*	Resource Procurement Site	N/C	Unknown	A few lithic flakes and possible burned bone fragments on Tonga Ridge in Alpine Lakes Wilderness
FS1727	Evans Lake Site	Skare et al. 1994*	Possible Quarry	N/C	Unknown	Sparse scatter of possible flakes along Evans Lake in Alpine Lakes Wilderness
FS1728	Dorothy Lake Fish Hatchery Site	Bonnifield et al. 1994*	Not Specified	N/C	Unknown	Lithic debitage along deflated shoreline of Dorothy Lake in Alpine Lakes Wilderness
FS1729	Dorothy Lake Site	Wells and Huelsbeck 1994*	Tool manufacture /maintenance	N/C	Unknown	Lithic debitage along deflated shoreline of Dorothy Lake in Alpine Lakes Wilderness

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