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Land Use Variation on Mid-Columbia Plateau Upland and Lowland Archaeology Sites

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LAND USE VARIATION ON MID-COLUMBIA PLATEAU UPLAND AND

LOWLAND ARCHAEOLOGY SITES

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ABSTRACT

LAND USE VARIATION ON MID-COLUMBIA PLATEAU
UPLAND AND LOWLAND ARCHAEOLOGY SITES
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Investigators of the Mid-Plateau archaeological record have interpreted artifact deposits in their environmental settings as evidence of human land use labeled as site types. Land use models consisting of cultural and environmental variables were developed from those studies. Those variables were compared to a sample of archaeological records located in the upland east Saddle Mountains and lowland Wenas Creek-Yakima River confluence. While much of the archaeological record fits expectations derived from cultural-environmental models of human land use developed during this research thesis, significant variation in the archaeological record remains unexplained.

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CHAPTER I

INTRODUCTION

Archaeology sites in the east Saddle Mountains upland and at Wenas Creek-Yakima River confluence lowland hold extensive evidence of human land use at two environmentally distinct areas on the Mid-Columbia Plateau. This research examines archaeological variability observed on the areal surfaces of those two locales. The Mid-Plateau archaeological record reflects two temporal dimensions of human presence in the region. Prehistory, defined as points in time before A.D. 1855, refers to antiquity, before traditional indigenous inhabitants of the Mid-Plateau met non-native groups descended from European and Euroamerican cultural traditions. The Historic Period refers to points in time, after A.D. 1855, when the archaeological record began to preserve patterns of land use that were introduced to the region. Evidence of human prehistory and history on the Mid-Columbia Plateau implies regional land use has changed significantly over the course of time.

Specifically, this thesis investigation bears on recent archaeological work in the east Saddle Mountains (Vaughn et al. 2008) and Wenas Creek-Yakima River confluence (Anderson et al. 2009, unpublished manuscript in possession of Central Washington Archaeological Survey; Schroeder et al. 2010). Each of those field studies produced new and comparable archaeological databases of surface survey information, which can serve to inform on lithic technology and its function in past Mid-Plateau human land use during the Precontact Period. The sub-set of Historic Period data can shed light on land use during and after cultural contact between native and non-native groups, from A.D. 1855 forward, which co-inhabited the Mid-Plateau region. Importantly, this research reflects a wide range of literature produced from past studies that are pertinent to each study area.

Previous research into upland and lowland variations between archaeology sites in the east Saddle Mountains (Bailey 2006; Chatters 1982; Galm et al 1981; Senn 2007; Woodard 2008; others), adjacent landscapes (Benson et al. 1989; Boreson 1998; Dancey 1973; DeBoer et al, 2002; Lewarch et al. 1999; others), and Wenas Creek-Yakima River confluence (Warren 1968) generated an array of archaeological expectations for artifact-landscape relationships. Predictive land use models construed from those investigations will facilitate comparison of the new upland and lowland data sets recorded during the 2008 field season. This thesis explores similarities and differences between archaeology sites located in the east Saddle Mountains and Wenas Creek-Yakima River confluence by integrating archaeological surface survey data recorded in the study areas with regional physiographic characteristics. A primary goal of this research is to discover how well the new data match existing precepts about previous human use of the study areas inferred from past land use across the Mid-Plateau region.

The presence and absence of certain artifact forms, particularly lithic technology, is especially informative when comparing upland and lowland precontact archaeological settings (Benson and Riche 1993; Dancey 1973; Lewarch and Benson 1991). Inclusion of historic archaeological materials can advance the discussion of both Native American and Euroamerican land use customs. Variable units of analysis such as archaeological artifact and site types, landforms, soils, flora and fauna resources, and other information (e.g., geoarchaeology, ethnography) provide the analytical dimensions of this research. The new archaeological data from the upland mountains and the lowland confluence study areas can be paradigmatically classified and statistically tested in order to reveal the extent of variability within each assemblage and, when compared to one another, the range of variability between them (Dancey 1973).

Physiographic variations detected in units of analysis capable of identifying study area similarities and differences offer this research a perspective from which land use can be examined at multiple scales in two distinctively different terrain types. For example, the upland is scattered with high country perennial springs interspersed with otherwise exceedingly ephemeral surface waters; the lowland is a perennial watershed and riparian zone. While both locales are resource-rich dimensions of the Mid-Plateau, their resource-based differences are significant and may account for artifact frequency similarities and differences observed between the two areas. Another explanation of artifact frequency variations is the extensive upland spatial scale (i.e. greater surface area [m^2]), which may distort differential artifact frequencies and account for a degree of dissimilarity seen in the density of archaeological evidence (Senn 2007; Woodard 2008). Still, explanation of past environmental utilization in the research areas hinges on the view Plateau cultures carried out resource acquisition activities regardless of the physiographic setting or environmental scale (Bailey 2006) at which those activities took place.

PROBLEM

Intensive pedestrian surveys, and systematically recorded surface data identifying upland archaeology sites in the east Saddle Mountains, have been underway since 1998 (Bailey 2006; Hughes and McCutcheon 2009; Hungar and McCutcheon 1999; Lubinski 2003; Lubinski and McCombs 2003; McCutcheon and Orvald 2002; Vaughn et al. 2008; Senn 2007; Woodard 2008). The lowland database from Wenas Creek-Yakima River confluence (Anderson et al. 2009, unpublished manuscript in possession of Central Washington Archaeological Survey; Schroeder et al. 2010) awaits in-depth analysis. While a substantial body of literature supports further examination of the east Saddle Mountains archaeological record and offers a range of approaches to upland studies problems, existing research for the Wenas Creek-Yakima River confluence is extremely limited. That data scarcity is augmented by the purposes and objectives of this thesis. In addition to the most recent research from 2008, this thesis draws from a large archaeological database of land use information generated through previous studies into Mid-Columbia Plateau prehistory and the region's Historic Period.

Additionally, few studies have compared upland and lowland environmental utilization from a cultural perspective on the Mid-Plateau (Benson and Riche 1993; Benson et al. 1989; Chatters 1982; Dancey 1973; Lewarch et al. 1999; Senn 2007; Uebelacker 1986). This thesis contributes to filling that gap by developing and testing hypotheses regarding artifact types, their presence or absence in the archaeological record, and their relative frequencies across environmental zone variables. Surface survey data recorded during the 2008 field season adhered to protocols used in previous regional investigations renders an initial observation of considerable similarity between the archaeological databases for the upland and lowland research areas. A systematic comparison of environmentally distinct physiographic settings and the archaeological records located within their dimensions is used in this thesis research to determine if previous research conclusions about differences in past instances of upland and lowland land use hold true for the study areas.

PURPOSE

The purpose of this research is to determine whether past land use in two environmentally divergent areas can be distinguished with surface survey data in order to answer the central question of this thesis: why are environmental utilization patterns different at upland and lowland archaeology sites? To do so would solve a set of problems using new archaeological information to answer additional, general questions:

1. What kinds of precontact and historic human activities took place at each study area?
2. How does the archaeological evidence of those activities compare to one another?
3. How does that evidence compare to previously identified precontact and historic land use models for similar or dissimilar upland and lowland settings?

In order to achieve this purpose, the following list of objectives is based on analyses of environmental and archaeological differences between the east Saddle Mountains and the Wenas Creek-Yakima River confluence study areas.

1. Develop archaeological expectations for the upland and lowland environments from an intensive review of the applicable literature.
2. Describe each research setting using environmental dimensions identified from the literature review in Objective 1.
3. Describe the archaeological record for each research environment using the 2008 surface survey databases, and archaeological expectations identified in Objective 1, to create a comparable upland-lowland data classification system.

4. Determine sample size differences (or deficiencies) in order to compare environmental variables based on the archaeological record identified in Objective 3.
5. Identify similarities and differences in that database through comparison of the archaeological record across environmental variables using statistical tests undertaken in Objective 4.
6. Interpret data defined in Objective 5 and determine how those results meet the archaeological expectations obtained in Objective 1.

Objective 1 derives archaeological expectations from previous research into upland and lowland environments. Examination of literature pertaining to regionally specific physiographies like those observed at each study area will provide a means to describe environmental variation relevant to the archaeological record. This clarification highlights site-specific surface data variables by identifying existing land use models in literature reflecting past upland and lowland environmental use and surface survey data.

Objective 2 builds a framework with which to describe and compare physiographic traits for each study area using archaeological expectations derived from the literature in order to select sets of comparisons. This approach permits use of previous environmental definitions that establish the context of each study area in order to compare them in a meaningful way.

Objective 3 integrates research expectations and environmental profiles in order to assess and describe the 2008 upland and lowland archaeological records. Artifacts and archaeologically significant physical features from each study area will be detailed (e.g.

recovery rates, biases, assemblage size/surface area ratio) using equivalent terminology derived from the literature.

Objective 4 determines whether sufficient sample size representativeness exists to make definitive comparisons and what particular scale of analytic comparisons (physiographic area or site-by-site) can be made accurately. The use of resampling computer software is a simple method for determining representativeness of sample size.

Objective 5 examines the 2008 upland and lowland archaeological records by comparing artifact classes. Similarities and differences in these records will be analyzed in relation to the variable environmental parameters identified for each research area.

Objective 6 interprets, using precepts derived from evolutionary theory, results for the data sets obtained by reviewing outcomes of this research in relation to what others have found in the region, as identified in Objective 1. Application of archaeological expectations defined in Objective 1 will direct inferences derived through analyses of each study area's data set.

SIGNIFICANCE

This research contributes to the knowledge base in three important dimensions of archaeological science. It expands the empirical record of our human heritage, adds to scientific data correlating the archaeological record with natural environments, and it addresses cultural resource management considerations that will be used to decide eligibility of the research areas as archaeological properties for inclusion in the National Register of Historic Places. Protracted investigation of human endeavors on the Mid-Columbia Plateau for the periods before and after A.D. 1855 demonstrate the value of filling three major data gaps in the archaeological record through this research.

First, a comparative elucidation of precontact land use patterns in upland and lowland settings will increase our understanding of human activity in these environments prior to A.D. 1855 and the inclusion of historical archaeological components for each research area will appreciably expand what we know about environmental utilization after A.D. 1855. Second, the identification of environmental variables through artifact-scale analyses will shed light on the unexamined spatial dimensions of two areas on the Mid-Columbia Plateau comparable to similar regional studies adjacent to the study areas. Third, identification of strengths and weaknesses of archaeological data gained from surface survey information will aid in determining its efficacy to distinguish land use over time and how the usefulness of surface survey data is influenced by sample size.

A literature review, in Chapter II, describes regional physiography, previous archaeological research, predictive land use models, geoarchaeology, and Mid-Columbia Plateau ethnography and history. An overview of the 2008 archaeological field surveys and east Saddle Mountains and Wenas Creek-Yakima River confluence data comprises Chapter III: Study Areas. Precontact and historic archaeological records for the upland and lowland research areas are presented in Chapter IV: Methods and Techniques. The outcomes of this thesis research are given in Chapter V: Results, followed by a discussion of this research, in Chapter VI, under the title Conclusions and Recommendations.

CHAPTER II

LITERATURE REVIEW

This chapter furnishes the literature context for exploring human land use as it is preserved in a portion of the Columbia River Plateau archaeological record. The literature cited provides readers both a means to understand the significance of this research as well as a guide for comparing the results of this study to other research. This review serves the aim of objective one to identify environmental and archaeological nomenclature germane to the research region. The lexicon of terminology and precepts presented here originate from past Plateau studies into human culture and land use in my research region.

The Columbia Plateau is a recognized traditional indigenous culture area of North America (Walker 1998). In the broad scheme of the Plateau's north, south, and east geographic divisions, the research region is located in the west center of the southern Plateau sector (Chatters 1998). The southern Plateau is bounded by the Rocky Mountains in the east, the Cascade Mountains in the west, the Columbia River headwater and sub-ranges of the Rockies in the north, and the Blue Mountains and Salmon River in the south (Walker 1998). The geographic area examined in this research is located on the west-most margin of the central southern Plateau. The following section provides description of the geophysical scope defining the cultural province referred to as the Mid-Columbia Plateau throughout the remainder of this thesis.

Physiographic Environment of Previous Archaeological Investigation

The research area is located east of the Cascade Mountains in central Washington State on the west edge of the middle Columbia Plateau. Here, the Columbia and Yakima rivers flow roughly southward and parallel one another, separated by about 56 km of generally horizontal distance. The Columbia River and the east Saddle Mountains lie within the Columbia Basin Physiographic Province (Franklin and Dyrness 1988) and abut the Channeled Scablands (Baker 1995; Baker and Nummedal 1978, Bretz 1923a). The Wenas Creek-Yakima River confluence overlaps the Columbia Basin Province (Figure 1) and flanks the Cascades Province south of Snoqualmie Pass (Franklin and Dyrness 1988).

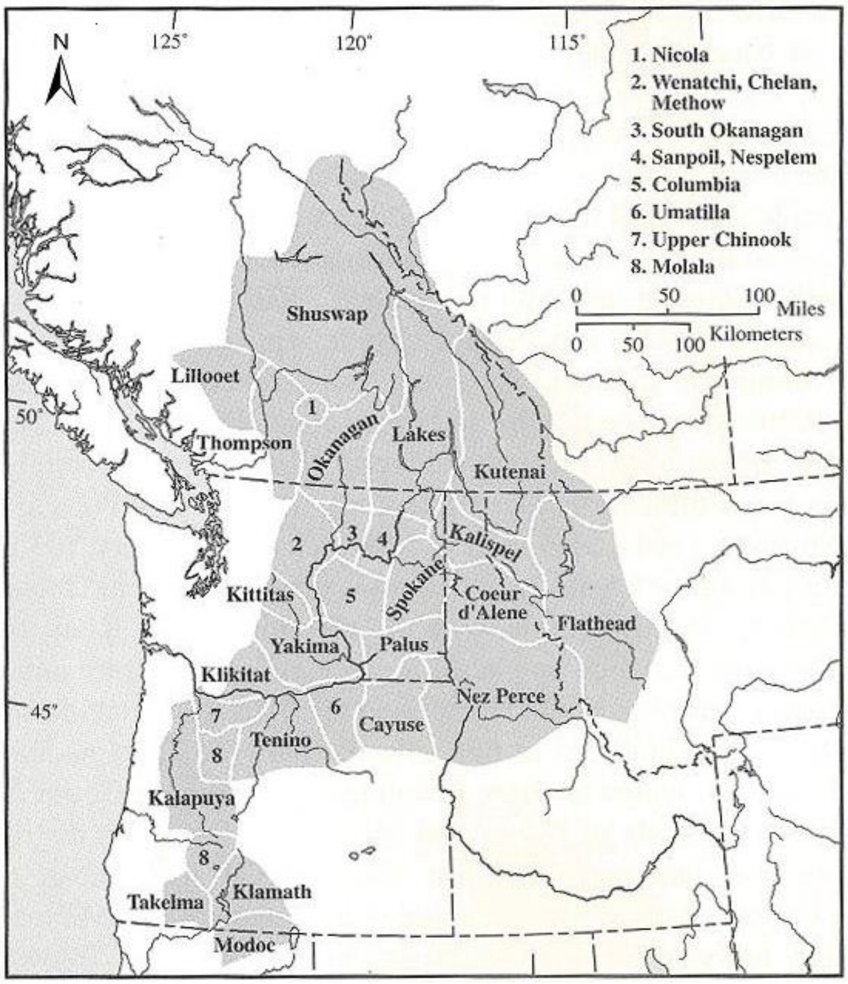

Figure 1. Ethnographic landscape in the Columbia River Plateau (after Driver and Massey [1957] in Walker [1998]).

Geology, topography, and biogeography began forming amid Cascades orogenesis that wrought the region's Columbia River drainage (Barnett et al. 2007; Reidel and Chamness 2007) ahead of dynamic geologic, tectonic, and climactic events that occurred from the Miocene epoch forward (Chernicoff and Whitney 2002). Emplacement of the Columbia River drainage was driven by the dual forces plate tectonics and volcanism (Tolan et al. 2002).

Columbia River Basalts formed the Plateau (Chernicoff and Whitney 2002) and Ellensburg Formation sedimentary interbeds emplaced between basalt layers (Fecht et al. 1985; Rohay and Reidel 2005) during lulls in serial lava flows. The interbeds consist of ancestral river gravels, quartzitic rock, organic fossils from paleo-lacustrine ecosystems (Grolier and Bingham 1978), and lahar debris from Cascade volcanoes (N. Campbell 1983, 1989). Erosional patterns on the region's volcanic terrain (Hamblin 1982:213-215) are in the initial stages of dissection by the areas major rivers, the Columbia and its Yakima River tributary. Basalt and interbed members along the Yakima River differ somewhat from those on the Columbia River (Barnett et al. 2007; Fecht et al. 1985).

The Yakima Fold Belt's west to east anticline ridges and syncline valleys (Alt 2001; Barrash et al. 1983) are consequences of Miocene tectonic folding and faulting (Reidel and Chamness 2007), which are on going. The Yakima River erodes Umtanum anticline (Alt and Hyndman 1984) and Wenas Creek joins the river directly south of Umtanum Ridge. The Columbia River incises the Saddle Mountains anticline into two ranges (Alt 2001) located east and west of the river; Crab Creek joins the Columbia River immediately north of the eastern Saddle Mountains segment (Grolier and Bingham 1978).

Pleistocene epoch glacial impoundments on the Columbia drainage provoked constant local flooding (Grolier and Bingham 1978; Pielou 1991), which terraformed the region's topography (Baker 1995; Bretz 1923a) into rough and ragged, severely incised coulees, cliffs, buttes, mesas, and extensive extinct waterways (Soennichsen 2008:xiii). Millennia of glacial ice deflation deposited loess (Bradshaw and Weaver 1993), gravel, silt, and sand (Alt and Hyndman 1984) across the landscape. Cascades volcano eruptions deposited ash (Rohay and Reidel 2005). Mount Mazama (todays Crater Lake, Oregon) erupted about 4,700 B.C. and emplaced a substantial layer of ash (Chernicoff and Whitney 2002; Zeilinga de Boer and Sanders 2002) across the research region. Paleoclimates drove mechanical and chemical weathering (Blinnikov et al. 2001) and terrestrial and aquatic ecosystem fluctuations (Pielou 1991). Depending on areal locality, soils formed from hillslope and canyon colluvium, valley alluvium, flood gravels, and glacial outwash debris (Clarke and Bryce 1997:12). The Holocene ecosystems came to reflect glacial geomorphology, fluvial erosion, and an arid climate (Clarke and Bryce 1997:8) across multiple-characteristic transition zones along the Columbia Plateau's perimeters (Clarke and Bryce 1997:14).

Pielou (1991) identified flora and fauna during glaciation of the Columbia River watershed and contended the Plateau generally lacked fauna until Berengian parent stock arrived. Fossil records abet the Pleistocene-Holocene transition faunal extinction theory (Gibbons 2004) explaining the demise of bison, horse, mammoth, and other species in the region. Palaeozoological data indicate bighorn sheep (*Ovis canadensis*) inhabited shrub steppe during most of the Holocene (Lyman 2009:143). Mehringer (1986, 1996) argued paleoclimate models were unreliable indicators of intra-regional resource variance;

however, flora studies suggest grasslands dominated eastern Washington by the Holocene (Blinnikov et al. 2001; Mehringer 1986, 1996; Reyerson et al. 2009). Drought-adapted arid land established ecosystems (O'Connor and Wieda 2001; Daubenmire 1974; Franklin and Dyrness 1973, 1988; Taylor 1992). Flora and fauna communities in the Cascades Physiographic Province (Yocom and Brown 1971) differ significantly from ecosystems a little farther east along the west-most edge of the Mid-Columbia Plateau. Classification of the region into flora/fauna associations or biotic units (Larrison 1946:22) define the range of habitats that exist between the central Cascades montane forests and arid Columbia Basin sagebrush plains.

The Cascades orographic effect relegated major precipitation to winter and the driest areas to Cascades east slope toes (Blinnikov et al. 2001), as late Holocene climate stabilized (O'Connor and Wieda 2001; Prentiss et al. 2006) and patterns of weather like those seen today emerged after about A.D. 1500 (Prentiss et al. 2006). Atmospheric and geo-dynamics of the Cascades "rain shadow" effect (Barry and Chorley 1998) across the region manifested seasonal wind turbulence and annual temperature extremes (Ferguson 1999; O'Connor and Wieda 2001). Flora and fauna dispersed according to soils (Taylor 1992) specific to moisture, temperature, and elevation (Daubenmire 1974:343). Moss, fungi, algae, and lichen biocrusts (Belnap et al. 2001; O'Connor and Wieda 2001), as moisture reservoirs (Blinnikov et al. 200l), became crucial to the overall botanical regime (Rosentreter 1995:1-2). Sagebrush-bunchgrass communities populated shrub steppe and meadow steppe subdivisions of a perennial grass steppe zone (Franklin and Dyrness 1973). Standard, saline, lithosol, sand, talus, and meadow soils developed differing floral communities (Taylor 1992:2-9). Meadow steppe grasses and broad-leaved forbs grew adjacent to highland forests and interfaced shrub steppe flora along the Yakima River (Franklin and Dyrness 1973:211-212). Columbia River flora had less evident forbs and was more openly dispersed (Franklin and Dyrness 1973:212) across the landscape.

Deliberately altered landscape is a separate layer of information from what is known for ecosystem potentials (Clarke and Bryce 1997:15) before Euroamericans arrived in the region. Anthropogenic modifications such as irrigation-altered water resources (Clarke and Bryce 1997:14-15), surface cultivation, introduced livestock and plants, and deliberate use of wildfire (Franklin and Dyrness 1973:210) transformed the local environment following Euroamerican colonization. Native ecological systems of landscape were further altered by hunting, trapping, and fishing regimes introduced by Euramerican colonists (Mrozowski 2009:23).

Flora and fauna distributions during prehistory were not related to intentionally ignited wildfire, according to Franklin and Dyrness (1973; cf., Boyd 1999; Mehringer 1986, 1996). However, Uebelacker (1986:88) contended fire was a major element of resource and habitat alteration that emphasized intentional flora and fauna management during prehistory by Native American culture groups. Alternatively, Euroamerican land use strategies routinely included intentional use of wildfire as a land-clearing device used to eliminate major native shrub species (Franklin and Dyrness 1973) from the Mid-Plateau. Large ungulate herds were not part of local ecosystems prior to contact; limited grazing was the norm before introduced livestock overgrazed many localities of the Mid-Plateau where native grasses rarely, if ever, recovered, and non-native flora thrived (Franklin and Dyrness 1973:210-211). Cheatgrass (Bromus tectorum) thrives in degraded sagebrush ecosystems (Pellant 1996:2).

The east Saddle Mountains and Wenas Creek-Yakima River confluence study areas conformation to and divergence from those physiographic frameworks result from naturally occurring and anthropogenic influences. Along with creating unlike topography, altitude disparities in the two areas cause dissimilar albedo, absorption, and insolation (Bradshaw and Weaver 1993). Aridity in the east Saddle Mountains upland is intensified by wind-induced evaporation. Wenas Creek confluence lacks similar magnitudes of wind and moisture evaporation because it is located in a sheltered, lowland, riverine valley.

Directional aspect combined with amplified altitude significantly affect upland temperature and the ability of air to retain warmth (Bradshaw and Weaver 1993:97). Those physiographic traits affect floral productivity (Raven and Johnson 1999:428) and plant resources available to fauna (Pielou 1991) and to humans. While the lowland study area straddles topographically protected shrub and meadow steppes, the upland is entirely within a shrub steppe zone (Franklin and Dyrness 1973:51). Upland shrub steppe displays special botanical florescence patterns (Franklin and Dyrness 1973:217) that are atypical of lowland shrub steppe. Upland forbs are atypical nonconformists lacking predictable annual, perennial, or biennial growth and dormancy cycles (Franklin and Dyrness 1973).

The upland and lowland environments offered rich floral and faunal food bases to humans during prehistory (Benoliel 1974; Hunn 1990; Schuster 1975). Plentiful lowland terrestrial and aquatic foods (Hunn 1990; Schuster 1975, 1998) were available, while the rocky sandy upland soils were habitat for numerous edible plants (Taylor 1992). Highly valued camas (*Camassia quamash*) (Benoliel 1974) favored meadow steppe (Taylor 1992) like that located in lowland; however, camas was often harvested in spring on elevated rocky soils (Benoliel 1974:33) like those located in upland. Staple bitterroot

(*Lewisia rediviva*), Fern-leaf (*Lomatium dissectum*) and Nine-leaved (*L. triternatum*) desert parsley, Large-fruited biscuitroot (*L. macrocarpum*), and other desert parsley resources (Taylor 1992:94-97, 122) were distributed extensively on lithosols. Upland birds and mammals, such as antelope, rabbit, prairie chicken, and sage grouse (Taylor 1992:14-15) provided human beings with faunal food resources.

Physiographic changes induced by anthropogenic forces in the study areas began with the arrival of Euroamericans in the Historic Period. Environmental changes from that time forward are related to events in each study area that are specifically detailed below, in the section entitled History. In brief, the lowland study area was claimed by private owners early in the cultural contact period between Native Americans and Euroamericans some 142 years ago. Military activity (Helland 1975; Gates 1941; Johansen and Gates 1957), farm and ranch enterprises (Lince 1984; Mendenhall 2006; Paul 1973, 1976), homesteads, urbanization (Lince 1984), and Wenas Creek water extraction, diversion, and impoundment caused non-native flora influx (Pellant 1996), soil compaction, and severe damage to Wenas Creek's riparian biome.

Similarly, anthropogenic forces affected the upland study area. Native grasses were grazed to near extinction in the east Saddle Mountains (Mendenhall 2006) from the Historic Period forward. As habitat for native flora and fauna, the landscape was all but ruined (Mendenhall 2006). O'Connor and Wieda (2001) detailed environmental change associated with Euroamerican land use practices that negatively impacted shrub steppe habitat adjacent to the Columbia River segment of the research region. In particular, non-native flora infestations (O'Connor and Wieda 2001; Pellant 1996) became problematic in upland. Oil and gas prospecting, communications and electricity installations (Bailey

2006), and a plethora of public recreation activities have ensued. Recreation includes unimproved road use, off-road vehicle use, sight seeing, hiking, camping, hunting, rock collecting, and livestock grazing, all of which have damaged the native surface (Bailey 2006) to an extent that surface disturbance is an introduced physiographic characteristic in the east Saddle Mountains (Hungar and McCutcheon 1999).

Previous Archaeological Investigation

This review of past Mid-Plateau research supplies a synopsis of regional studies into the precontact temporal phase. That body of literature is reviewed in chronological order of publication. The earliest regional antiquity studies, until about 1950 (Chatters 1982; Schalk 1982), centered on Columbia River floodplain excavations. When then new palynology and paleoclimate models helped pioneer notions of environmental variability (Schalk and Cleveland 1983), archaeologists realized humans used a far wider range of the environment (Swanson 1962) than previously considered. However, Dancey (1973) launched one of the early attempts to expand acuity of environmental utilization during antiquity (Boreson 1998; Bruce et al. 2001; DeBoer et al. 2002; Hackenberger 2009; Lewarch et al. 1999; and others) detailed the history of regional studies.

Dancey (1973:92) surveyed Yakima Training Center (YTC) terrains draining Hanson Canyon and No Name Creek into the Columbia River near Priest Rapids. Elevation ranged from 823 m (2,700 feet) on ridges to 153 m (500 feet) in drainages (Dancey 1973:37-39). Notably, Dancey's (1973:10) approach confronted the prevailing bias toward defining antiquity according to archaeological data derived exclusively from Columbia River floodplain excavations. Dancey's (1973) view of human environmental utilization in antiquity culminated in his atypical environmental study of natural factors

(Table 1) believed to condition human land use. (Lewarch et al. 1999:5). Along with furnishing one of the first hinterland studies (Benson et al. 1989) of upland terrains, Dancey tested hypotheses concerning non-random relationships between human land use and the environment (King and Caywood 1994).

Dancey (1973) originated the first functional classification of Mid-Plateau archaeology deposits (Benson et al. 1989:3.10) in order to explore those associations. Given the level of ideological restrictions on orienting research toward both surface data and hinterland, Dancey presaged the future of archaeology. In doing so, he initiated the system of investigation that rigorously controls archaeology’s cardinal variables, *space* and *form* (Dancey 1973:12). Interestingly, it was his rejection of vegetation, as a primary environmental variable, which led to Dancey’s adoption of macro-scale landforms (e.g., upland flat, ridge) (Dancey 1973:30) to serve as gauges of spatial variability. The flora species were disposed to climate-induced habitat and distribution alterations (Dancey 1973:29-30), which limited the utility of present-day botanical patterns in prehistoric land use research. Instead, micro-scale topographic traits indicative of ecosystem productivity and resource availability provided means for measuring landscape variability at the scale of microenvironmental variants in areal surfaces.

Table 1. Environmental Variables Examined During Previous Mid-Columbia Plateau Archaeological Investigation.

Dancey (1973)	Wilde and Wilke (1984)	Benson et al. (1989)	King and Caywood (1994)	Boreson (1998)	Lewarch et al. (1999)
Landform Slope Geology		Elevation Slope/aspect	Landform Elevation Slope/aspect Disturbance	Landform Elevation Slope/aspect Disturbance	Topography Disturbance
Hydrology Distance to river Distance to ridge		Distance to H_2O H_2O type	Drainage order Distance to H_2O H_2O type	Light conditions Surface light and reflectivity	Potable H_2O H_2O type
Sediment type Erosion pattern	Raw toolstone	Raw toolstone	Raw toolstone Primary soils Geomorphology		Raw toolstone Soils Geology
Solar exposure Wind exposure	Soils/flora habitat		Floral habitat Ethnobotany	Vegetation height Ethnobotany	Flora habitat and fluorescence timing
Microenvironment	High use area	Physiographic zone	Microenvironment	Habitat/landform	Fauna habitat and travel corridors
River floodplain Alluvial flat Bench Slope Upland flat Saddle	Creek drainage Alluvial flat Terrace Saddle	Riverine floodplain Riparian upland Arid upland (Sample strata) I. Flat, bench, terrace II. Gentle slope III. Steep slope	River floodplain Alluvial terrace Alluvial fan Bench/upland flat Slope	Lithosol, shrub steppe, shrub steppe/lithosol, riparian/steppe 8 landforms (e.g., bedrock, knoll, bench/flat)	Temperature Snowpack depth and duration

Artifact *form* (Dancey 1973:44), defined as *type* and calculated as frequency of occurrence and extent of distribution within a microenvironment, was used to establish technological and functional variability within artifact clusters. That variability inferred a range of human land use actions and pointed to landscape contexts where environmental utilization took place. Dimensions of *form* ascertained by identification of attributes in varying modes of expression constituted the technological elements seen on rock used for stone tool manufacture (Dancey 1973:44). Functional *type* classes were created by the shape and surface attributes (Dancey 1973:45) exhibited on an artifact's *form*. Manuwear

- Manuwear Regular attributes and/or use wear
- Blank Irregular attributes
- Core Angular stone with negative percussion bulb(s)
- Chunk Angular stone without percussion bulb(s)
- Flake Lenticular shape, striking platform, percussion bulb
- Unmodified Pebbles or cobbles with no reduction attributes

dimensions (e.g., shape, kind of wear), for example, each have modes of alteration (e.g., rectangular, abrasion), while the unmodified class is archaeologically significant through association with other functional classes (Dancey 1973:49-58). *Form* had spatial scales: discrete, portable object and aggregate (clustered objects). Differential land use patterns could be identified through analysis of functional *type* artifact frequency distributions that were linked to particular microenvironmental elements of landscape (Dancey 1973:102).

Dancey's (1973) research occurred at a point in archaeology's developmental history when excavated data eclipsed the potential of evidence from areal surfaces to inform on human land use (cf., Dunnell 1971). Aside from the advantage tight spatial control provided archaeological research, in general, Dancey (1973:22-23) used it to validate surface-derived data as a body of information distinct from but equal to subsurface data. In that context, Dancey (1973:58) combined riverine floodplain excavation with an upland surface survey in terrain located at a distance from the Columbia River. The upland landscape was given total coverage or one-hundred percent treatment (Dancey 1973:22-23). Microenvironmental units of analysis were selected and a sample unit grid was established on the areal surface (Dancey 1973:30, 58). Grid units with high artifact densities or aggregates (Dancey 1973: 59-63) equated to archaeology site *type* classes (e.g., camp, lithic reduction) used by other investigators.

Statistical and other tests of the data established artifact relative frequencies (i.e. kind, proportion) and frequency variations pointing to functional traits in the assemblage. Knowing artifact frequencies and variations in individual aggregates facilitated detection of functional differences between the aggregates (Dancey 1973:63). Presence/absence analysis showed the kind/proportion of artifacts aggregated into clusters and permitted comparisons of aggregates to one another (Dancey 1973:72). When analyzed in specific microenvironmental context, classes that markedly differed from all other classes in at least one functional respect were meaningful in terms of human utilization; environments showing little or no difference from one or several other classes in all functional respects were thought to signify the same kind of utilization (Dancey 1973:95).

Initially, the research classified all aggregates "in terms of economic function alone;" that is, human resource acquisition (Dancey 1973:80). However, the assemblage lacked stone tools suggesting some aggregates had non-economic functions (Appendix A). Artifact clusters dominated by lithic debitage suggestive of lithic workshops implied distinct technological functions took place that were not exclusively subsistence-related actions (Dancey 1973:80). Relative frequency variations in tool manufacture byproducts were used to measure technological production differential (Dancey 1973:81). Dancey's (1973:12) focus on differential land use inferred from aggregate distributions aimed to gain insight on subsistence economies at the outset of his research.

Dancey's methods set a precedence ensuing researchers attempted to emulate (cf., Schalk 1982). First, scrutiny of the archaeological record began to rely on surface survey data. Second, macro- and microenvironmental idiosyncrasies became fundamental diagnostics to interpret past human land use in terms of function. Third, systematic control of *space* expanded broad, fine-grained resolution of the total environment, not just the floodplain subsurface. Fourth, paradigmatic classification of archaeological *form* identified artifact variability, as a key function of human actions. In the opinion of this researcher, Dancey's installment of scientific rigueur into archaeological studies on the Mid-Plateau improved the quality of subsequent research. In sum, Dancey instituted the concept of hinterland land use in order to show previous investigative bias toward the Columbia River Valley had overlooked substantial parts of the archaeological record. Dancey's (1973) influence on succeeding Mid-Plateau research methodology is reflected in varying degrees throughout the archaeological literature reviewed in this chapter.

Hartmann and Galm (1976) surveyed the Rattlesnake Hills located south of the YTC. Until the time of their investigation, archaeology sites had not been recorded in the project area (Hartmann and Galm 1976:1) Aside from surface surveys previously carried out by H. Smith (1910) and D. Rice (1969a), and Warren's (1968) excavations at Wenas Creek, little archaeological work had been done in the central Yakima Valley (Hartmann and Galm 1976:1). An estimated 15 percent of microenvironments most likely to contain evidence of human land use (e.g., springs, extant/relict watercourses, saddles, lookouts) were inspected (Hartmann and Galm 1976:4). Hilltop, prairie, rock outcrop, and talus slope microenvironments received 5 percent coverage (Hartmann and Galm 1976:4). A relatively large occurrence of anthropogenic disturbances (e.g., cattle, site looting, roads, vehicle traffic, water development) had caused heavy artifact mixing and site destruction.

Hartmann and Galm (1976:6-36) briefly outlined environmental characteristics at each site deposit, as follow. Location, site description (i.e. artifact, feature), topography, vegetation, sediments, previous disturbance, and evaluation of further archaeological investigation were noted. Elevations ranged from 920 m on a hill to 378 m on a terrace. Sites deposits were located in terrains described as alluvial fan, bench, drainage, knoll, nob (hill), ridge, saddle, slope, and terrace. The majority of sites were on terraces (n = 20) with fewer seen in drainages (n = 2), ridges (n = 2), and saddles (n = 2). One archaeology site was located on each of the other landforms listed above. Of 31 precontact cultural deposits, 13 connected to springs and nearly all were located near perennial or ephemeral drainages. Two lithic artifact scatters had rock cairn features. A single site, Big Hunker Quarry (45YK63), occurred on a major outcrop of toolstone-bearing interbed with "large, very high quality toolstone material" (Hartmann and Galm 1976:17). "Sensitive areas" (e.g., Eagle Landing Locality, Mud Flat Locality) with artifact frequencies too thin to designate as archaeology sites were nominated for future investigation. (Hartmann and Galm 1976:37)

The following assemblage inventory is from site descriptions in the project report (Hartmann and Galm's 1976:6-36). Numerous deposits were made visible by sheet wash and other erosional forces in the project area. Thin lithic scatters typified the majority of site type deposits defined as seasonal camps (Hartmann and Galm's 1976:46) of chipping debris, flake tools, groundstone, and hopper mortar bases. A hearth with ash, bone, and charcoal was located in a drainage. A single projectile point and a scraper and several flakes were recorded at the Crossroads Locality sensitive area (Hartmann and Galm 1976:41). Along with rock cairns connected to lithic scatters, possible human interment area associated with an extensive and dense lithic scatter. Overall, the sites reflected flora (food) processing and the manufacture of lithic implements (Hartman and Galm 1976:48).

Hartman and Galm (1976:48) noted the percentage of Rattlesnake Hills cairn sites is much lower than in the (east) Saddle Mountains (see Galm and Hartmann 1975 ahead). A greater variety of resources and differing exploitation patterns in the Rattlesnake Hills might explain the "dramatically different" (Hartman and Galm 1976:48) cairn frequencies in upland. Access to water was deemed a major factor in site distribution. Thick site density in the watered east Rattlesnake Hills compared to fewer sites in the dry west Rattlesnake Hills (Hartmann and Galm 1976:47) was attributed to access to water. The presence of shell from "river mussel" suggested considerably greater amounts of surface water occurred in the area before degradation of the watershed (Hartmann and Galm 1976:47) through non-native land use practices during early colonization of the Mid-Plateau.

Wilde and Wilke (1984:3) surveyed YTC upland where portions of Cottonwood, No Name, and Alkali Creeks drained east to the Columbia River and part of Lmuma (formerly Squaw) Creek drained west to the Yakima River. Elevation ranged from 853 m

(2,799 feet) on ridges to 549 m (1,801 feet) in bottomland (Wilde and Wilke 1984:3). A thirty-percent surface sample of the archaeological record was systematically recorded (Wilde and Wilke 1984:9). In areas such as stream banks, alluvial flats, terraces, and saddles, which were thought to have high potential of prehistoric land use, a twenty-percent surface sample was recorded (Wilde and Wilke 1984:9). Although cultural resource assessment rather than research was their aim, Wilde and Wilke (1984:9, 18) acknowledged landforms and other environmental factors with potential for both attracting human land use (Table 1) and yielding evidence of those actions.

Project area terrain was delineated in terms of landforms (e.g., hill/ridge, slope) (Wilde and Wilke 1984:18). Interbed outcrops of raw toolstone, fossilized wood, and other cryptocrystalline silicates (CCS) were identified on ridge crests and slopes (Wilde and Wilke 1984:3, 23). "Specialized habitats" related to culturally significant flora/soils (e.g., lithosols) were noted (Wilde and Wilke 1984:5). In particular, Stiff sage (*Artemisia rigida*) and Sandberg's bluegrass (*Poa sandbergii*) in lithosol habitat on upland flats and ridge crests (Wilde and Wilke 1984:5) were viewed as the single most important food-related habitat available to humans during antiquity. While presence/absence of lithic tools was thought unlikely to assure detection of root harvest activity, the abundance of edible flora species suggested upland utilization was far greater than the archaeological evidence indicated (Wilde and Wilke 1984:41-42).

Wilde and Wilke's (1984) site classification system was important for recognizing proliferation of lithic resource procurement and reduction (Benson et al. 1989:3.11) in upland terrain. Artifact cluster contents served to distinguish five site types (Appendix A) (Wilde and Wilke 1984:18, 41), albeit prolonged surface exposure made identification of specific site functions difficult to determine. Site distribution indicated upland might have been an important land use element (Wilde and Wilke 1984:41).

Johnson and Morrow's (1997) study of lithic core technology shed light on raw toolstone availability and quality, as determinants of subsistence strategy variation. Local lithic traditions strongly reflected toolstone availability and quality that in turn informed procurement strategy in terms of a toolstone budget. Where local toolstone was scarce, toolmakers conserved resources by making expedient toolkits with highly portable cores suited to opportunistic subsistence (Johnson and Morrow 1987:141). Opportunistic cores were restricted to areas with inferior or lack of local material. Quarry access and distance from quarries to work centers (Johnson and Morrow 1987:141) may have figured in the Cascade adaptation in the Plateau, because it represented such a key advancement in the technology of expedient cores (Johnson and Morrow 1987:142-143).

The conspicuous correlate of opportunistic technology was a shift in settlement pattern across North America (Johnson and Morrow 1987:297). Increased expedient core technology coincided; that is tied directly to greatly altered mobility favoring residential stability. (Anthropological and archaeological literature depicts stable settlement patterns in terms of sedentism suggesting people sat about, went nowhere [Webster 1968], and were "idle" [Chatters 1982; all derisory estimates of human settlement at any scale in this research purview, especially considering strategy shifts in settlement are among the key targets archaeology seeks to identify.) The more salient points are two. First, stability argues the shift toward relatively fixed habitations involved highly mobile hunter/gather migratory cultures adopting less-nomadic and more localized collector practices (Driver and Massey 1957). The second point is environment and resources were the determinants of human strategy in antiquity. Residential stability is one example of a cultural response to an expanded or contracted resource base predicated by environmental conditions.

Mobility had a significant function in determining the role of tools. Stones weigh too much for mobile people to carry more than necessary; however, stable people did not travel great distances residentially or logistically and only required minimal toolstone at work places where it was utilized (Johnson and Morrow 1987:300). Stone tools had only to perform short-term work, and function and material alone affected tool shape; hence, expedient tools were satisfactory (Johnson and Morrow 1987:300). Though highly mobile groups employed opportunistic core technology, they shared one strategy element with residentially stable groups, as follows from Johnson and Morrow (1987:301). If raw material was available nearby or frequently imported (see Johnson and Morrow 1987 in this chapter's Ethnography section), there was no spatial or temporal difference in toolstone location of and its place of use. In those instances, stone tools were not formally shaped. Only the potential to overcome future or unforeseen raw material scarcity necessitated formal tool production. Given abundant lithic resources and the necessity to produced more formal tools was eliminated.

Benson et al. (1989:2.3) surveyed YTC terrain in Johnson Canyon, Wippel Creek, and Badger Creek seasonal drainages oriented west into Kittitas Valley, and perennial streams in Middle Canyon, Ryegrass Coulee, and Johnson Creek draining east toward the Columbia River. Upland elevations ranged from 318 m to 77 m and from 262 m to 67 m in the lowland (Benson et al. 1989:4.3). A thirty-percent sample of the archaeological record was systematically recorded. Based on paleoenvironmental, geomorphological, and palynological reconstructions, Benson et al. (1989:2.9) concluded the project area had limited environmental diversity throughout prehistory. For example, the absence of adequate spawning grounds in the riverine zone likely limited anadromous fish resources (Benson et al. 1989:2.5; cf., Galm et al. 1981). Riparian upland was described as seldom more than a “slender garland of species” (Benson et al. 1989:2.5) along even the most active streams. Availability of toolstone (Benson et al. 1989:2.1-3) was believed the compelling force of aboriginal land use.

Columbia River floodplain, perennially watered lowland, and arid upland slopes and ridges (Benson et al. 1989:5.2) were environments of interest to the research. Each of the zones was further defined in terms of sample strata landforms: (1) flat, bench, inland terrace, (2) gentle slope, and (3) steep slope (Benson et al. 1989:5.2). Since links between cultural deposits and the environment were deemed “inconclusive” (W. Smith 1986) in prior YTC research, elevation, degree of slope, and directional aspect (Table 1) were analyzed in order to detect parallels between functionally variable site types and the three topographic variables (Benson et al. 1989:6.27).

Presence/absence of lithic artifacts served to classify six site types (Appendix A) (Benson et al. 1989:5.2) tied to upland and lowland environmental settings. Cairns, talus slope depressions, and aligned rock features proved “virtually impossible” (Benson et al. 1989:6.12) to identify with cultural functions or precontact origins based on an absence of related artifacts. Because ethnographic records indicated precontact native groups had erected similar rock formations during prehistory, rock features were *a priori* attributed to precontact origins (Benson et al. 1989:6.12).

King and Caywood (1994:1) surveyed YTC landscape that included the perennial Hanson and Cottonwood Creek drainages flowing east to the Columbia River and the seasonal North Fork headwaters of Lmumma Creek draining west to the Yakima River. Elevation ranged from 866 m to 360 m on an upland alluvial terrace (King and Caywood 1994:47, 61). Thirty-percent of each drainage was surveyed. Seventeen environmental variables, including three vegetation communities and five ethnobotanical species, and twenty cultural variables (Table 1) were examined (King and Caywood 1994:36-37). Of the environmental variables, the greatest cultural variation occurred in the landform class (e.g., bench/upland flat, alluvial terrace) (King and Caywood 1994:36)

When cultural and environmental variables were correlated, links between lithic flakes and seasonal/perennial water sources, unifacial tools and biscuit root habitat, and bifacial tools and discrete landforms were identified (King and Caywood 1994:68-71). Frequencies of flake-derived artifacts related to environmental variables revealed rare to moderately rare relationships between ethnobotanical species and the archaeological record and rare to moderately rare links between five landforms and the archaeological record (King and Caywood 1994:66-69). Site distribution exposed resource productivity differentials between east-oriented terrains draining to the Columbia River compared to west-oriented landscape draining to the Yakima River (King and Caywood 1994:71). Columbia River-oriented terrains had greater archaeological evidence of intensive land use than lands oriented to the Yakima River. King and Caywood (1994: 71) attributed the difference to abundant Hanson Creek subsistence resources. Lmumma Creek drainage lacked canyon landforms thought to enhance resource availability (King and Caywood 1994:14). Hanson Creek's perennial water, fuel, flora and fauna food resources, and shelter availability contrasted sharply with resource scarcity seen on Lmumma Creek's ephemeral drainage (King and Caywood 1994:14). However, the upper portion of the

Lmumma Creek drainage held ethnobotanically significant habitat, which Hanson Creek lacked (King and Caywood 1994:14). In their final analysis, although King and Caywood (1994:71) did not survey west of the Yakima River, they concluded indigenous groups inhabiting that drainage may have preferred “more productive lands” west of the river.

Boreson (1995:2.1) surveyed YTC terrains on Yakima Ridge and in the Yakima River’s tributary Lmumma and Selah Creek drainages. The majority of isolated cultural deposits were located from 561 m to 1,055 m of elevation (Boreson 1995:3.3). Thirty-percent of the archaeological record was sampled and twenty-percent of survey tracts were oriented toward areas with perennial spring water (Boreson 1995:2.1). The Yakima Ridge tract yielded seven culture sites, Lmumma Creek held 10 sites, and Selah Creek contained 18 site deposits. The majority of sites (n = 35) were located on slopes (n = 22) followed by locales in drainage (n = 5), terrace (n = 4), saddle (n = 2), and ridgetop (n = 2) environments (Boreson 1995:3.1) where campsites (n = 3) and lithic scatters (n = 32) were located. Campsites included lithic tools, debitage, fire-cracked rocks, and, more rarely, faunal remains and charcoal. Boreson (1995:3.1-3.3) reported lithic scatters (n = 16) of highly concentrated culturally modified toolstone typified other site classes: lithic scatter/procurement area (n = 12), lithic scatter/reduction station (n = 3), and lithic scatter/quarry (n = 1) associated with a geologic exposure of toolstone.

Within a context of concentrated lithic scatters, the diagnostic artifact assemblage held uniface (n = 1), biface (n = 3), projectile point (n = 23), and pestle (n = 2) artifacts, along with a fauna bone fossil (Boreson 1995:3.4). Isolated artifact deposits had scraper (n = 24), projectile point (n = 15), core (n = 11), biface (n = 7), modified chunk (n = 5), modified cobble (n = 3), uniface (n = 3), and debitage (n = 252) defined as unidentified, tertiary, secondary, and primary flakes (Boreson 1995:3.4). When compared to known regional chronologies, the diagnostic projectile point assemblage made of local and non-local lithic material, suggested humans utilized the project area for the past 10,000 years. Galm (1993, in Boreson 1995:3.4) stated contrary to perceptions that projectile points from this area were poorly manufactured, the workmanship in the typically flawed and fractured toolstone material in this collection is nothing short of exceptional.

Boreson (1998:1.3) surveyed YTC landscape draining east to the Columbia River between Middle Canyon and Cold Creek and west-draining terrains in Badger, Lmumma, Burbank, and Selah tributaries of the Yakima River. Elevation ranged from 990 m to 183 m (Boreson 1998:5.23). Lithic debris concentrated between elevations of 457 m and 914 m. Thirty-percent of the archaeological record was systematically sampled. Landforms and flora/soils (Table 1) related to site locales (Appendix A) were recorded. The study was one of the first to measure micro-spatial variation within the landform classes. For example, rootbed habitat distribution was examined in relation to seasonal context based on monthly fluorescence schedules. Boreson (1998:4.3) reported edible root crops occurred universally in lithosol habitat but a fall season crop occurred in non-lithosol habitat. The finding suggested edible roots may have been available in the project area on a year-round basis.

Boreson (1998:3.7, 6.10) noted three research problems. First, it was difficult to assign lithic deposits lacking diversity or formed tools with site function. Second, artifact deposits lacking diagnostic projectile points biased research toward the floodplain-terrace landform and skewed temporal data toward more recent precontact occupations. And last, archaeological rock features, which lacked deposits of portable artifacts were difficult to attribute to cultural origins in either prehistory or the Historic Period. As discussed over the course of this research, the later problem was nearly universal among archaeological investigations that recorded the region's various types of rock features.

Gough's (1998) YTC excavation (45KT950) at the Columbia River's Hanson Creek-Priest Rapids Reservoir confluence is relevant to this research with regard to its areal proximity to the upland study area and, particularly, faunal remains contained in the sub-surface assemblage. Site 45KT950 may reflect cultural behaviors that linked resource acquisition in the east Saddle Mountains to resource processing activities that took place immediately across the river. Site 45KT950 was located 490 m west of the confluence on the creek's valley floor at the base of a west Saddles slope (Gough 1998:6). Elevations ranged from 159 m to 165 m and the site encompassed two active flow channels before exiting the area via a gap in a low, basalt ridge (Gough 1998:6). Site formation resulted from both fluvial and, to a lesser extent, eolian deposition (Gough 1998:12). Rounded and edge-abraded lithic debitage and abraded bone fragments showed evidence of fluvial transportation (Gough 1998:11) of artifacts within the deposit.

Twenty excavation units measuring 50 m by 50 m were positioned outward from the site's datum at 40 m intervals, matrices were screened with 1/8th and 1/4th inch wire mesh, and a single 1 m by 1 m test pit was placed adjacent to larger, contiguous sample units containing temporally diagnostic Mazama ash (Gough 1998:6, Figure 8). Seventy-five percent of the units held culturally associated materials (Gough 1998:20); debitage (87 percent), bone (8 percent), and mussel shell (3 percent) made up the portable artifact fraction of the assemblage. Two percent of artifacts were stone tool technology products, hematite (i.e. bloodstone, red ochre), and gastropod (i.e. snail) remains (Gough 1998:21).

Lithic artifact descriptions are taken from Gough's (1998:20-28) results summary. Multiple instances of modified shatter and flakes and bifaces occurred in the assemblage along with a single core, scraper, perforator, and projectile point/knife. Lithic objects were both *in situ* above, within, and below the Mazama lens deposited ca. 6,800 years prior. Geochemical tests of obsidian flakes (n = 2) were inconclusive as to the volcanic source of origin (Gough 1998:22). Fire-cracked rock and unmodified cobbles related to modified artifacts were also recorded. Lithic artifact evidence indicated stone tool technology was the focus of site use and the faunal remains suggested human activity indicative of short-term occupations of a campsite. By the time of Gough's (1998:31) work, few Vantage phase sites (n = 2 of 29) had been excavated in YTC terrain (see Chatters and Benson 1987; Gough 1996).

Bicchieri (1999a:1) directed Central Washington University field research, in 1993, in the upper Yakima River drainage located between Ellensburg, Kittitas County, and Selah, Yakima County. Project objectives included: (1) addressing methodological issues of artifact, site, and site type classification through sample collection and analyses of lithic debris from possible quarry sites and (2) documenting the archaeological record using pedestrian survey and sub-surface testing (Bicchieri 1999a:1). A survey interval of 15 m was used (Bicchieri 1999a:5). Location, azimuth, plant communities, soils, and geology, artifact content, maximum artifact density per $1m^2$ (including shatter), site dimensions, depth of fill, and age of site deposits were recorded (Bicchieri 1999a:5). In addition, distance from site to water resources (permanent or ephemeral) was recorded (Bicchieri 1999a:15). Sub-surface testing was done with a four-inch metal bucket auger and excavated matrices were screened through $1/8^{th}$ inch wire mesh (Bicchieri 1999a:7).

The survey reconnoitered 935 acres (35 percent) of the 2,640-acre project area (Bicchieri 1999a:15) and 24 archaeology sites evidenced precontact human land use, while eight had mixed precontact-historic artifact deposits.

The following synopsis of project results is taken from Bicchieri's (1999a:13-17) summary. Lithic cluster (n = 7), lithic procurement (n = 12), and rock feature (n = 13) site types were identified, along with one pictograph and one residence. Lithic cluster sites, located on ridge tops at elevations greater than 610 m. with an 8-percent average degree of slope, reflected initial stages of lithic reduction and, possibly, workshops related to toolstone raw material sources located downslope. Lithic procurement sites included the presence of a toolstone raw material source on site (Bicchieri 1999a:6); that is, a direct link to geologic interbed exposures that typically occurred on sloped landscape. Hence, lithic procurement sites occurred on terrain with a 20-percent average degree of slope where toolstone resources were accessible from interbed sediments. Rock feature sites included single or grouped talus pits (n = 36), cairns (n = 11), and alignments (n = 3). The cairn sites were generally isolated and at high elevations. Bicchieri saw no connection between cairns and lithic procurement sites.

Bicchieri (1999b:1) again directed Central Washington University field work, in 1994, on the upper Yakima River between and Ellensburg and Selah, Washington. The project's research objectives included: (1) surface survey and sub-surface testing of the archaeological record, (2) source edge modification (i.e. one/more flake scar [Bicchieri 1999b:11]) on surficial (chert) toolstone, (3) explore relationships between archaeology sites and geologic formations, (4) collect/analyze data related to methodological and artifact, site, and site type classification issues (Bicchieri 1999b:1). Survey interval (10 m to 15 m) varied (Bicchieri 1999b:7). All survey recordation of environmental variability and sub-surface tests conformed to field and laboratory protocols previously established. The surface survey reconnoitered 760 acres (74 percent) of the 1,030-acre project area (Bicchieri 1999b:14). Human land use occurred in three landform classes (frequency, type, elevation shown in parentheses): canyon slope (n = 1, talus slope pits at 835 m), ridge slope (n = 1 quarry at 762 m), ridge top (n =3, lithic cluster/rock feature at 853 m and 805 m; residence at 704 m) (Bicchieri 1999b:Table8). Three precontact sites were recorded, along with one that held a mixed precontact-historic artifact deposit.

Lewarch et al. (1999:2, 10) surveyed YTC terrain in the Boylston and western segment of the Saddle Mountains, Middle and North Middle Canyons, Johnson Creek, Foster Creek, and adjacent unnamed drainages flowing east to the Columbia River. A small north flank of Yakima Ridge was also surveyed. Elevation ranged from 1,030 m on an upland bench to 274 m on the floodplain (Lewarch et al. 1999:85, 93). A thirty-percent surface sample of the archaeological record was recorded. Environmental variables of known significance to “hunter-fisher-gather” (Lewarch et al. 1999:3) cultures (Table 1) were explored, including previously uninvestigated landscape characteristics. Elevation and degree of slope related to archaeology deposits were noted; however, Lewarch et al. (1999:130) emphasized local geology as the key environmental variable influencing all other physiographic characteristics of the region.

Landforms, resource habitats, and paleoenvironment (Lewarch 1999:12-13) were used to frame the area’s archaeological context. The “optimal foraging radius” model of human land use set forth by Binford (1980) was used to predict distribution of artifacts and cultural patterning (Lewarch et al. 1999:132). The model hypothesized cultural behavior would be tied to distances between human habitation sites in riparian zones and resource habitats located inland from those points. Lewarch et al. (1999:132) assumed travel routes, repeat-use, and fixed-use resource settings might skew artifact density in the direction of those localities.

Lewarch et al.'s (1999:16-18) archaeology site types (Appendix A) included rock cairns that bore no resemblance to indigenous burial formations (Lewarch et al. 1999:105). Cairns spaced at irregular intervals along the area's dominant ridge crest between Johnson Creek and Middle Canyon were thought to be locational markers of an inland trail route west of the Columbia River running through the Foster Creek water gap between the Boylston Range and the west Saddle Mountains (Lewarch et al. 1999:105). Cairns of piled angular cobbles and stacked tabular slabs located near basalt exposures, slope toes, and along flat edges of basalt flow tops were noted for their visibility from a distance, which may have provided west-bound travelers with directional markers for traversing the Foster Creek trail (Lewarch et al. 1999:108).

Lewarch et al. (1999:59, 69) departed from previous researchers' adoption of Binford's (1980) "location" typology for places where extractive tasks were exclusively carried out, defined as (1) low formed tool and other artifact densities representing short term human utilization and (2) wide and/or scattered site distribution of low artifact densities representing similar kind/distribution of preferred resources. Instead, the term "activity area" (Lewarch et al. 1999:69) was used to expand the scope of activities carried out at a distance from camp and village sites, primarily to acquire flora (food) and toolstone raw material acquisition.

The following excerpt from Lewarch et al.'s (1999:59-130) summary of results overviews functional attributes of cultural deposits recorded during the project. Cultural deposits were classified as activity area (n = 17), lithic reduction (n = 16), quarry (n = 30), and cairn (n = 2) sites. A total of 65 sites and 372 isolated deposits were recorded. Activity areas were located on ridge slopes that invited plant collecting in lithosolic habitat on ridges, along with prey game monitoring from ridge crests, and toolstone prospecting on ridge slopes. In all but one activity area, presence of lithic flake reductive classes pointed to raw toolstone processing activities. One-half of lithic reduction sites were located on slopes that differed in degree from activity area and quarry sites. Lithic reduction sites were seen as "single event" locales utilized for resource procurement and larger sites were thought to represent multiple utilizations by many generations of human groups during prehistory.

Lithic reduction sites were in proximity to geologic exposures of toolstone on steep slopes, although Lewarch et al. (1999:71) stated such sites signified a wider range of activities than simply manufacturing stone tools. For example, all lithic reduction sites were dominated by high tertiary flake frequencies pointing to tool production; however, used flake, projectile point, biface/biface preform, and scraper artifacts were recorded at lithic reduction sites, which indicated flora collecting and processing, and game hunting and processing (Lewarch et al. 1999:71). Quarries were related to erosional exposures of lithic raw material and they had higher degrees of slope than other sites (i.e. 10-degrees or greater) (Lewarch et al. 1999:73). Large quarries occurred on ridge crests or slopes and small quarries were on intermittent drainage slopes. Fifty-percent of quarry sites had evidence of activity other than toolstone acquisition such as flora and fauna procurement inferred from utilized flake, scraper, biface, and projectile point artifacts; the principal concentration of projectile points was located at a quarry site (Lewarch et al. 1999:71). Temporally diagnostic projectile points suggested land use spanned the past 5,000 years at that quarry (45KT1318) (Lewarch et al. 1999:71).

Miss (1999:1) excavated previously recorded archaeology sites on YTC upland where elevation exceeded 610 m in the Columbia River's Hanson Creek tributary and the Yakima River's Lmumma Creek tributary. Miss (1999:1) evaluated five cultural sites of which four had southerly directional aspects and one was on a northeast slope face; all sites were sparsely vegetated shallow aeolian soils with sagebrush/grass/forb habitat. Miss (1999:6) cited previous researchers' observation that archaeology site distributions differed across YTC terrain relative to major drainage orientation; that is, high site density relative to the Columbia River in the east and low density relative to the Yakima River in the west (see King and Caywood 1994). That site distribution differential may reflect fixed travel routes or distribution of flora resources (Hartmann and Stephenson 1980, in Miss 1999).

Miss's (1999:7) "lithic landscape" model was first-of-its-kind research in Plateau studies. The model incorporated and expanded then current archaeological precepts of the local toolstone resource base: (1) surface exposures of raw material often co-occur with basalt outcrops; therefore, exposed basalt may mark resources utilized in the local lithics industry, (2) late Pleistocene glacial deposition resulted in considerable and lithologically diverse cobble dumps that amplified raw material resources, and (3) obsidian, an exotic, non-local material entered the archaeological record from extra-regional sources. Miss (1999:7) analyzed local toolstone and lithic technological systems in order to suggest subsistence, settlement, social organization, mobility, and (trade, and) exchange patterns. Miss (1999:9) focused on quarry sites in order to better expose and describe procurement and early stage raw material reduction characteristics of the local lithic landscape.

The project entailed sub-surface excavation carried out according to the following field methods (Miss 1999:19-21): Test units (.50 m^2) were placed at systematic intervals in the areal surface to an extent determined by site size (m^2). Sites of less than 5,000 m^2 were sampled at 10 m intervals, sites of 100,000 m^2 or greater were sampled at 80 m intervals. Between those parameters, sample intervals increased by 10 m increments relative to areal dimensions (e.g., 5,000 to 10,0000 m^2 = 20 m, 10,000 to 50,000 m^2 = 30 m). Geologic sources of toolstone were sampled with dug trenches and sediment matrices were screened through 6 mm wire mesh.

Laboratory analysis and classification focused on distinguishing manufactured goods from lithic by-products as means to differentiate between quarrying activities (Miss 1999:49). The assemblage (n = 61,884 artifacts) analysis emphasized definition of technological (e.g., object type) and functional (e.g., utilization/modification) classes in order to define reduction products. Technological classes representing the complete early stage reduction cycle (i.e. chunk, shatter, core, hammerstone, flake) were present in the assemblage. The artifacts were additionally classified according to material type, physical condition, cortex index, dorsal topography, heat treatment, and metric factors. Functional classes identified evidence of artifact modification and/or utilization, wear pattern (i.e. kind, location, shape), and edge angle.

The results of Miss’s (1999:20) analysis follow: (1) Material type served to differentiate cryptocrystalline silicates from smaller frequencies of basalt; however, type designations such as opal or fossilized wood was misleading given the tendency of local raw material to exhibit all degrees of geologic silification. (2) Cortex index analysis was moot because sub-surface objects failed to undergo weathering such that rind or patina was discernable. (3) Dorsal topography was irrelevant for the reason that early stage reduction objects lacked multiple dorsal scars; a point emphasized by the fact the bulk of the assemblage consisted of such objects. (4) Heat treatment detection proved thorny for the reason that cryptocrystalline rock surfaces have crazing and luster in the natural state, particularly fossilized wood, which resembles heat modification.

In order to discern if quarries represent lithics industry resource procurement sites exclusively, Miss (1999:22) outlined expectations of early stage resource acquisition: (1) low flake/flake fragment to shatter ratio, (2) abundant large-size/complete flakes, (3) low specialized flake frequencies, (4) low tool frequency per object, and (5) few formed objects. Miss (1999:22) assumed raw material mining and its earliest reduction sequences would leave large amounts of debitage and prismatic waste (shatter) and little evidence of tool manufacture or use. Overall, those expectations held true. The sites had low flake-to-shatter ratios, large flake sizes, rare occurrences of specialized flakes, and few tools in the "worn" class of functional object types (Miss 1999:59). The functional analysis tended to confirm interpretation of the quarry sites as focus on toolstone acquisition, while pointing to intensity of activities among the sites (Miss 1999:56).

Given that a small number of microblades exist in the lowland study area data set examined in this research, Miss's (1999:52) view of "prepared" lithic cores (n = 3) as potential microblade cores, is provocative. Microblade technology raised "something of a regional conundrum" (Miss 1999:60) based on its construal as an early temporal marker and evidence for human migration in the Canadian Plateau and on Mid-Columbia Plateau peripheries of the Northwest Coast. Miss (1999:51-52) notes prepared cores are the best evidence for microblade technology; while the project assemblage did not offer strong evidence for microblade production, a few small cores suggested the technology was used. Previous researchers of Plateau prehistory (Ames et al. 1998; Brown and Munsell 1969; Daugherty et al. 1967; Sanger 1967, in Miss 1999:60) suggest microblades first appeared in the regional assemblage at Rye Grass Coulee, ca. 6,800 years ago, and later in lithic assemblages recorded at both Chief Joseph Reservoir and Wells Reservoir.

DeBoer et al. (2002:2-3) surveyed YTC land in the west Saddle Mountains, Johnson, Hanson, Alkali, and Corral Creek drainages to the Columbia River, west Umtanum Ridge, and the Yakima River's tributary Selah Creek drainage (DeBoer et al. 2002:2-3). The mountains ranged in elevation from 1012 m to 365 m. Terrain along the Columbia River was 150 m in elevation (DeBoer et al. 2002:128, 144-148). Toolstone outcrops were observed throughout the west Saddle Mountains. Landform, elevation, directional aspect, and distance to reliable water were used to mark the environmental context of cultural deposits.

DeBoer et al. (2002:47) framed and interpreted their survey project in terms of Nicholas's (1994) System State Theory "effective environment" model (i.e. total environs to which humans most closely articulate). According to the theory, resources clustered in highly productive and spatially variable patches, and humans adopted differing strategies to maximize their efficiency in such environments (DeBoer et al. 2002:47). The research correlated cultural site distribution with environmental variables thought to condition human land use (DeBoer et al. 2002:48). The several land use models derived from DeBoer et al.'s (2002) project results (Appendix A) are based on System State Theory.

Hackenberger (2000) synthesized what is known from past studies of traditional indigenous mortuary practices in the Pacific Northwest with emphasis on comparing and incorporating Mid-Columbia Plateau traditions into the regional chronology. The work is pertinent to this research, in particular, for clarifying environmental settings and physical features such as "pit burials" (Hackenberger 2000:3-4) first reported in the archaeological record from Marmes Rockshelter. Amplified definition of regional burial environments and their archaeological features can serve to shed light on recognizing cultural function and provenience for rock cairns and talus slope features that differentially occur in both the upland and lowland study areas. For example, Hackenberger (2000:67) described two burial container-grave marker associations that resemble areal surface and rock features located in the study areas: (1) unmodified pits in earth or talus marked by cairns or surface depressions, and (2) cists in earth or talus marked by cairns. Such definition, at its least, is important to a systematic process of elimination in order to suggest cultural functions for intentionally altered surface and rock features in the research database.

Hackenberger (2009) collected a prodigious amount of Plateau literature in order to outline cultural resource management and research plans for Yakima Uplands located on the YTC. Cultural history and relations, settlement and subsistence, technology, and paleoenvironment records (Hackenberger 2009:5-35) formed a database of the cultural-environmental paradigms extant during antiquity on the Columbia Plateau, beginning ca. 13,500 years ago. Hackenberger (2009) treated those variables as analytic units, which – juxtaposed into cultural-environmental constructs – explicated the Plateau's peopling and occupation. Hackenberger's (2009) chronologies detailing environmental vacillations and ecological responses, including human adaptations seen in the archaeological record, give us a catalog of what is currently known or yet to be answered about Plateau prehistory.

Plateau lithics industry attributes (Hackenberger 2009:163-181) are germane to this research, which is essentially based in artifact-scale lithic analysis. Lithic toolkits, as assemblages of technological variables (e.g., artifact form/frequency, debitage/core ratio) (Hackenberger 2009:Table 20) can be instrumental in alluding to a continuum of human behaviors in the Mid-Plateau environment. Hackenberger's (2009:2.5) discussion of groundstone, microblade, and quarry technologies particularly assists interpretation of presence/absence frequencies for such artifacts and features in upland and lowland data examined in this research. Groundstone, indicative of flora processing (Hackenberger 2009:169-170), is present in the research database. Microblades, rare in Mid-Plateau toolkits (Hackenberger 2009:167-168), are present in the research database. Quarry sources of toolstone raw material (Hackenberger 2009:179-181) are present in the research database.

House pit features are a part of the Plateau's earliest expressions of human culture (Hackenberger 2009:131) in the archaeological record. House pits suggested cultural history and relations, settlement, subsistence, and paleoenvironmental characteristics (Hackenberger 2009:131-136) used to develop temporal frameworks from the middle Holocene forward. House pits (and other dwelling types) in the middle Columbia River locality suggest winter sedentism (Hackenberger 2009:137-147) became an element of the Mid-Plateau occupation model. Given that perspective, Hackenberger's (2009) house pit data provides this research a means to refine an interpretation of surface pit features classified as human habitations that exist in the research database.

Hackenberger (2009:174) stated Lohse's (2005) projectile point phase chronology was the most complete Plateau study available to date. Older chronologies (see B. Butler 1962; Carter 2010; C. Nelson 1969) – Hackenberger (2009:174) cited Leonhardy and Rice (1970) – have produced a range of terminology for identifying stylistic type classes. Projectile point technology, and projectile point artifacts in the research assemblage and those reported in the literature reviewed thus far in this chapter are treated as a special class of analytic units. As such, regional projectile point data are discussed ahead in the section entitled, Projectile Point Chronology of Previous Research.

Orvald (2010a) looked at archaeology sites (n = 17) located on YTC land in order to assess data potential for the archaeological record in each area (Orvald 2010a:47). The sites were selected according to their areal connection to a naturally occurring spring or seep (Orvald 2010a:33). The archaeology sites examined were located on slopes in the west Saddle Mountains (1,029 m), drainage slopes in Johnson Creek's upper reach (724 m), Middle Canyon (560 m) and its north fork (408 m), on drainage terraces in North Fork Middle Canyon (231 m) and at Sentinel Gap (174 m) (Orvald 2010:Table 14). Site sampling predicated on Dancey's (1973, 1974, in Orvald 2010:52) methods of scrupulous spatial control and meticulous inspection of space were used to conduct surface and sub-surface analyses.

Pedestrian survey (meter interval unspecified) was used to ascertain site surface dimensions followed by recordation of surface artifacts and features (Orvald 2010a:229). A controlled surface analysis of one site entailed placing a number of contiguous survey units (5 m x 5 m) in a disturbed roadbed and along the edge of the spring channel (Orvald 2010a:80). Sub-surface tests used bucket auger and shovel probes located at 10 m intervals across site surfaces with arbitrarily positioned excavation units of varying sizes. (Orvald 2010a:229) Five of seven sites on southern slopes of the west Saddle Mountains directly related to watered environments (Orvald 2010:67). Five of seven sites in Johnson Creek drainage (including Middle Canyon) associated with surface waters (Orvald 2010a:68). An archaeology deposit linked to a spring was recorded at Sentinel Gap (Orvald 2010a:95). Most sites were known from past studies and literature produced during those efforts was included in Orvald's (2010) site descriptions.

Sub-surface stratigraphies, artifact inventories, geological profiles, water resource characteristics, and topographic maps convey Orvald's (2010a:Chapter 6) project results, as follow. Spring-related archaeology sites existed mainly in upland and connected to surface exposed Columbia River Basalt Group (CRBG) members and, less obviously, to the Ellensburg Formation (Orvald 2010a:69). Archaeology deposits at spring sites held the full range of lithic artifacts typically recorded in the region (e.g., debitage, core, battered cobble, flake/flake-derived artifacts, groundstone [e.g., hopper mortar base, pestle), bone, and shell. Orvald (2010a:111) noted artifact frequencies concentrated most densely where areal surfaces were most highly eroded.

Along with its study of upland geologic exposures of toolstone raw material and soils/flora associations, Orvald's (2010a) work is additionally pertinent to this research for the light it sheds on archaeological relationships with upland springs and seeps in the research region. This synopsis is taken from Orvald's (2010a:16-22) explanation of those relationships. First, local geology and geomorphology underpin hydrologic systems that generate ground water discharge zones in the form of springs and seeps in arid upland. Tolan et al. (2009) summarized the role of Columbia River Basalt Group members, as infrastructure, in regional subsurface hydrology patterns. Vaccaro et al. (2009) outlined the hydrogeologic framework underpinning the Yakima River Basin system. Spring/seep zones, along with predicting upland toolstone outcrops in ridge microenvironments, contain archaeological evidence of seasonal human occupation sites. (By 2005, more than 200 spring/seep features had been identified on YTC landscape [Orvald 2010a:64]). Soils vary by landform (e.g., ridgetop, alluvial flat); lithosol soils/flora habitats of known value to humans in the main occur on upland ridge south slopes (Orvald 2010:23-24). The archaeology sites at springs and seeps often hold evidence of stone tool manufacturing and flora/fauna resource utilization (Orvald 2010a:231). Porcupine Spring exemplifies numerous precontact lithic scatters on ridge and slope landforms with lithosolic soils (Orvald 2010a:113).

Barrick's (2013:10-12) Master's thesis research focused on previously recorded archaeological data from six non-contiguous study units totaling about 18,000 acres in diverse YTC terrains of the Boylston and West Saddle Mountains, Ryegrass Mountain, Manastash and Umtanum Ridge, and Selah Canyon. Environmental data from surface surveys (i.e. elevation, slope, aspect, landform, spring, rootground, interbed), digital technology (i.e. light detection and ranging [LiDAR], digital elevation map [DEM]), and non-digital sources (e.g., hydrologic survey, geologic surface map) and archaeology site deposit data were combined in the research database (Barrick 2013:34). Spatial analysis with applied GIS methods was conducted in order to model the archaeological record in environmental context for each study unit.

Barrick (2013:61) looked at distribution characteristics of six portable artifact classes (i.e. debitage, core, battered cobble, biface, modified flake, and projectile point) in order to determine how objects patterned across the landscape. In addition, spatial relationships between artifacts and environmental variables, particularly interbeds, were examined. The database was statistically analyzed (Barrick (2013:61-62) using (1) the "average nearest neighbor" test for random, clustered, or dispersed patterning of data points, (2) dimensional analysis of variance test showing which cultural objects clustered, dispersed, or randomly patterned, and (3) dimensional analysis of variance test to show the dominant (meter distance increments) scale of patterning for artifact type classes. The average nearest neighbor test, for example, indicated a clustering pattern occurred for all artifact classes in the West Saddle Mountains study unit (Barrick (2013:61); the debitage class exhibited the greatest degree of clustering followed by lithic cores. Clustering began at smaller distance scales for debitage and cores and at larger scales for bifaces, modified flakes, and projectile points (Barrick 2013:62, Figure 19); battered cobble patterning was dispersed at all scales of distance.

This synopsis of artifact spatial relationships with environmental variables is from Barrick's (2013:64) results discussion. Chi-square tests showed the majority of artifact classes (n = 37 of 42 tests) were nonrandomly distributed across environmental variables (e.g., elevation, landform, interbed). Biface, projectile point, debitage, and core artifact distributions were nonrandom in all environmental strata. Modified flakes and battered cobbles showed potentially random distribution patterns; however, modified flakes were not shown to be nonrandom in slope and interbed classes, while battered cobbles were not shown to be nonrandom in landform, rootground, and interbed classes.

Artifact distribution markedly connected to elevation (Barrick 2013:64). High frequencies of bifaces, modified flakes, cores, and battered cobbles occurred at low elevations (ca. 152 m to 572 m) and high frequencies of projectile points were seen at middle (ca. 572 m to 782 m) and middle-high elevations (ca. 572 m to 782 m) (Barrick 2013:65). Biface, projectile point, debitage, core, and battered cobble distributions corresponded to degree of slope; modified flakes had insignificant association (Barrick 2013:65-66). Fewer than expected battered cobbles and cores occurred as degree of slope increased and bifaces, projectile points, and debitage were fewer than expected as degree of slope decreased (Barrick 2013:66). All artifact classes had significant correspondence to directional aspect (Barrick 2013:66-67); all classes oriented toward a southerly aspect (135 to 225 degrees) with the exception of battered cobbles, which oriented to westerly aspects (225 to 315 degrees). All class frequencies were lower than expected relative to northerly aspects and all, except projectile points, occurred at low frequencies relative to easterly aspects (Barrick 2013:Figure 22).

Barrick (2013:67) classified topography as alluvial flat, bench, drainage, knoll, saddle, slope, and upland flat landforms. This synopsis of artifact distributions relative to landforms is taken from Barrick's (2013:67- 69) results discussion. High frequencies of biface, modified flakes, projectile points, and debitage occurred on benches, upland flats, knolls, saddles, and drainages, while low frequencies occurred on slopes, drainages, and alluvial flats. High lithic core frequencies were located on benches, upland flats, knolls, saddles, and slopes. Low lithic core frequencies were seen on drainages and alluvial flats.

Previous Archaeological Work in the East Saddle Mountains

Galm and Hartmann (1975, 1976a, 1976b, 1979) carried out a number of surface surveys (Bruce et al. 2004:4.33) in the upland study area examined in this research. The earliest focused on areal settings known to attract human land use (Galm and Hartmann 1975:1-2). The most elevated landform, Wahatis Peak (822 m), had shallow rocky and ashy-loess soils supporting shrub steppe flora. Landforms, water resources, soils, and flora were recorded for 15 archaeological deposits (Bruce et al. 2004:4.33). Most often, cultural material was located near active springs originating at basalt and sedimentary interbed interfaces and in ephemeral drainages (Galm and Hartmann 1975). Four cairns, seven lithic scatters, one talus slope depression, and three toolstone quarries (Galm and Hartmann 1975) were recorded in the upland study area or in directly adjacent terrains. Quarry sites were located on basalt terraces, slopes oriented toward the west, and ridge crests. Toolstone raw material procurement was thought to be the main land use in the east Saddle Mountains (Galm and Hartmann 1975, in Bruce et al. 2004:4.33).

Galm and Hartmann (1975) stated rock cairns proved highly problematical to assign cultural derivation. Cairns thought to have been emplaced during antiquity were identified as either human burials (see Hackenberger 2000) or traditional indigenous religious features related to vision quests (Galm and Hartmann 1975; see Hartmann and Galm 1976). Galm and Hartmann (1979) later redefined some cairn sites as precontact locational markers of toolstone sources (Galm et al. 1981:79). Lithic debris observed in Section 8 near Log Wells water tank (Galm and Hartmann 1975:20) was recommended for future archaeological scrutiny. (Log Wells was systematically surveyed in 2008 and that information is included in the upland study area data set examined in this research.)

Galm and Hartmann (1975) reported disturbed surfaces near site deposits exhibited recent rock collector activity and impacts from road use in the area.

W. Smith (1977:4) focused on mesa landforms in channeled scabland terrains located east of the Columbia River and due north of the upland study area. The project is primarily of interest to this research for its descriptive account of “enigmatic” (W. Smith 1977:1) cairn, pit, and aligned rock features that resemble similar archaeological features present in the upland study area. W. Smith’s (1977:18-19) project area included mesa terrains mapped on the Coulee City, Marlin, Othello, Soap Lake, and Wilson Creek quadrangles (U.S. Geological Survey 7.5’ Series). Eight mesas in the lower Crab Creek drainage (W. Smith 1977:Figure 1.2) were recorded along the east Saddle Mountains’ north toe near the creek’s confluence with the Columbia River. Twenty-four mesas were recorded, six were intensively surveyed and four of those were excavated (W. Smith 1977:17). Geological exposures of basalt bedrock typified four mesa environments: (1) flat upper tabular zone, (2) vertical upper wall columnar zone, (3) lower talus slope basal zone, and (4) peripheral zone surrounding each mesa base (W. Smith 1977:17).

W. Smith’s (1977:17-18) excavation units varied in size (e.g., 1 m^2, 1 m by .5 m) and screen size was not reported; however, a total of 99 test units yielded 17,100 artifacts located, on average, in the upper 20 cm of stratigraphy. Debitage, cores, hammerstones suggested lithic procurement and initial reduction activity (W. Smith 1977:46-57); formed and use-worn unifaces, bifaces, and projectile points were also recorded. Two culturally modified landscapes were described: (1) non-structural feature (e.g., activity area, fire hearth) with portable objects and (2) structural feature (W. Smith 1977:58-60). Structures consisted of loosely arranged basalt “rubble” W. Smith (1977:58-60): (1)

linear mounds, (2) crescent, irregular, or rectilinear alignments, (3) depressions, (4) pits, (5) cairns, (6) angular enclosures, (7) circular earth enclosures, and (8) angular basalt/earth enclosures identified as housepit features (W. Smith 1977:60). W. Smith (1977:60, 70) thought pits were resource caches and cairns were vision quest monuments or landmarks. Such basalt features are pertinent to this research primarily because a number of similar forms are present in the upland data set.

Galm et al. (1981) reviewed extensive literature from past Mid-Plateau studies and produced an archaeological, ethnographic, and environmental overview of regional patterns. The east Saddle Mountains/Wahluke Slope tract was one of 18 sub-regions east and west of the Columbia River that furnished the archaeological database (n = 555 sites) analyzed during the study (Galm et al. 1981:63, 83). Eight archeology site types and twelve landforms (Galm et al. 1981:84-85) were identified. “Upland, non-canyon” landforms were slopes, benches, saddles, and flats (Galm et al. 1981:85); others were overlook, mesa, canyon wall, boulders, talus, dunes, island, and alluvial flat. The alluvial flat class was further divided into sub-classes: floodplain, floodplain terrace, active/relict drainage, and canyon bottom (Galm et al. 1981:85).

Galm et al. (1981:59, 61) considered archaeological site classes synonymous to culture phases derived from revisions of Nelson (1969) and Swanson (1962). Technology and function, subsistence and settlement, and environmental patterns for the Windust (D. Rice 1972), Vantage, Frenchman Springs, and Cayuse culture phase temporal sequences (Galm et al. 1981:83, 90-99) were based on projectile point phase chronologies. Those data were then coupled to geology, soils, flora, fauna, climate, and paleoenvironment analyses in order to infer resource availability (Galm et al. 1981:5-8) during each temporal sequence.

Galm et al. (1981:79) cited east Saddle Mountains surface surveys carried out by Chatters (1980), Galm and Hartmann (1975), and D. Rice (1969a). Two of eight regional site types, camps and rock cairns, existed in the area (Galm et al. 1981:84). Camps were thought to have been briefly occupied sites used during upland food harvests and game hunts (Galm et al. 1981:84). Rock cairns were observed more often in the east Saddles than in any other upland terrains analyzed during the project. Rock cairn functions were attributed to vision quest monuments, resource locational markers, resource caches, and human burials (Galm et al. 1981:84). The east Saddle Mountains were considered sacred land in the traditional indigenous belief systems (Galm et al. 1981:32) and, according to ethnographic records (Galm et al. 1981:30), vision quest cairns were constructed in the east Saddle Mountains during prehistory.

Yakama Nation informants were cited regarding lithic materials obtained from the east Saddle Mountains by their predecessors. Those reports lead Galm et al. (1981:29) to surmise some cairns had served as locational indicators of toolstone resources. Although quarries were not recognized as a discrete site class in the study, Galm et al. (1981:79) reported toolstone quarries existed in the east Saddle Mountains tract. When compared to upland in the Rattlesnake Hills and Yakima Ridge, Galm et al.'s (1981:79) data indicated land use in the east Saddles was short, low intensity resource harvesting encumbered by water scarcity throughout the area.

Chatters (1982:127, 131) surveyed seven physiographic sub-regions of the Mid-Plateau located east of the Columbia River from which ten sample units were selected.

Two units targeted the river in order to measure distance (e.g., 0-1, 1-2 miles) away from the floodplain (Chatters 1982:131) and detect change in kinds and intensities of land use. The east Saddle Mountains unit encompassed the north face above Crab Creek, Wahluke Slope's south face, and the mountain's east terminus at the Othello Channels. Elevations at Wahluke Slope and the Othello Channels were at or below 305 m and plots above Crab Creek were at or below 610 m (Chatters 1982:Figure 1). Slightly more than 15-percent of the east Saddles unit (i.e. 13,350 acres) was surveyed (Chatters 1982:129).

Each sample unit constituted an environmental variable (Chatters 1982:130), as sub-regional environmental division, which included additional physiographic variables (e.g., geology, hydrology, soils/flora, topography) that spawned differential flora/fauna habitat and resource densities (Chatters 1982:130-131). In each units' set of habitat variables, soils/flora habitat variations were matched with human and wildlife food values that, in turn, offered limited resources to humans (Chatters 1982:131), as follow:

- Rocky scabland – biscuit root, wild onion, bitterroot (human food)
- Stony sandy loam – sagebrush/bluebunch wheatgrass (fauna forage)
- Sandy loam – sagebrush/bluebunch wheatgrass (fauna forage)
- Sand – Indian rice grass (human food)

Although fauna forage habitat in stony sandy loam provided for game species hunted by humans, Chatters (1982:133) reported rocky/scabland soils dominated sediment classes across the total 66,626 acre sample. The east Saddles were classified as rocky scabland (Chatters 1982:132). Topographic variability affected human land use because terrain type influenced resources (Chatters 1982:132). Chatters (1982:136) characterized the east Saddles topography as "all rocky with marked variability of relief". Surface conditions (e.g, archaeological visibility, erosion, disturbance) and landforms were not disclosed in Chatters' (1982) project overview.

In order to recognize human behavior patterns through the archaeological record, Chatters (1982:125-126) tailored Dancey's (1973) method to suite his project: (1) deposit distribution defined settlement pattern, (2) differential deposit distribution defined land use, (3) distribution of artifacts classified by function pointed to varying kinds of land use, (4) deposit and functional artifact class distributions indicated cultural variations that could be matched to environmental variations, (5) statistically significant associations of artifacts and biological species indicated why humans were active in given environmental contexts. Chatters' (1982) project also recognized the role of toolstone outcrops in human behavior patterns.

Six site classes were classified by artifact kind/quantity: (1) presence/absence of hopper mortar base, rock cairn, and toolstone outcrop, (2) assemblage percent consisting of lithic artifacts with secondary retouch/use wear, and (3) waste flakes from one/more cores (Chatters 1982:130). Of total sites (n = 54) and isolated artifacts, 96-percent (n = 278) were in rocky scabland (i.e. human food) or stony sandy (i.e. fauna food) habitat and where artifact densities exceeded those located in fine-grained soils by a factor of three or more (Chatters 1982:129, 136). Humans utilized areas with rocky scabland soils to the near exclusion of areas with fine-grained sediments (Chatters 1982:140).

Core, unworn flake, worn flake/tool, and projectile point functional classes made up the project's lithic database (Chatters 1982:138). All classes were present in the east Saddle Mountains assemblage (i.e. core [n = 2], unworn flake [n = 49], worn flake/tool [n = 19], and projectile point [n = 15]) at frequencies exceeded only by the most intensively used sample unit located immediately north of the Saddles along the river. Thirteen sites in the east Saddles unit consisted of four types (Chatters 1982:136, 139):

- Multifunctional type-2 (n = 1) where one or more intensive activities took place, hopper mortar base absent
- Quarry (n = 3) with geologic outcrop of raw toolstone present
- Secondary lithic reduction station (n = 2) with flakes from multiple cores present
- Single event lithic reduction station (n = 7) with flakes from a single core present

Multifunctional type-2 sites (hopper mortar base present) and rock cairns were absent in the east Saddles unit (Chatters 1982:Figure 7, Table 6). Rocky habitats such as the east Saddle Mountains was complex: (1) toolstone procurement/processing, (2) game hunting, and (3) root crop harvests (Chatters 1982:140).

Vaughn et al. (2008:21-23) listed surveys and limited subsurface tests in the east Saddle Mountains during the 1980s and 1990s that identified primarily lithic scatter and quarry sites, along with rock cairns and camps. Chatters (1980) excavated and surveyed nearly 700 artifacts from three sample units on Wahluke Slope that included diagnostic projectile points indicating land use during the Quilomene Bar and, possibly, Early Cayuse phases. Boreson (1984) recorded two ridge crest sites within boundaries of the upland study area examined in this research. Thompson and Cunderla (1988) recorded isolated flakes and Thompson et al. (1989) recorded a lithic scatter and rock features in a geologic exposure of gravels. During a later survey, Thompson (1990) did not detect the presence of archaeological materials. Bailey (1993) recorded three lithic scatters, five quarries, and two rock features between the south flank and crest of Sentinel Mountain.

Flenniken and Ozbun (1993) examined a quarry site at Sentinel Peak and another at Wahatis Peak in order to investigate differential surface disturbance characteristics of toolstone acquisition in antiquity and more recent rock collector activity (Lubinski and McCombs 2003:12). Both sites exhibited evidence of use during prehistory and recent, intensive rock collecting (Vaughn et al. 2008:23). Surface digging and depression traits analyzed in conjunction with artifacts permitted differentiating prehistoric toolstone quarrying from recent rock collecting activity (Vaughn et al. 2008:23). Flenniken and Ozbun (1993) identified early stage lithic reduction artifacts, which served to expand definition of precontact quarry sites in the vicinity (Lubinski and McCombs 2003:12).

Danz's (1999) Washington State University Master's thesis research expanded Flenniken and Ozbun's (1993) project by re-examining Sentinel Peak quarry using surface survey and sub-surface excavation. A survey was carried out in order to select sub-surface test areas based on surface density and distribution of lithic material (Danz 1999:36). The site location on an intensely windy ridgetop all but barred soils formation and the surface was predominated by rocky, shallow, loamy sand with cryoturbated (i.e. ice-cracked) basalt layered over (Ellensburg Formation interbed) sediments that held chalcedony, fossilized bog, fossilized wood, and opal (Danz 1999:1). The effects of cryoturbation's freeze/thaw force on such silicified rock (e.g., toolstone) and basalt bedrock provided the stratigraphic units of analysis (Danz 1999:38, 49) used to evaluate geologic and cultural data identified within two sub-surface sample units, to compare those date to their areal surface context, and to one another.

Danz's (1999:2, Figure 15) analysis of the lithic assemblage (n = 7,305 objects) used Collins and Andrefsky's (1995) diagnostic criteria for classifying chipped stone (adapted from Sullivan and Rozen [1985]). The resulting artifact classes included shatter, flaked, flake tools, cores, and bifaces (Danz 1999:44) defined by morphological traits (e.g., cortex, metrics, platform, weight) and their distribution (Danz 1999:44) within the quarry. Those data were compared to the region's archaeological record in order to identify lithic reduction patterns at Sentinel Peak quarry.

In light of previous research, which stated small debitage and large flake sizes indicated early stage reduction, an abundance of small proximal flakes (Danz 1999:53) suggested late stage reduction had taken place at Sentinel quarry. However, nearly 90 percent of flakes in the surface-derived assemblage had no evidence of platform preparation (Danz 1999:53), again indicative of early stage lithic reduction. Danz (1999:56) concluded the Sentinel quarry pattern was similar to the region's lithic production beginnings during which raw toolstone was gathered from the site either during game hunts or when task groups went to the east Saddle Mountains for the express purpose of quarrying for toolstone.

Central Washington University (CWU), under contract with the Bureau of Land Management (BLM) federal overseer of the east Saddle Mountains, conducted annual archaeological and cultural resource management field schools in the east Saddles from 1998 to 2006 and again in 2008. Systematic surface data recovery protocols developed by Dr. Patrick T. McCutcheon (Hungar and McCutcheon 1999) during the first east Saddle Mountains reconnaissance project remained consistent during later CWU field schools (Lubinski 2003; Lubinski and McCombs 2003, 2006; McCutcheon and Orvald 2002; McCutcheon 2004, 2008a, 2008b; Vaughn et al. 2008).

Hungar and McCutcheon (1999) established systematic techniques for recording a 10-percent sample of the archaeological record, emplacing and analyzing 1 m by 1 m artifact sample units (i.e. flake to chunk ratio) on the areal surface, and other intensive field and laboratory artifact analyses. Temporally diagnostic projectile points were collected for laboratory analyses of lithic morphology and cultural typology in order to infer temporal parameters of land use. Washington State's Department of Archaeology and Historic Preservation required additional cultural and environmental data. Region- and microenvironment-scale physiographic identification included landform, elevation, slope, directional aspect, soils and flora habitat, bedrock, major drainage, other water-related characteristics, and surface visibility traits. (See Appendix C in this research for a detailed outline of the CWU field school surface data recovery protocol.)

Hungar and McCutcheon (1999) surveyed 570 acres of east Saddle Mountains terrains and identified 18 sites and 21 isolated artifacts from precontact origins. The site deposits varied in proximity to toolstone-bearing sediments; however, three sites were located directly atop an interbed. Along with investigating cultural deposit relationships with geologic outcrops of raw toolstone, Hungar and McCutcheon (1999:35) examined artifact frequencies and distribution, including the relevance of flake to chunk ratio data to the site distributions, in order to better understand precontact quarrying.

Intensive use areas (Hungar and McCutcheon 1999:31) were surface depressions typified by backdirt bermes, which evidenced toolstone procurement and lithic reduction. In some cases, a relation existed between artifact type ratios, presence of surface depressions, and toolstone-bearing interbeds (Vaughn et al. 2008:24). Site deposits were lithic debris clusters and lithic scatters (Hungar and McCutcheon 1999:26). The isolated artifacts consisted of flakes and bifacial tools (Hungar and McCutcheon 1999:26). Land use in the project area inferred from temporally diagnostic projectile points occurred throughout the Cayuse Phase (Hungar and McCutcheon 1999:26).

McCutcheon and Orvald (2002:28) recorded 11 sites and 22 isolates on 165 acres. Global Positioning Satellite (GPS) equipment was used to correlate sedimentary interbeds with intensive use area (IUA) locations (McCutcheon and Orvald 2002:34). Toolstone resource locales and cultural deposit parallels were identified but those associations failed to explain the range of observed artifact distribution (McCutcheon and Orvald 2002:35). 1 m by 1 m judgmental flake to chunk ratio sampling units were placed in lithic scatters and again served to expand recognition of cultural deposit distribution variability (McCutcheon and Orvald 2002:40).

McCutcheon (2004:28:31-32) identified 13 sites and 56 isolates on 232 acres. Relationships between the distance to toolstone outcrops, flake to chunk ratios, and raw material and flake densities revealed an absence of strong relational patterning within lithic scatters or IUAs (McCutcheon 2004:47-49). Over the ensuing eight years of CWU surveys in the east Saddle Mountains, research dimensions established between 1998 and 2000 served as templates (e.g., IUA, flake to chunk ratio, archaeology deposit proximity to toolstone-bearing sediment interbeds) for subsequent CWU field school investigations. Overall, from 2002 to 2008, CWU surveyed 3,083 acres and recorded 127 sites and 394 isolates (Hughes and McCutcheon 2009; Lubinski 2003; Lubinski and McCombs 2003; McCutcheon et al. 2008a, 2008b). Lubinski and McCombs (2003:14) relocated Sentinel Peak quarry identified by Flenniken and Ozbun (1993). CWU field school survey data additionally formed the basis for three Master's research theses (Bailey 2006; Senn 2007; Woodard 2008) and the upland data set examined in this research (Vaughn et al. 2008).

Bailey (2006:88) relocated lithic scatters recorded by CWU between 1998 and 2001 in order to investigate lithic technological organization and site patterning within a known toolstone procurement area. Upper ridge elevation (732 m) was considered an important locational index for calculating land use relative to toolstone resources. Raw toolstone outcrops included chert, fossilized bog, opal, and fossilized wood in surface exposures of the Squaw Creek and Quincy interbeds, while granite and quartzite were in the Rattlesnake Ridge and Snipes Mountain Conglomerate interbeds (Bailey 2006:14-15). Lithic raw material in the area occurred as debris, shatter, tabular bits, cobbles, angular chunks, and boulders (Bailey 2006:50). Though size and quality of toolstone resources significantly varied, chert cobbles suitable for tool production occurred more frequently than fossilized wood at lithic procurement areas and it was used to make many more tools (Bailey 2006:222) observed in site deposits. High site density, low tool frequency, and varying artifact density indicated human activity was extensive but not intensive (Bailey 2006:222) in the project area.

The following overview is taken from Bailey's (2006:219-224) discussion of site *type* classes examined during the project: quarry, lithic procurement, lithic reduction, and activity. Quarries spatially related to pit features associated with toolstone outcrops but lithic procurement sites were nearer to a source of lithic raw material. Many quarry and procurement areas had lithic cores and varied widely in size and density but included the largest and most dense sites in the area. Lithic reduction sites were near but not at toolstone resource exposures. Core reduction took place at reduction sites, which also varied in size and density and had the greatest artifact richness of all the site classes. Reduction sites were less spatially dispersed and nearer to other sites with raw toolstone sources than were activity areas. Activity areas were small, compared to the other classes, and had low density, wide spatial distribution, and the least artifact richness among all of the site deposits.

Bailey's (2006) ultimate objective was to draw inferences from comparison of previously recorded archaeology sites (isolates excluded). The research database was re-assembled using the following methods (Bailey 2006:70-76). Sites were re-resurveyed using a 1 m pedestrian survey search interval. Artifact class, flake attribute, surface pit and depression characteristics, raw toolstone presence/absence, and landform types were recorded. Artifact morphological and functional classes were initially identified based on lithic reduction sequences. Laboratory analysis (Bailey 2006:76-) included paradigmatic lithic classification, artifact frequency and distribution mapping, and correlation of those data to site-specific landform, elevation, and interbed location relative to site deposits.

Bailey (2006:222-224) explained the organization of lithic technology in the project area, as follows. Early stage lithic reduction was in evidence but later reduction stages were not well represented at any sites. Formal tools were infrequently observed, although bifacial reduction at some sites may reflect anticipatory tools produced by a logistically mobile population. While relatively low frequencies of formal and situational tools would be expected with low residential mobility, situational tools would be expected at locales with abundant toolstone sources. Even within a technological system that produced anticipatory tools, expedient tool use might be expected at toolstone sources. However, the prevalence of early stage reduction artifacts and informal cores relative to limited formal tools and large bifacial cores indicated most emphasis was on informal cores and situational tools. Raw toolstone that was initially reduced at procurement sites was transported to other sites for further reduction and use.

Senn (2007:9) analyzed cultural data from CWU field school surveys between 1998 and 2006 in order to detect archaeological and environmental connections. Spatial associations between flora and fauna habitat and raw toolstone exposures were defined as resource indicators, extraction opportunities, and artifact-scale land use evidence (Senn 2007:2-3, 48-49). The effects of deep eolian or shallow lithosol soil depth on resident flora were dovetailed with plant-based nutrient regimes required by game fauna, as the basis for inferring vegetation and wildlife acquisition patterns. Solar radiation classes derived from directional aspect, sun angle, elevation, and viewshed were used to measure flora and fauna habitat characteristics.

Ellensburg Formation interbeds in the project area included the Mabton, Quincy, Squaw Creek, Vantage, Rattlesnake Ridge, and Selah members (Senn 2007:Figure 3). Sixteen soils were identified in the project area (Senn 2007:54). Local flora associated with either lithosolic or loess soil types, which in turn supported edible plants such as forbs and root crops. Soils constituted an environmental class based on the known utility of botanical food resources during prehistory (Senn 2007:16-17). The project area was characterized for four elevation dimensions with geographic information system (GIS) software, which Senn (2007:53-54) employed to define topographic locale and eastward distance from the Columbia River. Elevation was additionally classified according cliffs connecting lowland to upland and two exclusively upland environmental divisions (Senn

2007:53-54). Across all classes, elevation ranged from 145 m (476 feet) nearest the river to 752 m (2,467 feet) in the highest upland ridges.

Senn (2007:121) stated not all of the archaeological record was located near the most probable resource areas, which may have resulted from (1) a general rather than a specific extraction strategy, (2) artifact discards located away from utilization locales, or (3) insufficient current knowledge to predict with great spatial accuracy localities with resources during prehistory. Senn's (2007:121) findings matched previous research suggesting the eastern Saddle Mountains exhibited the broad regional land use pattern. Artifacts (i.e. flake, core, hammerstone) and archaeological features (e.g. surface depressions) appeared to be spatially linked to the presence of toolstone-bearing sedimentary interbeds (Senn 2007:122). Soil depth, elevation, and landforms correlated to the archaeological record (Senn 2007:122), in general. Lithic flakes, in particular, correlated with solar radiation (Senn 2007:122).

Woodard (2008:44-45) expected specific artifact and feature localities in the east Saddle Mountains would co-occur with three landscape variables: landform, geology, and soils (the primary determinant of vegetation zones). Woodard (2008:47) analyzed links between those dimensions and the archaeological database previously recorded by CWU field schools between 1998 and 2003. Environmental context and variability were gauged through topography, geology, and soils characteristics related to ridge, slope, flat, and gully landforms that were examined (Woodard 2008:49). Columbia River Basalt group members and Ellensburg Formation sedimentary interbeds were incorporated into the research design (Woodard 2008:49). Thirty-three sediment classes spanning eleven soil type dimensions were included (Woodard 2008:Table 7) in the study.

Environmental and archaeological variables were converted into geographic information system (GIS) formats (Woodard 2008:67). Analysis revealed archaeological surface visibility directly related to vegetation density, depositional factors (i.e. wind direction, soil moisture retention) and the capacity of sand and silt to act as “density filters” capable of obscuring cultural deposits (Woodard 2008:67). Both isolated artifacts and larger sites had a higher than expected occurrence on lithosolic soils (Woodard 2008:68). Woodard (2008:68-69) concluded geomorphic deposits may have effectively obscured the archaeological record in the east Saddle Mountains.

Woodard (2008:70) examined site and isolated artifact locations in relation to landforms, geology, and soils. Analysis of landform classes relative to cultural variables (i.e. flake, modified flake, core, projectile point, biface, hammerstone) showed that all deposits correlated with slopes (Woodard 2008:71-72) and 17 of 22 surface depressions correlated with slopes. An archaeological variable class consisting of hammerstones, cores, and surface depressions was significantly related to geologic structures such as sedimentary interbeds (Woodard 2008:83). Cultural variables occurred in higher than expected frequencies in relation to interbeds only, which suggested human behaviors associated with interbeds reflected preferred land use and not an underrepresented archaeological record (Woodard 2008:84).

Vaughn et al. (2008:36) continued CWU field research in 2008, directed by Dr. Patrick T. McCutcheon, in order to compare 2005 survey results from six previous years of CWU investigations in the east Saddle Mountains. The project focused on identifying toolstone quarries in the archaeological record (Vaughn et al. 2008:49) through locating surface exposures of lithic raw material. Vaughn et al.’s (2008) results make up the upland study area data set examined in this research. Vaughn et al.'s (2008) findings for the east Saddle Mountains study area are given ahead in Chapter III, under the title Study Areas.

Previous Archaeological Work in the Wenas Creek-Yakima River Confluence

Archaeological research of the Yakima River's confluence with Wenas Creek was nonexistent until pipeline construction (Warren 1968) forced professional investigation of the area. Lack of access to a locale of known cultural importance (Ruby and Brown 1965; Schuster 1975, 1998; Splawn 1958) resulted from the confluence's status as private real estate beginning in A.D. 1865 (Lince 1984). The U.S. Bureau of Reclamation purchased lower Wenas Creek from private landowners, in 2007, and set in motion cultural resource assessments carried out by Central Washington University field schools. The following review details seven archaeological investigation conducted in the lowland study area examined in this research.

Warren (1968:2-3) lead the first inspection of Wenas Creek confluence, which resulted in recordation of Site 45YK51. Warren (1968:25) noted, as at most other Plateau sites, ecological patterns were not studied. During Warren's (1968:1-2) project the creek bottom was irrigated pasture with several hundred cattle. Pipeline construction involved dynamiting a basalt cliff near the main excavation. Three sample units were excavated at 343 m of elevation (Warren 1968:1): (1) an old meander channel (main excavation), (2) a gentle talus slope (Schmid section) thinly vegetated with unidentified grasses, sagebrush (*Artemisia rigida*, *A. tridentata*), and greasewood *(Sarcobatus vermiculatus*), and (3) a talus section (Warren 1968:1-3, Figure 2). The site's location at a west Columbia Plateau and Cascade foothills geographic interface was valuable for its access to deciduous and evergreen trees and terrestrial and aquatic faunal resources (Warren 1968:1).

The bulk of artifacts (n = 1,145 of 1,300) were recorded in the main excavation (Warren 1968:2). The following account of the Site 45YK51 assemblage is taken from Warren's (1968:3-17, Table 3) artifact inventory. Lithic artifacts were made from local basalt, local toolstone (e.g., agate, chalcedony, fossilized wood), and non-local obsidian. Deer antler (n = 2) tools and other bone implements (e.g., awl, punch, needle), Olivella shell (n = 1) and dentalium shell beads (n = 2) were recorded. House pit depressions, hearths, and rock concentrations were located throughout the main and Schmid units, along with archaeologically significant features classified as miscellaneous. The later class consisted of a lithic flake cache (n = 30) near a hearth, a clay platform constructed of material that did not occur in the site, and two postholes. Human interments containing lithic artifacts, faunal remains, and a single Historic Period copper kettle were collected and removed from the pipeline construction's trajectory directly across the talus area. (Hackenberger [2000:8] stated interment sites that included traces of copper were most often dated to the protohistoric phase of cultural contact between native and non-native culture groups in the region.)

Warren (1968:3-9) classified the assemblage's technological fraction of lithic tools as cores, scrapers, gravers, drills, knives and knife blanks, projectile points, and projectile point blanks. Pebble tools were functionally classified as hammerstones, pestles and mortars, choppers, and a single flanged-top maul (Warren 1968:10). Miscellaneous functional tools included grooved sinkers or mauls, an abrading stone, a "lucky stone," (Warren 1968:10) and a scratched pebble possibly used as a whetstone or mano. The projectile points (n = 200) and artifacts associated with two distinctively differing strata were classified as the Selah Springs and Wenas Creek phases (Warren 1968:25).

Warren (1968:26) additionally used the Selah Springs and Wenas Creek artifact patterns to distinguish between faunal remains linked to food consumption. The Selah Springs stratum were dominated by deer, followed by beaver, elk, mountain sheep, rodents, birds, and a small quantity of fish (n = 3). Wenas Creek stratum nearly matched, except mountain sheep and beaver were absent and turtle were present with relatively abundant fresh water mussels and salt-water clams (n = 2) (Warren 1968:26). Food remains and artifacts indicated hunting and shellfish gathering dominated a subsistence pattern in which fishing played a small role (Warren 1968:26). That interpretation was inferred from a near total lack of fishing gear and fish remains (Warren 1968:26) in the assemblage and the ethnographic record of human seasonal migrations during prehistory based on Ray's (1933) findings. A historical U.S. military map from A.D. 1854 was used to support Warren's (1968:26) construal of Site 45YK51 as an aboriginal "winter resort" connected to the Selah Fishery located from the mouth of Wenas Creek southward to the Naches River. Warren (1968:26) believed Site 45YK51 provided a cultural sequence for the west central margin of the Columbia Plateau.

D. Rice (1969b) intended to rectify a data gap in the archaeological record that had existed since H. Smith (1910) worked in Washington State. Rice's (1969b) goals included a survey of known regional archeology sites located from Yakima to Randle in order to ascertain relationships between mountain and river basin sites. Cultural sites along Wenas Creek and from Selah to the Cascade highlands were revisited (D. Rice 1969b:1). Owhi's Garden site, located northwest of Wenas Creek confluence and destroyed by farming, was evidenced by a historical marker (D. Rice 1969b:1). A human interment in a root-digging locale (45YK111) was intact (Rice 1969b:1).

D. Rice (1969b:4) revisited Wenas Creek confluence (45YK51) and excavated a test pit located midway between Warren's (1968) area and the creek's mouth. The test unit contained several occupation floors of a pit house below which sterile gravels gave no evidence for earlier cultural components (D. Rice 1969b:4). Based on that finding, Rice (1969:4) concluded seasonal flooding on the creek and river erased earlier deposits, if they had existed. Rice (1969b:4) surmised Warren's (1968) test units were subjected to less severe flooding by virtue of location at the creek's floodplain terminus, which may have preserved early cultural deposits. Rice (1969b:8) recorded an assemblage (n = 207) of core, scraper, graver, knife, notched-pebble sinker, and projectile point (n = 42) artifacts, along with an antler wedge fragment and an unidentified cut bone. Rice did not comment on toolstone material types or artifact frequencies. Artifact homogeneity suggested deposition took place over a relatively short occupation by a single culture group (D. Rice 1969b:9).

Chatters (1984:2) revisited Wenas Creek confluence and investigated an area not previously examined by Warren (1968) or D. Rice (1969). Initial surface reconnaissance revealed terrain south of the creek had no prehistoric surface sediments or likely cultural deposits on the south canyon wall or adjacent hillside (Chatters 1984a:2). Landscape north of the creek exhibited Holocene sediments but artifacts on the surface and in the stream cut bank were not observed (Chatters 1984a:2). Four test pits in the floodplain plow zone revealed broad rodent disturbance throughout 145 cm of sediment sequences (Chatters 1984a:3). Mount Mazama ash dated to 6,700 years ago (Chernicoff and

Whitney 2002) and seen at other locales in the area (Chatters 1984a:4) was absent. The entire sediment sequence had been affected by post-depositional erosion and was likely less than 6,700 years of age (Chatters 1984a:4). In addition, artifact distribution patterns displayed effects of plow zone sediment mixing and prolonged bioturbation (Chatters 1984a:4). The greatest concentration of floodplain cultural material was in the upper40 cm (Chatter 1984:5).

Chatters (1984:4) recorded chipped and pecked lithic artifacts (n = 341) similar to Warren's (1968) findings, with the exception of projectile points (n = 2). Lithic tools (n = 315) were made of cryptocrystalline silicates (n = 260), fossilized wood (n = 16), chert (n = 2), and basalt (n = 34) (Chatters 1984a:5). The assemblage remainder was core, worn uniface and biface flake, biface, scraper, graver, and hammerstone (Chatters 1984a:5) artifacts. Apart from fire-altered rock (n = 37), Chatters (1984:4) saw no archaeologically significant features. Faunal remains were similar to Warren's (1968) findings with two exceptions: higher fish (n = 22) and lower fresh water mussel (n = 3) (Chatters 1984a:4-5). Low mussel frequency was attributed to post-deposition plow zone destruction of fragile *Margaritifera* shells (Chatters 1984a:5). Faunal evidence (i.e. fish growth rest bands) indicated harvests occurred between November and March (Chatters 1984a:5). Chatters (1984:2, 4) supported Warren's surmise the site functioned as a winter encampment.

Uebelacker's (1986:85) cultural geographer perspective defined indigenous land use strategy as cultural appraisals of resource-bearing habitats. Wenas Creek fell within Uebelacker's (1986:Figure 1) study area of various habitat types located from the Yakima River westward into the Cascade highlands. Uebelacker (1986:15) asserted valley basins were the heartland of indigenous forager land use. Wenas Creek confluence matched valley basin habitat (Uebelacker 1986:Figure 5) identified with shrub steppe/riparian vegetation and elevation ranging from 198 m to 427 m. Of valley basin elements valued by indigenous foragers in particular, mild winter temperatures favored migratory bird and game species (Uebelacker 1986:15), which existed at the confluence. In localities where highland forest edges and riparian zones were near valley basin habitat, archaeological evidence of winter occupation was always present (Uebelacker (1986:144). In addition, Wenas Creek Valley was an unrestricted elk migration route between Cascade highlands and the Yakima Valley (Uebelacker 1986:Figure 13). The landscape association Wenas Creek shared with the Naches River was one of ten places with a full range of resources in a relatively small area that were central to indigenous people in the region.

Central Washington University's cultural resource management field school conducted three seasons of archaeological fieldwork at Wenas Creek-Yakima River confluence. Dr. Patrick T. McCutcheon directed the 2007 and 2008 surveys and Shane Scott directed the 2010 survey. These surveys were undertaken in cooperation with the U.S. Bureau of Reclamation in order to inventory cultural resources located on federally managed land, as required by Section 110 of the National Historic Preservation Act. Results of the cultural resource assessments make up the lowland study area data set examined in this research. The Wenas Creek-Yakima River data set is treated in-depth ahead in Chapter III, under the title Study Areas.

Projectile Point Chronology from Previous Archaeological Investigations

Archaeology studies include temporal ordering of data as a basic precondition to recognizing the sequences and processes of prehistory (Hester et al. 1997:319). Lipo et al.

(1997) defined evolutionary archaeology's stance toward cultural transmission of stylistic *type* phases, which provide legitimate temporal markers in the chronological order of human adaptations to selective environments. Past Plateau studies (Carter 2002; Galm et al. 1981; C. Nelson 1969; others) defined stylistic variation in projectile point technology (Andrefsky 2005; Johnson and Morrow 1987; Kooyman 2001; Odell 2004) such that authors of the archaeological literature cited in this research had temporal parameters from which to infer land use chronology for varying project localities in the research region. Prentiss et al. (2006) broadly outlined Plateau chronology in relation to paleoenvironments and available resources based on stylistic variations in lithic toolkits, including projectile points. Bruce et al. (2001; see also Hackenberger 2009) summarized development of diagnostic projectile point phases that are applicable to the west-most edge of the Mid-Plateau. Projectile point data given in this section (Table 2) are from previous research that furnishes the precontact land use models described below.

Table 2. Projectile Point Phase Chronology of Mid-Plateau Precontact Land Use Models (after Nelson 1969).

Phase (Years B.P.)	Dancey (1973)	Chatters (1982)	Wilde/Wilke (1984)	Benson et al. (1989)	Boreson (1998)	Lewarch et al. (1999)	DeBoer et al. (2002)
Cayuse 2,000-200	X	X	X	X	X	X	X
Quilomene Bar 3,000-2,000	X	X	X	X	X	X	
Frenchman Springs 4,000-3,000	X	X	X	X	X	X	X
Cold Spring 4,500-4,000			X				
Vantage 8,000-4,500	X			X	X	X	X
Windust 10,500-8,000			X	X		X	X

Precontact Land Use Models

Thus far, upland and lowland variation and Mid-Plateau archaeological and physiographic nomenclature have been set forth. Artifact-landscape relations identified from Mid-Plateau research have provided a glimpse of the extent of archaeological contexts that can be expected in the research region. Those data additionally revealed the scope of variability in the upland and lowland archaeological record. In order to advance the purpose of this research, the models introduce units of analysis capable of showing landscape-scale macroenvironmental utilization with artifact-scale microenvironmental data. As such, each model is an areal “document” (Wandsnider and Camilli 1992) of the regional archaeological record.

The data for the models described in this section were taken from two literature sources: (1) purposively designed examples of human life on the Mid-Plateau inferred from science-based studies and (2) cultural resource inventories recorded by investigators for whom predictive modeling was neither a goal nor a claim. Most of the land use model scenarios depicted below are synthesized from authors of the second source. That point noted, the predictive constructs developed from those data are intended as tools able to potentially identify human activity in space.

In that context, precontact land use models presented here (Appendix A) portray potential human behaviors in areal space, as well as variants of those cultural-spatial relationships. The models represent site *type* deposits that, in turn, signify frequencies and distributions of correlated human and terrestrial variables. These models, as units of analysis able to clarify human behavior, are diagnostic tools that incorporate two assumptions inherent to exploring land use phenomena: (1) environmental utility corresponds to resource access and use, and (2) artifact-landscape parallels will hold true in settings analogous to the predictive models' cultural and environmental parameters. Because the models are inferred from permutations of objects *in situ*, a range of site *type* descriptors exists in the literature that reported varying combinations of artifacts and features in differing settings of the environment.

Archaeology sites reported in literature from the west-most edge of the Mid-Plateau take four forms: (1) permanent riparian zone dwellings, (2) transitory lodgings near natural resources, (3) transitory work places evidencing at least one cultural event (Chatters 1982; Dancey 1973), and (4) surface earthen and/or rock features. A number of examples in the research literature (Benson et al. 1989; Boreson 1998; Chatters 1982; Dancey 1973; DeBoer et al. 2002; Lewarch et al. 1999; Wilde and Wilke 1984) provide the set of precontact *type*-based predictive models (Appendix A) of regional variation in artifact-scale cultural variables coupled to landform-scale environmental variables.

Dancey (1973) derived centimeter scale data from 100-percent surface coverage of his YTC project area, which were treated as distributions of clustered artifacts or aggregates, rather than site *type* classes. Aggregate clusters, as Class A type, Class B type and so forth, articulated (*sensu* Dunnell 1971) to microenvironmental landform classes. Micro-scale environmental variation was seen as the primary determinant of distribution variations. East-west directional orientation of the upland (i.e. hinterland) survey tracts identified aggregate distributions relative to distance from the Columbia River (Dancey 1973:112). Seven aggregates articulated with broad and narrow floodplain environmental dimensions of the lowland and alluvial flat, bench, and upland flat microenvironments of the upland (Dancey 1973:114).

Dancey (1973) interpreted his results in terms of Riverine Period settlement and land use: (1) permanent and winter lodgings on floodplain and coulee bottom lowland, (2) seasonal camps in coulee bottom lowland, (3) seasonal camps in upland located at a distance from the river. Lowland aggregates were habitation sites with cores, debitage, formed lithic tools, bone tools, and hearths, charcoal, and organic matter, which together evidenced food consumption (Lewarch et al. 1999:18). The upland aggregates were short-term seasonal work areas related to food acquisition (Lewarch et al. 1999:18) and all were located in drainages (Dancey 1973:Figures 3 and 21). In all microenvironments, flakes were the most frequently observed artifact class (Dancey 1973:81-82).

Specialty camps on alluvial flats had debitage, cores, root harvest and processing tools, and hearths and earth ovens indicative of springtime camas procurement. Debitage, utilized flakes, and formed tools typified resource acquisition in upland flats. Specialized camps with fire-cracked rock, charcoal, and bone indicated upland game hunting. The upland assemblage contained large frequencies of flakes and manuwear (i.e. regular surface attributes and/or use wear) along with smaller frequencies of blanks, cores, and chunks (Dancey 1973:81).

Chatters' (1982) Columbia Basin project identified differing levels of land use through artifact form and frequency variability relative to distance from river, soils/flora, and raw toolstone availability. Chatters' (1982:140) results included: (1) Activity concentrated in the Columbia River Breaks within one mile of the floodplain and in the east Saddle Mountains. (2) Rocky soils (i.e. upland rootbed, fauna forage) were utilized intensively and fine-grained sediments were all but disregarded. (3) Utilization of rocky habitat pointed to lithic raw material, wild game, and rootbed exploitation in the Breaks and east Saddle Mountains. (4) Hunting was primarily done in the Breaks and east Saddle Mountains and root harvests concentrated in Ephrata and Soap Lake. In the later unit, root processing camps were at springs and other waters.

Multifunctional I and II sites (i.e. flake, core, hopper mortar base, cairn, toolstone outcrop present/absent) occurred in all sample units, except in the east Saddle Mountains (Chatters 1982:140). Projectile point frequency, 20-percent of isolated artifact deposits in the east Saddles, implied hunting co-occurred with quarrying (Chatters 1982:137). Single event lithic reduction sites had flakes from a single core and lacked toolstone outcrops; secondary lithic reduction sites had flakes from more than one core and high unmodified flake frequencies (Chatters 1982:134, 137). Multi-use sites had flakes from more than one core and high frequencies of retouched and/or worn flakes. Flakes and cores were the main component of upland quarries Chatters (1984:138-139); 49-percent had low flake-to-core ratios and high frequencies of unmodified and/or unworn flakes, both indicative of toolstone procurement and initial lithic reduction.

Wilde and Wilke's (1984:41) YTC upland project identified variously configured lithic artifact scatters linked to all lithic reduction stages during toolstone acquisition at quarry sites. Lithic scatters, the most frequently observed deposit, had initial reduction primary decortication, secondary large core reduction, and tertiary thinning flakes, plus worn flakes (Wilde and Wilke 1984:18); lithic reduction sites included cores with initial reduction flakes (i.e. primary, secondary, tertiary) and worn flakes (Wilde and Wilke 1984:16-18). Artifact deposits were deemed multi-functional sites when two activity classes, as frequently observed, co-occurred at the same location and were oriented toward toolstone outcrops and rootbed habitat. Toolstone quarrying and edible root procurement activities were reflected in the upland artifact deposit distribution and the lowland assemblage evidenced food consumption at habitations sites.

Benson et al.'s (1989) YTC project extended site *type* definitions by placing fire-cracked rock, organic remains, and rock features in archaeological dimensions, which recognized human modification (King and Caywood 1994:19-20). Cultural deposits seen in both the upland and lowland environments were defined as camp, location, lithic reduction, quarry, and rock feature (Benson et al. 1989:Tables 6.3 and 6.9). Benson et al.'s (1989) definition of stone tool manufacture, maintenance, and use incorporated the local lithics industry into a model of upland utilization (King and Caywood 1994:20). Upland had more (n = 100) areas of human activity than did lowland (n = 27); however, camp *type* sites (i.e. flake, tool, fire-modified rock, shell, bone) occurred only in lowland. Interestingly, only one of the total ten camp *type* sites contained lithic cores (Benson et al. 1989:6.16). Location sites had chunks of raw material, flakes, and tools but lacked cores; lithic reduction sites universally held flakes and cores with fewer chunks and tools.

Upland quarries (n = 63) ranged from small (<1,000 m^2) to very large (>20,000 m^2) areas with toolstone outcrops, chunks, and lithic reduction evidence (Benson et al. 1989:6.8). Lithic reduction sequences varied widely between sites. In addition to raw toolstone outcrops and chunks present at all quarry sites, some quarries held flakes, cores, and tools, others held flakes and cores, and still others held flakes and tools; nearly one-half of the quarries contained only raw material and flakes (Benson et al. 1989:6.8). The upland quarry sites were located in direct proximity to rootbed habitat.

Cairn and talus pit rock features occurred in both the upland and lowland areal dimensions and were assigned origins in antiquity only when devoid of other cultural associations. This account of upland and lowland rock features is taken from Benson et al.'s (1989:6.12) results summary. The upland held eight cairns and five talus pits. Some of the cairns and one talus pit had intermixed Historic Period artifacts and were placed in the Historic Period temporal class. The lowland had two rock features without evidence of any other cultural association. One was a larger than average talus pit with three on a terrace landform and the other was a talus pit in a drainage (Benson et al. 1989:6.17). In addition, one lowland camp *type* site was connected to a talus slope pit (and to Historic Period refuse) (Benson et al. 1989:6.17).

Boreson's (1998:5.2) YTC project modeled land use according to vegetation zone and landforms for upland slopes and ridges, drainages, and lowland floodplain terraces. Most sites and isolated artifacts were located on southeast or southwest slopes (Boreson 1998:5.1-5.2), although isolates had a south directional aspect. Site deposits were more likely on ridges and terrace/floodplains than isolates, although isolates were occasionally recorded in drainages (Boreson 1998:5.1-5.2). Boreson's (1998:6.1-6.11) results reported the following. Cultural deposits were rare on ridges and in lithosol/shrub-steppe habitat, characteristics. Projectile points were most often located in the upland shrub-steppe and lithosol habitats. Little evidence of land use was observed on the alluvial fan, bedrock, riparian/shrub-steppe, bench/flat, and knoll landforms.

Along with showing differing resource-bearing terrain preferences, stone tool manufacturing and use was strongly reflected in the lithic scatter, lithic procurement area, lithic reduction area, quarry, and camp classifications. Boreson (1998:5.11) defined archeology site classes, as follow. (1) Scatters of culturally modified lithic objects. (2) Procurement areas with toolstone outcrops and debitage. (3) Reduction areas with lithic reduction sequence decortication flakes (e.g., primary, tertiary), cores, blanks, preforms, and unfinished bifaces. (4) Quarries with toolstone outcrops and lithic scatters (defined as above). (5) Camps with formed tools, debitage, fire-modified rock and, more rarely, charcoal and bones.

Lewarch et al.'s (1999:130) YTC project tested Binford's (1980, 1983) forager-collector model of resource extraction sites in circles (12-mile diameter) around villages and base camps. In particular, the forager-collector model suggested daily land use within a six mile optimal foraging radius (relative to habitation sites). The model hinged on the premise site density decreased as distance away from the river increased. Lewarch et al.'s (1999) revised and localized model suggested thick artifact frequencies occurred four to eight miles from the river, with upland sites noticeably affixed to resource-bearing areas. Lewarch et al. (1999) stated the local model deviated from Binford's model at three-to-nine miles from the river. Lewarch et al. (1999:16-18) defined artifact deposit types and functions, as follow. (1) Activity areas with debitage, utilized flakes, and formed tools. (2) Lithic reduction sites with cores, debitage, preforms, formed tools, and toolstone outcrops absent. (3) Quarry with core and tool manufacturing evidence and proximity to wild game and flora food resources. (4) Camps (i.e. residence, field) with formed tools and debitage, fire-modified rock, and occasional bone, shell, and charcoal.

DeBoer et al.'s (2002:292) YTC project tested Binford's (1982) optimal forager and logistical zones predicted to exist within or beyond a six-mile distance from the river. DeBoer et al.'s (2002:285) site density increased markedly relative to toolstone exposures that existed throughout the majority of the project area, although toolstone access, site type, and topographic variables were not incorporated in DeBoer's model of land use.

Instead, areal proximity to human travel corridors was cited to explain discontinuities in the Binford's six mile rule. DeBoer et al.'s (2002) model exposed higher than expected site densities beyond the optimal foraging zone.

DeBoer et al. (2002:Table 4.1) used habitation and extractive site class in order to categorize artifact deposits, as follow. (1) Base camp/habitation with house and storage pits, hearths, rock art, formed tools, debitage, groundstone, bone, and shell. (2) Field camp/habitation with shelters, hearths, formed tools, debitage, groundstone, bone, and shell. (3) Lithic procurement/extractive with preforms, formed tools, utilized flakes, cores, debitage, quarry pits, and toolstone outcrop present. (5) Lithic scatter/extractive with preform, formed tools, utilized flakes, cores, debitage, and toolstone outcrop absent. (6) Lithic reduction/extractive with preforms, formed tools, utilized flakes, debitage, and toolstone outcrop either present or absent.

Wilde and Wilke's (1984) *lithic scatter* nearly matched and Lewarch et al.'s (1999) *activity area* closely matched Dancey's (1973) *acquisition site*. However, site functions were defined differently for each of the three. Attempts to define toolstone quarries are another example of cultural variability seen in the region's toolstone-bearing microenvironments. Benson et al.'s (1989) *quarry* had debitage, cores, preforms, formed and broken tools, and utilized flakes, while Chatters' (1982) *quarry* had flakes from more than one core and more than one percent retouched or worn artifacts. DeBoer et al.'s (2002) *quarry* deposit closely matched Benson et al.'s (1989) *quarry* deposit, although DeBoer et al. (2002) labeled artifacts linked to a toolstone outcrop as a *lithic procurement* site. The surfeit of site type and function definitions given in Appendix A are unwieldy;

however, the design of this research provides means to reduce terminological redundancy ahead in Chapter III, under the title Study Areas.

Ethnography

Common to all precontact land use models are the native Plateau cultures that peopled the region during antiquity and created the archaeological record examined in this research. Walker (1998) set forth the Plateau's geographic sub-regions in terms of cultural affiliations and territorial boundaries. A number of bands inhabited the research region from prehistory forward (Guie1937; Hunn 1990; Relander1956; Ruby and Brown 1992; Schuster 1975, 1998; Splawn 1958; Walker 1997). The summary below describes native bands that utilized the upland and lowland study areas and adjacent landscapes.

On the middle Columbia River, the most productive fishery was located at Priest Rapids (Bruce et al. 2001), an asset of Wanapum people who dwelled south of Crab Creek (Relander1956; Splawn 1958). The Kawachen band of Columbia-Sinkiuse people lived from Crab Creek northward to the Rock Island fishery (Ruby and Brown 1992). On the Yakima River, the Kittitas band inhabited the upper river from Kittitas Valley to today's City of Selah (Ruby and Brown 1992). The highly productive Selartar fishery extended from Wenas Creek northward into the Yakima River canyon (Lince 1984). Silahlama people dwelled between Wenas and Umtanum creeks (Schuster 1975). The Kittitas Skwanana band lived south of Wenas Creek (Guie1937). Waptailmin (Schuster 1975) and Pakiutlema, referred to as Yakama following contact with non-native culture groups, lived from today's City of Selah (Ruby and Brown 1992) to the Yakima River's confluence with the Columbia River (Schuster 1975, 1998).

Despite differing idioms, all of those people pursued parallel life ways (Schuster 1998:327) and shared a common culture based on inter-marriage, kinships, joint harvests, and trade (Schuster 1975:25). They differed more by geographic position (Figure 2) than

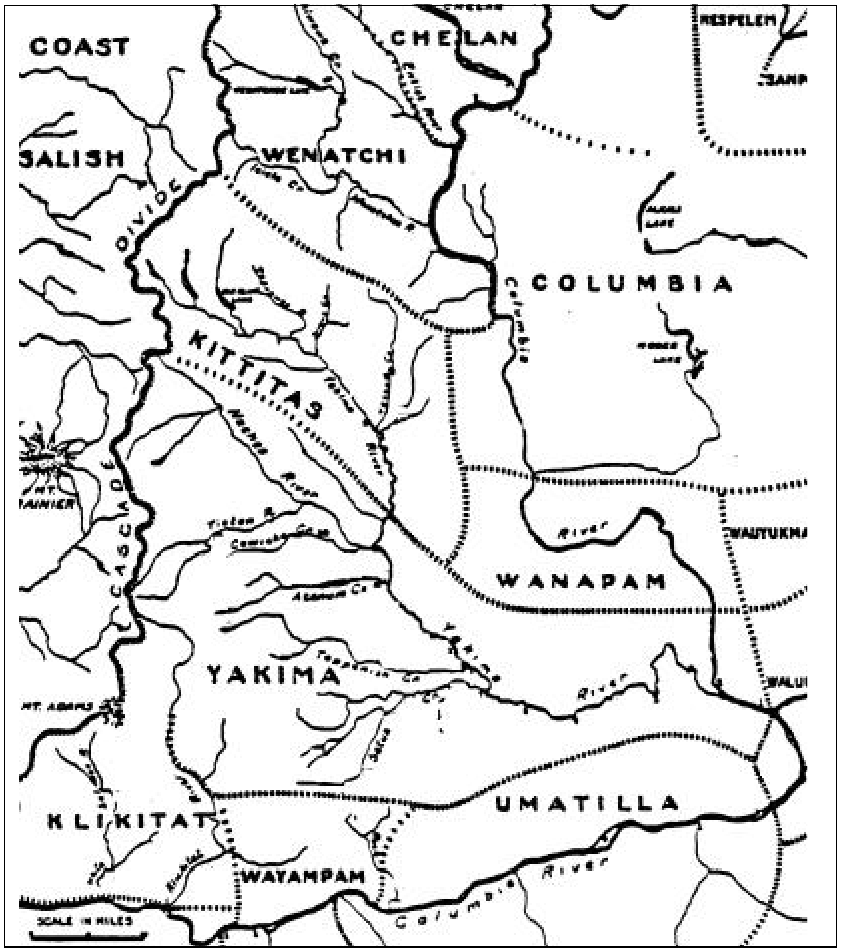

Figure 2. Mid-Columbia Plateau cultural territories in A.D. 1855 (after Ray [1936]).

by custom (Walker 1997). In short, people allied by blood, speech, and similar interests controlled the Columbia Plateau (Guie 1937:5). Social stability prevailed (Ray 1933; cf., W. Smith 1977) based on travel route links to neighboring areas that maintained the trade system (Walker 1997). Basic survival was secured through the primary social and economic entity on the Mid-Plateau, the family (Hunn 1990:137). Flora and fauna life cycles and recurring habitat productivity guided seasonal rounds undertaken by family-based task groups (Hunn 1990; Schuster 1975, 1998).

Task groups moved to upland rootbeds in spring, river fisheries until summer, lowland plant harvests in late summer, and highland resources in fall (Schuster 1998). One-half or more of food resources consisted of roots (Schuster 1975:68). Other staples included fish, fowl, game, botanical products (Hunn 1990; Schuster 1975; Walker 1997), and lichens (Rosentreter 1995). Winter was spent in riverine encampments (Hunn 1990; Walker 1997; Schuster 1975, 1998) and wintertime was used for performing domestic tasks (Schuster 1998) that included carrying out talus slope interments of deceased family members (Schuster 1998:338) at ancestral cemeteries in riverine habitation sites (Ray 1939:135; see also Hackenberger 2000).

In addition, wintertime allowed for tool manufacture and repair (Hunn 1990). Ethnographic records fail to describe the local lithics industry; however, toolstone preparation and tool manufacture likely occurred in winter (Prentiss et al. 2006). Seasonal rounds were occasions to acquire local toolstone (Galm 1980; Galm et al. 1981). Exotic, non-local toolstone such as obsidian entered the region via the trade network (Walker 1997). Obsidian was valued as a toolkit status symbol and, along with shell, formed the nucleus of trade (Galm 1980:1). The Mid-Plateau’s geographic location at an intersection of the Pacific Coast, Great Basin, Plains, and Canadian trade networks (Figure 3) aided obsidian import (Walker 1997). Obsidian (and other exotic toolstone) represented a

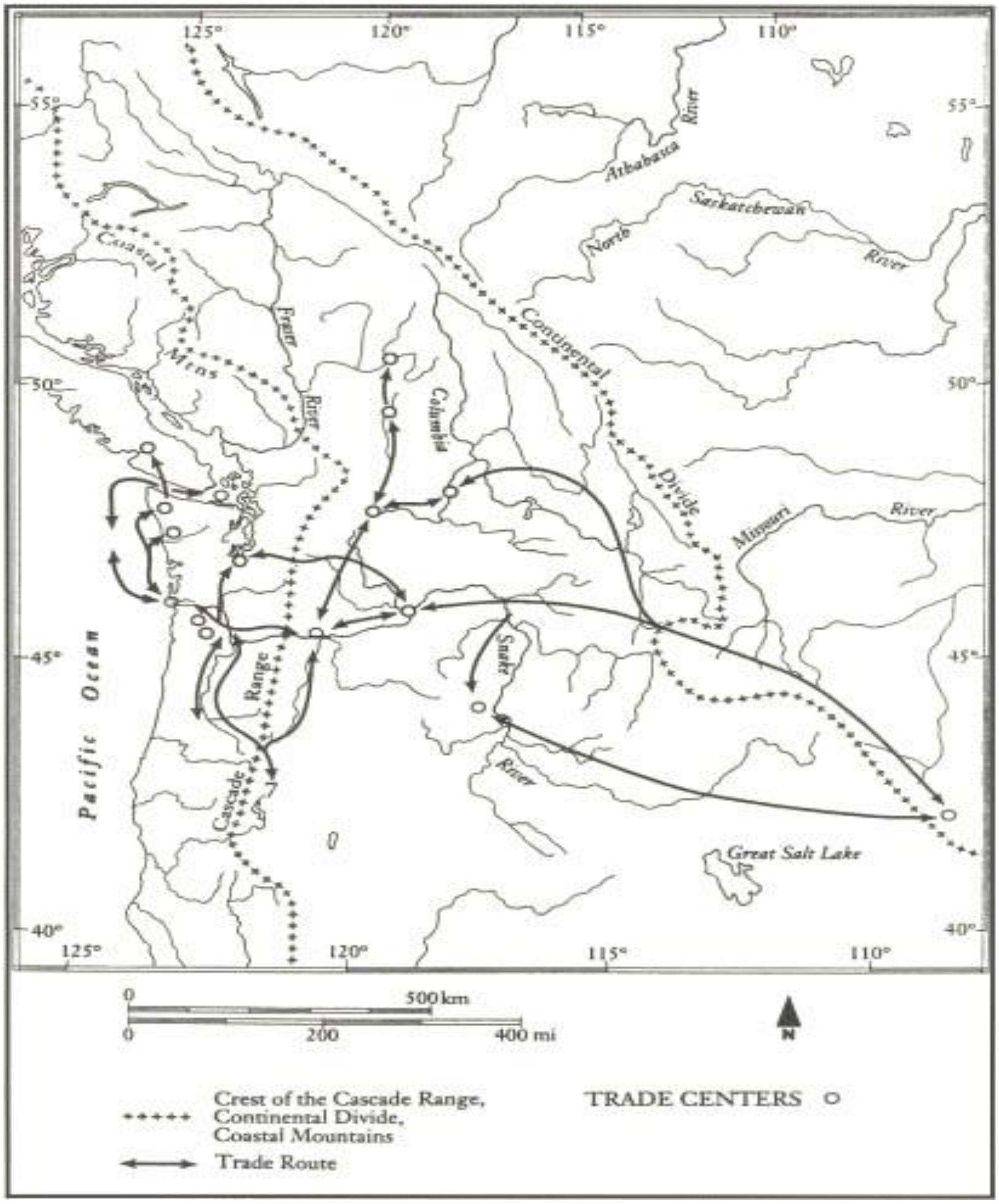

Figure 3. Western North American indigenous trade and exchange networks (Walker 1997).

high level of workmanship, technological complexity, and probably related to some form of craft specialization (Johnson and Morrow 1987:141). The network added support to the lithic industry's need for design, manufacture, and maintenance strategies, which are integral to technological systems; hence, access to the network sustained the trade system (Walker 1997:90) and oral contact fortified it (Kehoe 2002). Not coincidently, local lithic manufacturing practices were a means to transmit social information about various aspects of stone tool technology (Johnson and Morrow 1987:140), including trade network and local raw material sources. (See Johnson and Morrow [1987] above in this chapter's section entitled, Previous Archaeological Research.)

Driver and Massey's (1957) comprehensive summarization of North American cultures included the Plateau. Along subsistence, material culture, economic, and social organization influences in native communities until contact with a non-native populous, Driver and Massey's (1957) extensive map series placed a range of cultural nuance in geographic perspective at the continental scale. The Plateau was seen as a culture trough or sink distinguishable mainly by the absence of traits from areas surrounding the region (Driver and Massey 1957:173). There was probably more variation in personality type and customs in aboriginal North American than in all of Europe in 1492 (Driver and Massey 1957:167). That range of innate diversity at every level of human existence in the New World would become distorted following its discovery by Old World cultures. Those distortions and changes in traditional indigenous lifeways in the Mid-Plateau are the subject of the following section.

History

No one knows how many times America had been discovered by people from the Old World (Driver and Massey 1957:167); however, the aboriginal trade network bears responsibility for the collapse of Native American cultures on the Plateau (Hunn 1990). The demise of native cultures began well ahead of direct contact between indigenous and Euroamerican populations. Diseases were transmitted to the region along trade routes (Kehoe 2002). From the mid-A.D. 1770s forward, one-half of Mid-Plateau native people perished (Schuster 1975; Walker 1997). Ethnographers did not work in the region until A.D. 1883 (Hunn 1990), but anecdotal reports from explorers, traders, soldiers, clergy, and missionaries reflected aboriginal cultures that had been depopulated, traumatized, and besieged by disease and conquer (Hunn 1990; Kehoe 2002; Mrozowski 2009; Schuster 1975; Walker 1997).

Horses arrived in Yakima Valley in the A.D. 1730s (Ruby and Brown 1992; Schuster 1998) and became exchange mediums (Schuster 1998), an industry (Walker 1997), and means to militarize, colonize, and commercialize the Plateau. Between Corps of Discovery contact, in A.D. 1805 (Fitch 1974), and the acquisition of Washington as U.S. territory, in A.D. 1853 (Johansen and Gates 1957), uneven land use emerged in the east Saddle Mountains compared to Wenas Creek-Yakima River confluence (Helland 1975; Mendenhall 2006; Splawn 1958). The shift from Native American to Euroamerican practices was pressured by combined physiographic (Mendenhall 2006; Splawn 1958) and political factors (Douglas 1990; Johansen and Gates 1957; Ruby and Brown 1965).

By A.D. 1853, important trailheads to north Plateau mines were located near the east Saddle Mountains (Mendenhall 2006) and Wenas Valley was the entry to Cascades trails leading to the Pacific Coast (Splawn 1958). Proximity to resources proscribed east Saddle Mountains utility (Mendenhall 2006) compared to Wenas Creek-Yakima River confluence (Splawn 1958). Wenas Valley had fewer weather and terrain extremes and superior access to water, firewood, livestock graze, and food resources. Moreover, after Washington Territory’s governor, as director of railway surveys (Johansen and Gates 1957), had the entirety of Wenas Creek surveyed (Douglas 1990:338), the prospect of public transportation added to the area’s assets. While lowland resources trumped those in the upland, geographic location advanced the confluence as a pawn in the series of political events that ensued.

In his capacity as Superintendent of Indian Affairs, the governor sent an agent, in A.D. 1854, to set up Plateau natives for treaty meetings (Ruby and Brown 1965:29). The majority of Native American leaders “signed away” nearly ten million acres of Plateau land, in A.D. 1855, and a rush of gold miners descended on the region (Ruby and Brown 1965:29-31). The Plateau opened to settlers prior to treaty ratification and Kittitas began killing them (Ruby and Brown 1965:32). Amid an advancing plan to nullify Indian land titles (Scheuerman and Finley 2008), Kawachen (Ruby and Brown 1965), Kittitas, and Yakama (Splawn 1958) began meeting at Wenas Creek to devise a response (Douglas 1990:25). Kawachen House of Half-Sun and Kittitas House of Weowikt mounted a line of defense located between Wenas Creek and Rock Island, near present-day Wenatchee, in order to repel foreigners (Ruby and Brown 1965:33).

Within hours of forming that alliance, Kittitas band members killed six miners at Wenas Creek confluence (Splawn 1958). Soon after, Yakama band members killed the governor’s “Indian agent” for his role in setting up treaty negotiations thought to have duped native elders (Ruby and Brown 1965). So began the Yakima Indian War of A.D. 1855 (Debo 1970; Ruby and Brown 1965; Splawn 1958). U.S. Cavalry headquartered the northern-most war front in Yakima Valley (Helland 1975) at Wenas Creek-Yakima River confluence. The cavalry constructed a bridge across the Yakima River directly north of its confluence with Wenas Creek and built a wagon road across terrain paralleling the creek’s north bank (Helland 1975; Gates 1941; Johansen and Gates 1957). The Yakima

Indian War ended, in A.D. 1856, and settlers recommenced colonizing the region (Splawn 1958).

In A.D. 1859, the U.S. Congress ratified the Treaty of 1855, which created the Yakama Indian Reservation and granted native people access to traditional resources and trade centers (Walker 1997). Yakama, Kittitas, Wanapum, and Wenatchi bands moved to the reservation at that time (Schuster 1975). The Homestead Act of A.D. 1862 officially opened Mid-Plateau land to settlers (Morris 1953). Wenas Creek confluence, in A.D. 1865, was homesteaded by a dairy, sheep, and lumber entrepreneur, and the first local post office was later established there (Lince 1984). Irrigation and livestock water claims to Wenas Creek were filed in A.D. 1865 (Clausing 1997). Settlers occupied Indian land, in A.D. 1877-1878, and disgruntled Yakama killed them (Douglas 1990:25-26).

The Dalles stagecoach to Ellensburg stopped at Wenas Creek confluence from A.D. 1877 to A.D. 1881 (Lince 1984; Trotter et al. 1936). Traffic on the Yakima River and trespassers on Kittitas and Yakama lands spiked, in A.D. 1878, when the Timber Act permitted log floats from Kittitas Valley forests to Yakima Valley lumber mills (Meinig 1995). A new federal land office in Yakima City legalized homestead titles in A.D. 1880 (Douglas 1990). Native fishermen at Wenas Creek complained to Selah officials, in A.D. 1885, that railroad dynamiting during track construction in Yakima Canyon was ruining their Selartar fishery harvest near the mouth of Wenas Creek (Helland 1975).

Drought, in the A.D. 1880s, caused Crab Creek, Yakima and Kittitas Valley homesteads to fail (Mendenhall 2006) and, by the century's end, vast irrigation systems were in place and commercial agriculture was dynamic all over the region (Doncaster 2008). Wenas Valley was the north-most extent of irrigated land in the Yakima Valley

(Federal Emergency Management Agency 2007) and ranches on Wenas Creek were exceedingly profitable enterprises (Lince 1984; Mendenhall 2006; Paul 1973, 1976).

Wenas Creek was prone to flash flooding and its basin flooded whenever the Yakima River exceeded flood stage. The first catastrophic flood recorded on both the Yakima and Columbia (Mendenhall 2006) Rivers occurred in A.D. 1894. The largest Yakima River flood, in 1933, resulted in the construction of an extensive levee system, in 1947 and 1948. When an earthen dam failed on Wenas Creek, in 1952, a severe flash flood caused loss of human life, loss of livestock, and extensive land and property destruction.

Historical events in the east Saddle Mountains quicken, in A.D. 1811, after Thompson's descent of the Columbia River spurred colonization of Wanapum and Kawachen lands (Mendenhall 2006). By the A.D. 1850s, White Bluffs was a locally popular river destination that included a military fort to protect miners (Mendenhall 2006). Colonization increased significantly after the Yakama Indian War (Schuster 1975; Splawn 1958). The House of Half-Sun, in A.D. 1860, conducted a final seasonal round (Ruby and Brown 1965). The Half-Sun horse herd was pastured at lower Crab Creek and winter lodges were erected at present-day Vantage on the river's west bank (Ruby and Brown 1965:48).

Overland traffic across Wanapum territory inflated, during the A.D. 1860s, when White Bluffs became a cargo transfer station and cattlemen overwintered immense herds in the area ahead of springtime drives to the northern mines (Mendenhall 2006). By the A.D. 1870s, the east Saddle Mountains, Wahluke Slope, and White Bluffs were severely over-grazed; native grasses collapsed and atmospheric dust clouds were a persistent problem (Mendenhall 2006). The railroad by-passed the area ostensibly for that reason and the ferry, retailers, most cattle operations, and settlers of the area vanished by A.D. 1870 (Mendenhall 2006). Except for scattered Wanapum camps, White Bluffs was all but deserted. Despoiled landscape barely provided adequate sheep graze and the east Saddle Mountains became a labyrinth of protected lambing stations (Mendenhall 2006:80). The tradition of nomadic native land use was practically extinct by the advent of A.D. 1877 (Henretta et al. 1997:517).

Government and railroad entities promoted dry-land farming in order to increase colonization (Henretta et al. 1997:526) of Wanapum and Kawachen territories after the Yakima and Kittitas valleys were fully claimed (Mendenhall 2006). Surplus settlers took over both banks of the river from the east Saddle Mountains to Hanford (Mendenhall 2006:80-81) and re-colonized Crab Creek (Ruby and Brown 1965). The Nez Percé War of A.D. 1877 served to extinguish all aboriginal land claims (Henretta et al. 1997) and homesteaders began "wholesale Indian killing" (Debo 1970:261). A group of Umatilla, fleeing Oregon citizen militias to refuge with the Kawachen House of Half-Sun, in A.D. 1878, killed ranchers near White Bluffs (Splawn 1958). U.S. military and citizen militias in Kittitas and Yakima Valley deployed protectors for homesteaders at Crab and Wenas creeks (Ruby and Brown 1965). Moses Half-Sun, arrested at Crab Creek in A.D. 1879, was acquitted of complacency in the White Bluffs slayings (Ruby and Brown 1965).

Riverboats traveled as far as Priest Rapids, in the A.D. 1890s, and the Wanapum "valley of short winters" held only a few farms and Wanapum lodges (Mendenhall 2006). Washington became a state in A.D. 1889 (Henretta et al. 1997) and White Bluffs grew, after 1905, as Hanford hydroelectricity enticed settlers back to derelict farms; World War

I and the Great Depression ended that effort (Mendenhall 2006:86-87). Hanford nuclear project and World War II ended private land ownership, in 1943, and Priest Rapids was vacated, except for Wanapam living in rush-mat lodges (Mendenhall 2006). They lacked treaty rights due to early bureaucratic conflicts between federal government agencies and because their land did not appeal to white settlers (Ruby and Brown 1992). A local utility district, in 1957, gave Wanapam access to traditional resources in the district, along with housing, electricity, water, a longhouse, and jobs at Wanapam Dam on the Columbia River (Ruby and Brown 1992:261).

Approximately 55 years transpired between the Corps of Discovery's arrival on the Columbia Plateau and the Yakama Nation's entrenchment on reservation lands that consisted of a fraction of their aboriginal sphere of influence. From that time forward, the imported accoutrements of non-native cultural systems hastened the rise of Americanized western civilization throughout the research region. A detailed overview of the Historic Period component of the archaeological record examined in this research is presented in the following section.

Previous Historic Period Archaeological Research

Historical archaeology refers to temporal (from A.D. 1855 forward on the Mid-Plateau) and material database characteristics, not a different kind of archaeology from any other (South 1977:1-2). The historical archaeological record demonstrably reflects traditional indigenous land use shifts on the Mid-Plateau (Boreson 1998) fueled by Euroamerican exploration, intercultural contact, military conquest, and immigration (Little 2007:47). Cross-cultural elements affected traditional indigenous settlement as well as pressured emigrant Euroamerican adaptations to new ecological and social conditions on the frontier (Little 2007:47-48).

Common patterns of cultural variation in frontier colonies include household, farm, military, garden, and other (intentionally altered) landscapes (Little 2007:47). At every artifact scale, from homestead and hamlet to cities, social and political relations among differing ethnic groups and economic classes (Little 2007:48) appear in historic archaeology sites. From the perspective of this research, Mid-Plateau historic land use paralleled traditional indigenous land use in the sense that phenotypical resource acquisition and consumption did not differ from traditional indigenous land use; however, the Historic Period archaeological record reveals cultural dimensions that powerfully depart from precontact environmental utilization paradigms.

The historic archaeological record reflects introduced resources (e.g., non-native flora/fauna species tied to agriculture/animal husbandry), Industrial Age manufactured goods and technologies, large-scale landscape alterations (e.g., mining, dams/irrigation, road and railway networks). DeBoer et al. (2002:35) reported the earliest Euroamerican land use occurred in better-watered creek valleys; the uplands were homesteaded only after more desirable lands were occupied. From the ideological standpoint of settlers, the wilderness and its native peoples needed to be tamed, improved, and civilized (Merchant 2005:22). That ideology may, in part, explain why Historic Period cultural deposits created by native people mirrored the activities of Euroamericans, particularly farming and ranching (DeBoer et al. 2002:34).

Following prolonged contact between Euroamericans and Mid-Plateau indigenous groups, cultural sites generated by Yakama, Kittitas, and Wanapum peoples exhibited either entirely precontact characteristics or artifacts and features of non-native land use (DeBoer et al. 2002:34). The inclusion of Euroamerican cultural behaviors into the patterns of traditional indigenous land use stymied attribution of certain archaeology sites to a cultural provenance (Benson et al. 1989; Boreson 1998; DeBoer et al. 2002).

D. Rice (1969) inventoried historic cultural resources on the Hanford Nuclear Reservation and surrounds, which included east Saddle Mountains terrain abutting the Columbia River at the toe of Wahluke Slope. D. Rice (1981) additionally evaluated an indigenous trail originating at Priest Rapids on the YTC that extended west to Lmumma (formerly Squaw) Creek, which was appropriated for use by Euroamerican horse and cattle ranchers. Galm et al. (1981) synthesized the Historic Period chronology for Mid-Plateau settlement east of the Columbia River including the east Saddle Mountains. Bruce et al.'s (2001) overview of historic cultural expansion in terrains located between Priest Rapids and Rock Island included the east Saddle Mountains.

Historic archaeology research generated from surface surveys carried out on the YTC military reservation (Benson et al. 1989; Boreson 1998; DeBoer et al. 2002; Lewarch et al. 1999; Wilde and Wilke 1984) provided in-depth excerpts from historic records that furnished chronological land development (e.g., homestead claims, railroad expansion) within the YTC boundaries. The majority of YTC research literature reported estimated dates of use for sites based on temporally diagnostic, industrially manufactured metal and glass artifacts.

Numerous road and trail routes originating in prehistory crossed YTC terrains (Boreson 1998:2.13). The earliest historic archaeology sites related to Columbia River transportation networks oriented west to Puget Sound (Benson et al. 1989:3.5). An emigrant wagon trail, in use between A.D. 1864 and A.D. 1866, followed a creek tributary of the Columbia River westward to the Yakima River immediately south of Selah Creek (DeBoer et al. 2002:27). Land assessors reported differential resource habitat qualities such as arid land bunch grass, riparian zone mixed grasses, and perennial water sources (Boreson 1998:2.16) that were conducive to ubiquitous Euroamerican land use customs such as livestock rearing and farming.

Wilde and Wilke (1984:38) recorded features of an upland homestead (Appendix B) on the YTC defined by a collapsed house originally constructed from milled lumber, a related collapsed wood barn, and an earthen berm root cellar (Wilde and Wilke 1984:38). Debris scatters linked to each structure contained glass, round nails, tarpaper, tongue-in-groove floorboards, milled lumber, barbed wire, other wire, and copious military trash. The site was excessively disturbed by refuse dumping, and vehicular traffic; both of the structures appeared to have been heavily scavenged for wood (Wilde and Wilke 1984:18).

The dwelling was at the south base of a ridge near a shallow drainage bottom at the head of a perennial creek; the adjacent slope directionally oriented toward the west-northwest (Wilde and Wilke 1984:38). The barn and root cellar were located 200 meters (ca. 656 feet) north of the dwelling in an adjacent drainage. Homesteading and ranching, along with exploration, trapping, and mining, were well documented in historic records for the project area (Wilde and Wilke 1984:7). In addition, one of the main trail routes between Priest Rapids and Kittitas Valley during the A.D. 1860s (Wilde and Wilke 1984:8; see D. Rice 1981) was in near proximity to the project area.

Lindeman and Williams (1985) developed a classification system for Washington State agricultural archaeology sites and the political, governmental, and environmental forces that shaped them. General farming, livestock, crops, and ethnic properties were divided into 16 site classes, which included temporal dimensions based on non-portable archaeological features (Lindeman and Williams 1985:13-15). General farming, for example, contained two “diversified farm” (Lindeman and Williams 1985:13) types: pioneer subsistence (A.D. 1792 to A.D. 1870s -1880s) and market production (A.D. 1880s to 1940s), both of which are represented in the Historic Period literature database and upland and lowland study area data sets. In addition, the livestock class sheds light on cattle and sheep husbandry (A.D. 1850s-1940s), along with archaeological features, originating from the A.D. 1850s to 1880s, that distinguish open range (e.g., perennial spring) and enclosed grazing (e.g., water trough) (Lindeman and Williams 1985:13-15) land use practices in the research region.

Benson et al. (1989) recorded both upland and lowland historic sites (Appendix B). Upland land use was demonstrated by homesteads, refuse accumulations, rock features (i.e. cairns, alignments), and “miscellaneous structural features” such as a tool cache of steel pick heads, a water trough, a wagon frame with associated metal debris, a well, and a military site (Benson et al. 1989:6.1) of historic YTC activity. The upland assemblage included temporally diagnostic cans and bottles, ceramics, stove parts, and metal and glass fragments (Benson et al. 1989:6.1-6.3). Lowland sites were a homestead, a campsite with associated debris, a railroad settlement, and many refuse dumps (Benson et al. 1989:6.12). The lowland assemblage contained temporally diagnostic cans, along with metal containers, whole jars and bottles, solarized glass, fragmented glass, lumber, and other debris (Benson et al. 1989:6.12).

Benson et al. (1989:3.6) did not explicitly identify historic sites relative to their spectrum of environmental classes (e.g., flat/bench, slope, ridge); however, a historic map documented indigenous trail routes adapted into dirt roads that traversed flat terraces in upland creek bottoms. The upland homesteads were located at a distance from perennial water sources and all of the sites reflected agriculture (homesteading/ranching), railroad construction/maintenance/use, and military activity (Benson et al. 1989:6.1). The authors' noted the difficulty of attributing cultural function to cairn and aligned rock features in the upland sites (Benson et al. 1989:6.1). Lowland sites were concentrated near road and trail routes located on flat, stream terraces (Benson et al. 1989:6.12, 6.14). Lowland sites held evidence of agricultural, railroad, and military activities (Benson et al. 1989:6.12).

Boreson (1995:2.1) surveyed YTC terrains on Yakima Ridge and in the Yakima River's tributary Selah and Lmumma and Creek drainages. Historic Period isolated artifacts (n = 22) were distributed across the project area, as follow: Yakima Ridge (n = 9), Selah Creek (n = 8), and Lmumma Creek (n = 5) (Boreson 1995:3.3). Three springs had evidence of water developments such as earth berm dams, a rock-and-wire (fence) retention dam, and metal/concrete livestock water tanks (Boreson 1995:3.3-3.4). Eight isolated debris scatters were attributed to late A.D. 1800s to mid-1900s land use (Boreson 1995:3.4) based on the presence of temporally diagnostic metal and glass. The remaining isolates consisted of vent-hole and hole-in-cap cans, solarized glass, ceramic, metal, and glass fragments, and a single rock berm feature (Boreson 1995:3.4).

Boreson (1998:5.3) recorded permanent and temporary settlements, refuse dumps, and architectural features (Appendix B) in YTC upland, primarily. Permanent habitations included household, personal, ranch, architectural, and transportation-related artifacts in addition to archaeological features such as dilapidated dwellings and their foundations, root cellars, water wells, and surface depressions (Boreson 1998:5.7-5.8). Temporary habitation artifacts related to food preparation and consumption but lacked evidence of permanent dwellings (Boreson 1998:5.8). Refuse dumps contained household, personal, and architectural debris, and one debris scatter was linked to silica mining (Boreson 1998:5.8) Water-related and ranch features included earthen dams, developed springs, a fenced stock pond, and livestock corrals and pens (Boreson 1998:5.8). Cans (e.g, hole-in-cap, sanitary, vent-hole) and a single solarized glass fragment gave reliable manufacture dates ranging from A.D. 1880 to 1940 in debris scatters present at all sites types (Boreson 1998:5.3).

Boreson (1998) correlated artifact and feature localities with directional aspect, soils/vegetation, and landforms. Historic Period cultural deposits most often had open or southwest directional orientations and shrub steppe zone soils and vegetation (Boreson 1998:5.1-5.2). More than 80 percent of total sites (n = 23) were positioned on sloped terrain associated with ridges and floodplain terraces (Boreson 1998:5.2). Less than two percent of the historic assemblage was located in riparian zone shrub steppe and no site evidence occurred in eroded drainages with the exception of a small number of isolated deposits (Boreson 1998:5.2). Numerous sites evidenced scavenging and destruction of archaeology sites and features (Boreson 1998:6.1). In particular, the absence of water wells at four permanent habitations and the lack of privies at all of the sites was attributed to an YTC military practice of filling deep holes for safety purposes (Boreson 1998:5.8).

DeBoer et al. (2002:35) expected little trace of the historical archaeological record based on lack of land development in their YTC project area. Nearly all archaeological materials evidenced agricultural enterprise and refuse disposal or the railroad industry (Appendix B). Sprague's (1981) historic site classification system was used to catalog artifacts linked to farming, ranching, railways, mining, and irrigation (DeBoer et al. 2002: 243). Of the total number of sites (n = 15), refuse dumps (n = 8) were most frequent, followed by railroad activity sites, a single homestead, and features related to agriculture (DeBoer et al. 2002:243). Domestic goods such as personal and household items (e.g., cans, bottles, exhausted footwear) were the most frequently observed assemblage artifacts (DeBoer et al. 2002:282). Analysis of refuse dumps contents indicated field camps likely related to temporary work away from ranches located in creek drainages or surrounding communities (DeBoer et al. 2002:34).

Historical archaeology sites located in the east Saddle Mountains were recorded during the Central Washington University field school surveys cited here. Lubinski and McCombs (2003:56, 62) recorded a historic mine located on a hill at mid-slope that had fallen wood posts, post-cairns, and metal debris, while a second mine located on an upper ridge slope had similar posts and a single can. McCutcheon et al. (2008a:Tables 7, 8) recorded one mixed deposit (i.e. artifacts attributed to more than one culture) associated with surface pits attributed to historic origins. McCutcheon et al. (2008a) additionally recorded an isolated can and an isolated rifle shell. Historic Period materials recorded by Vaughn et al. (2008) form the upland study area historic database examined in this research. Those data are treated ahead in the Historic Period Database Analysis and Historic Period Database Classification sections of Chapter IV, under the title Methods and Techniques.

Warren (1968) and Chatters (1984) mention historic landscape qualities at Wenas Creek-Yakima River confluence originating from historic farm and ranch activities. The Historic Period was not considered in those projects, except for Warren's (1968) mention of a Euroamerican kettle in a Native American burial site. Historic archaeology sites were recorded by CWU field school surveys in confluence terrain reported in (2009, unpublished report in possession of Central Washington Archaeological Survey) and Schroeder et al. (2010). Results from those projects comprise the lowland study area historic database examined in this research. Those data are treated ahead in the Historic Period Database Analysis and Historic Period Database Classification sections of Chapter IV, under the title Methods and Techniques.

Euroamerican cultural practices resulted in pervasive environmental change (Mrozowski 2009:23) seen as degradation of vegetation and landforms at historic sites. Benson et al. (1989:2.5) described environmental damage associated with historic sites such as intensely eroded soils denuded of flora. Such environmental disturbance was attributed to intensive seasonal livestock grazing that selected for sagebrush over native bunchgrass (Benson et al. 1989:2.5). Introduced non-native shrubs and trees observed at historic dwelling sites on the YTC were located near riparian zones or surface springs (Benson et al. 1989).

Nearly all of the YTC research reported two problems with interpreting historic archaeology sites. First, sites containing mixed artifact deposits prevented site attribution to a single temporal/cultural provenance. The origin of sites with mixed cultural material proved thorny to assign to either the precontact or historic period (DeBoer et al. 2002:34). Benson et al. (1989:6.2) labeled mixed artifact deposits as “both,” whereas in later work (Benson and Riche 1993:6) a number of upland sites entirely evaded temporal/cultural attribution. Boreson (1998:5.1) labeled mixed artifact sites as “unknown cultural derivation.” Second, differentiating between historic and precontact rock features in order to interpret cairn and alignment functions was problematic for Mid-Plateau researchers (Benson et al. 1989; Benson and Riche 1993; Boreson 1998; DeBoer et al. 2002; Galm et al. 1981; Galm and Hartmann 1975; see also Bicchieri 1999a).

Historic Period Land Use Models

This section accomplishes the fifth and final aim of Objective one as it applies to establishing archaeological expectations for artifact-landscape associations originating from the Historic Period. Regional physiographic characteristics framing the spatial context of historic archaeology sites in Mid-Plateau microenvironments were given earlier in this chapter. Historic Period archaeological information joined to those data summarize literature generated during regional studies cited previously in this chapter. While research into Historic Period archaeology reported for the region is particularly limited compared to prehistory studies, the addition of historic records added depth to technical description of the historic archaeological record. Recordkeeping, a cornerstone of Euroamerican culture, offered an abundance of land development records from which to decide occupation dates and site functions.

It is crucial, here, to emphasize two implicit points about the historic Mid-Plateau. First, the regional archaeological record, from A.D. 1855 forward, reflected across-theboard change – from the scale of artifact to the scale of region. Second, Historic Period literature reflected a new tool calibrated to explain that change. Both points can be illustrated with one example, the historic record. The historic record was both means for researchers to better explain large-scale land use change, while simultaneously offering a source of information that, literally, translated that change from historic archaeology site deposits of "exhausted shoes" (DeBoer 2002) into where, why, and who wore them.

After the collapse of traditional indigenous landscape utilization, regional land use shifts included pervasive floral and faunal resource introduction and large-scale alteration landscape. As a guide to Euroamerican culture, the historic record abetted description and interpretation of historic archaeology deposits by furnishing site-specific information. The Train Order Station of Boylston, constructed, maintained, and used from 1909 until the 1930s (Benson et al. 1989; Lewarch et al. 1999) is one such example of that specificity. Invention and use dates for nineteenth and twentieth century technology, and material culture manufacturing chronologies for identifying and dating artifact assemblages, added temporal detail to land use.

Archaeological expectations for cultural-spatial manifestations reflective of fundamental nineteenth century regional land use shifts are presented here in the form of Historic Period land use models (Appendix B), as required in Objective one. Each model corresponds to archaeology sites made up of cultural and environmental variables that are distinctive of Euroamerican landscape exploitation. The analytical capacities of Historic Period models, like those representing traditional indigenous land use, include the basic hypotheses that resource availability, acquisition, and use equate to environmental utility and parallel artifact-landscape contexts will hold true in environments analogous to the archaeological and environmental parameters inherent to the predictive models.

Of the archaeological literature cited thus far in this research, seven surveys on the YTC military base included coverage of the Historic Period. Each of those projects recorded significant instances of ubiquitous historic military refuse. Such deposits are irrelevant to the purpose of this research and no further mention of military material is included in this discussion. Chatters (1982) and Dancey's (1973) research focused exclusively on traditional indigenous land use. King and Caywood (1994) saw a single isolated glass fragment during the whole of their project and were not included in the following review of historic archaeology research amenable to contributing data for the construction of predictive Historic Period land use models necessary to this research.

Although Wilde and Wilke (1984) recorded but one historic archaeology site in their YTC survey area, the property exhibited cultural and spatial elements seen in most Mid-Plateau historic deposits. For that reason, it serves here as an example of a typical upland permanent domestic habitation. Wilde and Wilke (1984:38) described the site as follows: A homestead ruins was located on the heads of two perennial creek drainages flowing in direct proximity to one another. The remains of a wooden house were located in one drainage and, a short distance away, a similarly ruined wooden barn with an earth berme root cellar were located in the other drainage. The architectural structures were originally made of milled lumber. Associated debris scatters held nails, tarpaper, glass, grooved floorboards (i.e. building material), and barbed wire (i.e. ranch material). The site was at the south toe of a ridge that directionally oriented to the west-southwest. The structures had been scavenged for wood and the area was damaged by vehicle traffic.

Benson et al. (1989:3.6) assessed YTC upland sites in terms of available water. Homesteads strikingly similar to Wilde and Wilke's (1984) example, albeit distant from water were seen to represent futile attempts at arid land farming, a view cooberated by the historic record of the area's failed (water scarce) land claims (Benson et al. 1989:6.1). Permanent (e.g., well) and temporary habitations with similar refuse (e.g., cans, bottles, ceramics, stove parts, metal/glass fragments), railroad (e.g., pick heads), miscellaneous structural features (e.g., water trough, wagon frame, metal debris, fence), and enigmatic rock cairns and aligned rock features (Benson et al. 1989:6.1-6.3) indicated a range of upland utilization patterns. Important as a point of interest in this research, Benson et al. (1989:6.1) reported cairn and rock alignment features linked to the upland archaeological sites were difficult to associate with cultural function.

Benson et al. (1989:6.12-6.14) described YTC lowland sites as follow: According to the historic record, from the A.D. 1880s to 1930s, land claim and sale sequences in the project area suggested ongoing patterns of failed agricultural endeavors, most particularly ranching, and land speculation tied to railroad right-of-ways. Archaeological support for agricultural (e.g., a single homestead, farming/welding equipment, ditch/flume) and railroad activity (e.g., temporary camp, multiple habitation railroad settlement) existed, including artifacts identified in the lowland's most numerous site type, refuse dumps. Refuse deposits had metal (i.e. can, container), glass (i.e. jar, bottle, solarized), lumber, and other debris. Refuse dumps notably lacked construction (e.g., nails, milled lumber, tools) or farm and ranch equipment (e.g., particularly wire), which is not surprising in light of site scavenging potentially aimed at useful materiel retrieval. Spatially, the sites concentrated near road and trail routes located on stream-built terraces that were flat.

Boreson's (1998) work implies upland utilization took place in settings with varying access to water fit for human consumption and water suitable for livestock. In addition to variable perennial or seasonal water access, Boreson's (1998) habitation sites, be they permanent or temporary, evidenced farm, ranch, and livestock-related endeavors. Distinguishing habitations oriented toward agriculture and farming from those related to animal husbandry and ranching is difficult. In that context, Boreson's (1998) permanent dwelling sites represent fixed location homesteading with accessible water and livestock rearing of unknown scale. Artifact assemblages at Boreson's (1998) temporary habitation sites are ostensibly identical. Again, access to water suggests the environmental variable that sets temporary campsite habitations apart from refuse dump temporary habitations. Boreson's (1998) earthen feature model is a spring site indicative of resource acquisition and use for livestock maintenance. Along with variable water sources and access to them, Boreson's (1998) four site models are qualified by a probability of occurrence in (1) ridge slope terrains with (2) open or southwest aspects in (3) shrub steppe soils/flora habitat.

DeBoer et al. (2002:35) expected scant trace of historic material based on the historic record of negligible land development in the YTC project area. Nearly all of the site deposits evidenced agriculture, refuse disposal, and railroad activity. Classification of farm, ranch, railroad, mine, and irrigation activity was based on Sprague's (1981) system (DeBoer et al. 2002:243). A little more than half (n = 8) the site total (n = 15) were refuse dumps, followed by railroad deposits, a homestead, and agricultural features (DeBoer et al. 2002:243). Personal and household domestic goods were ubiquitous in site deposits (DeBoer et al. 2002:282). Refuse analysis linked temporary field camps to ranching away from permanent habitations in near drainages or communities (DeBoer et al. 2002:34).

The literature reviewed here serves as the source for predictive models of land use during the Historic Period on the Mid-Plateau (Appendix B). The models will be used as a template against which the historic archaeological record examined in this research will be compared in Chapter V, under the title Results of Survey.

CHAPTER III

STUDY AREAS

The point of this research is to discover if surface survey data are efficacious for distinguishing land use patterns in upland and lowland environments of the Mid-Plateau. In order to apply the archaeological record as a lens for recognizing patterns of cultural behavior, it is crucial to first, identify the spatial contexts and areal dimensions in which the record exists. This chapter initiates the first aim of Objective two by establishing the geophysical parameters for cultural sites located in portions of the east Saddle Mountains and the Wenas Creek-Yakima River confluence, which are the focus of this research. An understanding of the geological setting and physical circumstances involving exposure of cultural materials is essential (Hester et al. 1997:35) in order to describe and interpret the archaeological record in its environmental context.

The second aim of Objective two to provide descriptions of the discrete cultural-environmental associations in each study area wholly relies on a portrayal of the upland and lowland terrains as resource-bearing landscapes. Previous archaeological research on the Mid-Plateau demonstrates how knowing those associations can create a perspective from which to first, identify how artifact deposits articulate with landscape in each study area. Second, and of equal importance, knowing those associations can create a viewpoint from which to interpret artifact-landscape relationships in ways that contribute to learning why evidence of past human land use in the study areas may be differentially expressed in the archaeological record.

Vaughn’s (2010) reference to natural selection posits a rationale that supports the dual purposes of Objective two. Vaughn (2010:33) stated variables can measure selective environmental traits that capture requisite data for comparison across assemblages. The second objective of this research structures definition of “selective conditions” (Vaughn 2010:33) in the study areas such that environmental contexts are set up for comparing the upland and lowland research datasets to one another and to predictive models of past land use derived from previous Mid-Plateau research literature.

Physiographic dimensions of the upland and lowland study areas (Table 3) and their relationship to cultural data that exist in each research setting are drawn from Central Washington University (CWU) archaeology project summaries. Vaughn et al. (2008) reported CWU surface survey work done in the east Saddle Mountains for the U.S. Bureau of Land Management. CWU surveys done at Wenas Creek-Yakima River confluence for the U.S. Bureau of Reclamation are reported in Anderson et al. (2009, unpublished manuscript in possession of Central Washington Archaeological Survey) and Schroeder et al. (2010).

Table 3. Upland and Lowland Locational, Geological, and Physiographic Profiles.

Study Area	East Saddle Mountains	Wenas Creek-Yakima River
Washington State Location	Grant County	Yakima County
USPLS Location	Sections 8, Section 18 T15N R24E	Section 18 T14N R19E
USGS 7.5' Quadrangle	Beverly (1965), Beverly SE (1965)	Selah (1953), Pomona (1958)
Elevation (amsl) of Archaeology	Section 8 579 m – 678 m Section 18 415 m – 678 m	Section 18 397 m – 549 m
Aspect of Landform	Section 8 North Section 18 West	Section 18 South (north of creek) Section 18 North (south of creek)
Slope Gradient	Section 8 4º – 10º Section 18 4º – 90º	Section 18 0º – 56º
Columbia River Basalt Group	Frenchman Springs Priest Rapids Roza	Pomona Roza
Ellensburg Formation	Squaw Creek Quincy	Rattlesnake Ridge Snipes Mountain Conglomerate
Major Landform	Sentinel Peak	Umtanum Ridge
Local Landform	Unnamed mountain ridge	Umtanum Ridge slope
Distance (km) to Major Drainage	Columbia River Section 8 6 km west Section 18 5 km west	Wenas Creek, Yakima River Section 18 0 km – 1.6 km east
Distance (km) to Minor Drainage	Unnamed ephemerals on site	Unnamed ephemerals on site Perennial springs on site
Physiographic Province	Columbia Basin	Columbia Basin Cascades
Steppe Ecosystem Subdivision	Shrub Steppe	Riparian Shrub Steppe Meadow Steppe

(Franklin and Dyrness 1973; Bingham and Grolier 1966; Schroeder et al. 2010; Vaughn et al. 2008)

Upland Study Area

The east Saddle Mountains are bordered by the Columbia River to the west, the Columbia Basin to the east, Quincy Basin to the north, and Wahluke Slope to the south (Figure 4). The area is public recreation land administrated by the Bureau of Land Management.

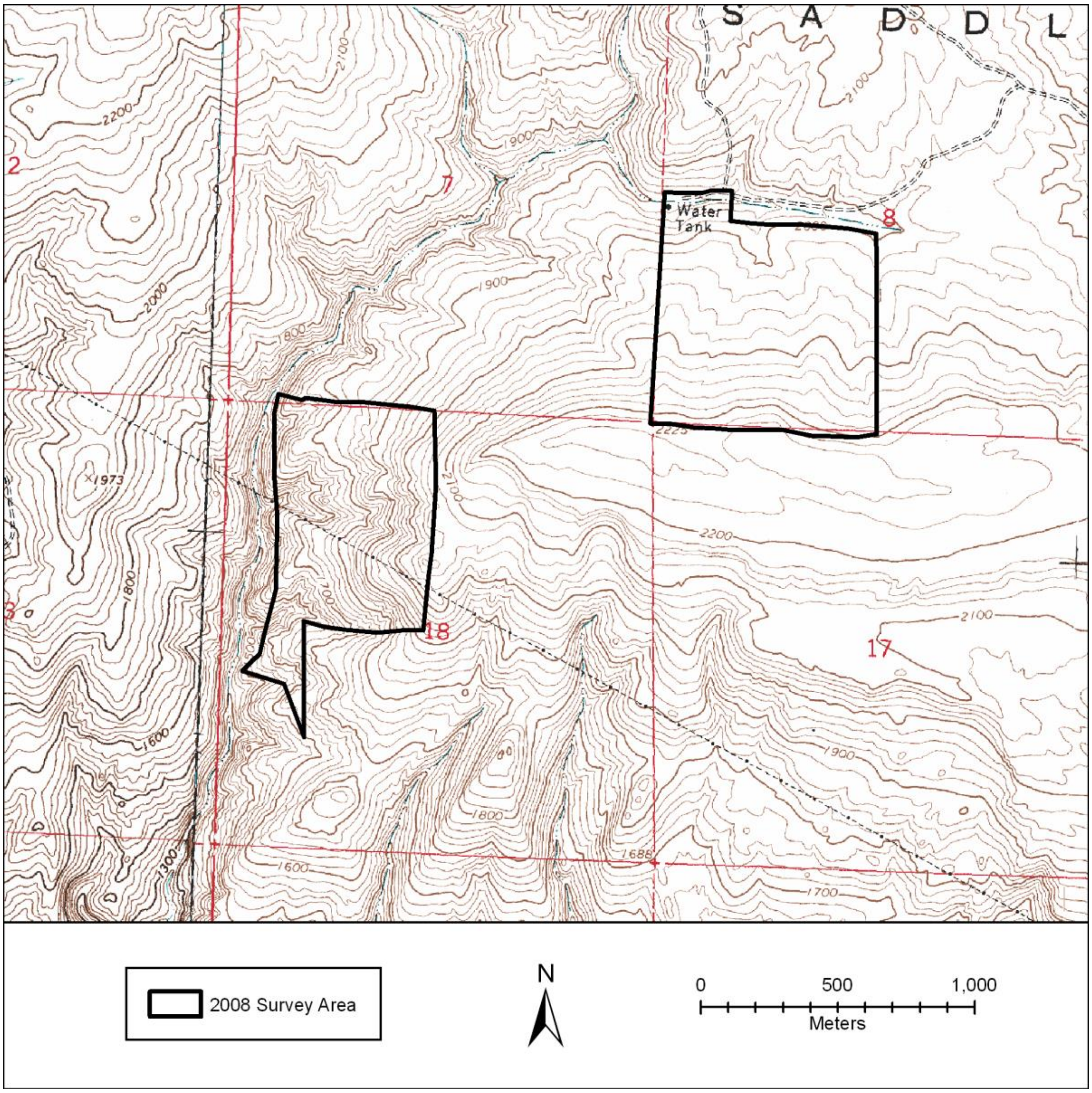

Figure 4. East Saddle Mountains upland Sections 8 and 18 study area surveyed in 2008 (Map by Kevin Vaughn).

The survey was conducted on parcels located within Sections 8 and 18 on the same east-to-west trending ridge. Section 8 is the north slope, which terminates in a sand-filled ravine and Section 18 is the west slope, which ends in a similarly sand-plugged ravine. Crest, slope, bench, and drainage microenvironments typify uneven topography in both parcels. Basalt outcrops and sediment interbed exposures are cut with ephemeral stream channels that drain limited seasonal precipitation and snowmelt, and then go dry for the bulk of each year.

Squaw Creek and Quincy interbed sediments provide on site sources of toolstone raw material. Snipes Mountain Conglomerate quartzite river cobbles exist adjacent to the study area. Lithic elements contained in the interbed and conglomerate exposures were utilized for lithic tool production during prehistory. Deep eolian sandy loess interspersed with shallow rocky lithosol (Senn 2007:14) make up soil matrices in the area. Soils were classified as either sandy loess or lithosol during the field survey. Intense wind turbulence serves to deposit Columbia River floodplain sand on north and west-oriented landscape that occasionally obscures the underlying surface. Native shrub steppe and introduced flora intermix with anthropogenic surface disturbances, discussed below, which range from moderate to severe across both parcels.

Lowland Study Area

Wenas Creek-Yakima River confluence (Figure 5) is bordered by Wenas Valley to the west, the Yakima River to the east, Umtanum Ridge to the north, and suburban Selah,

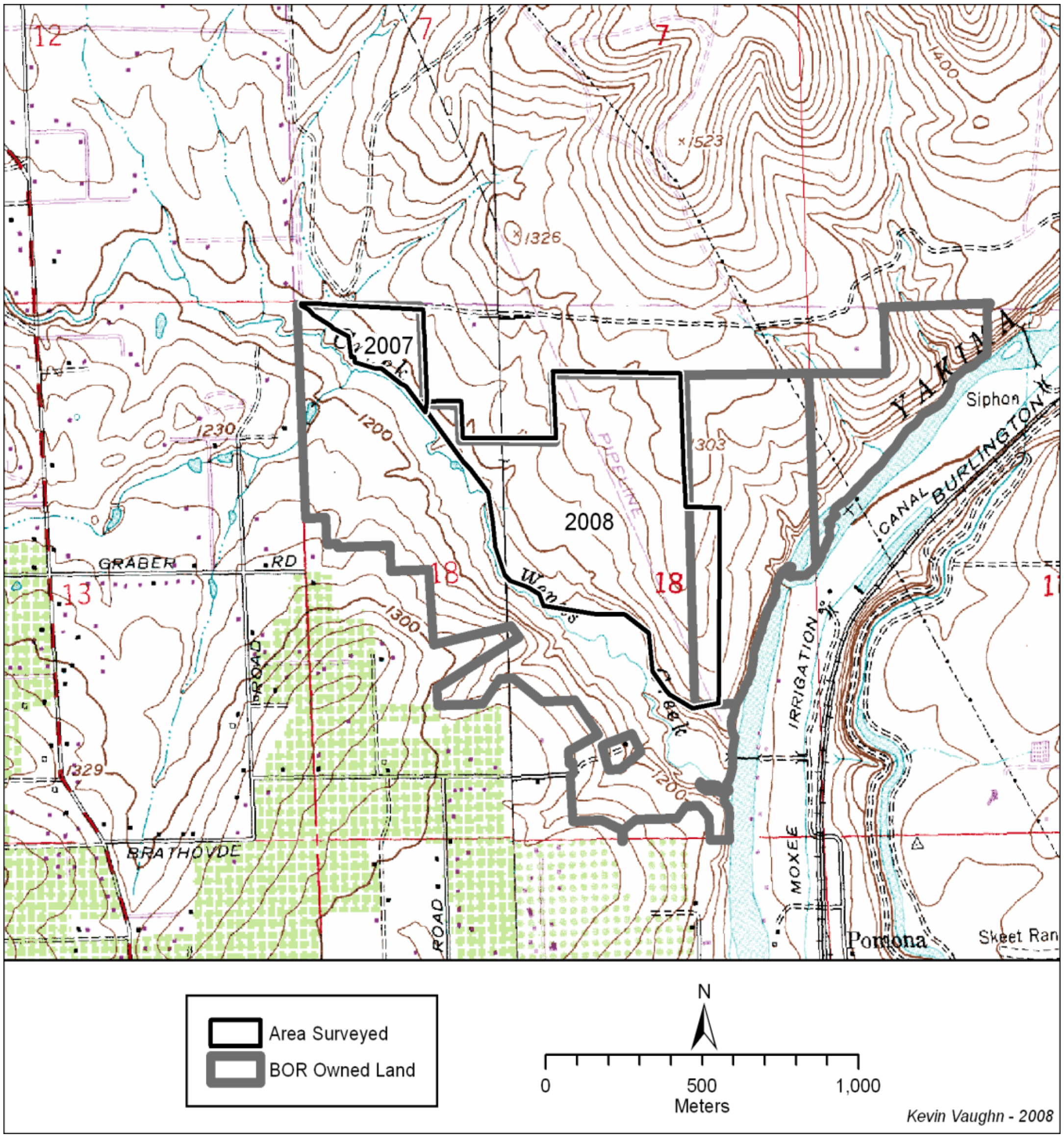

Figure 5. Wenas Creek-Yakima River confluence survey area.

north and south of the creek. The survey occurred within Section 18 on two parcels. The area is anadromous fish habitat undergoing restoration administrated by the Bureau of Reclamation; public access is barred. The study area is within habitat repair boundaries.

The confluence is at the terminus of the gentley inclined south slope of Umtanum Ridge where topography is fairly even. The slope abates on benches rimmed with basalt cliffs and talus slopes bordering Wenas Creek floodplain and a riparian zone interface with shrub steppe and meadow steppe floral habitat. Terrain is morphologically identical on both sides of the creek with two exceptions: the south bank steepens eastward toward the river and perennial springs occasionally rise from the bedrock. Bench, cliff/talus, drainage, and floodplain microenvironments characterize both parcels. Local soils consist of a number of loam classes coveted for agriculture (Clark 1998:231). Soils were defined during the survey as sandy loess, lithosol, sandy loess and lithosol, and basalt and sandy loess. Rattlesnake Ridge sedimentary interbed contains toolstone raw material and Snipes Mountain Conglomerate contains quartzite river cobbles used for lithic tool production during prehistory. Native and invasive flora intermixes with anthropogenic disturbances, discussed below, which range from moderate to severe across both parcels.

Upland and Lowland Study Area Environmental Comparison

The upland and lowland each have a bench microenvironment. However, upland benches are mid-slope elements of steep ridges, while lowland benches are elements of a gentley inclined slope terminus at the base of a ridge in the Yakima Fold Belt system. Likewise, while both areas include a drainage microenvironment, the upland ephemeral type rarely contains water and the perennial lowland springs are active Wenas Creek tributaries. Prior to present-day water restriction, lowland water assets caused flash floods on the creek and catastrophic floods on the river that inundated the creek. Post deposition flooding (Chatters 1984a) disturbed subsurface stratigraphy. Prior to anthropomorphic alteration of regional hydrology systems during the Historic Period (Clarke and Bryce 1997), spring water exposures may have been more abundant in the upland study area. Galm and Hartmann (1975) recorded springs associated with cultural sites in the portion of the study area they surveyed and in the surrounding vicinity. Upland aridity in the east Saddle Mountains is exacerbated by wind induced evaporation. The lowland is spared similar magnitudes of wind and moisture loss attributable to location in a lowland basin sheltered by the Cascades to west, Yakima Fold Belt ridges to north and south, and a general lack of weather event from the east.

Along with creating topographic contrasts between the two study areas, altitude disparities point to dissimilar albedo, absorption, and insolation rates (Bradshaw and Weaver 1993). Directional aspect combined with increased altitude effects ambient temperatures in uplands by diminishing the ability of air to hold warmth (Bradshaw and Weaver 1993:97). Those environmental qualities affect floral productivity (Brook 1964) and availability of plant resources to upland fauna (Pielou 1991) and to humans. The following outline from arid lands literature (Franklin and Dyrness 1973; O'Connor and Wieda 2001; Taylor 2002) describes the botanical systems underpinning flora and fauna variability within and between the upland and lowland study areas.

Both are located within the Mid-Columbia Plateau steppe (perennial grass) zone (Franklin and Dyrness 1973). Steppeland, generally variable in climate, topography, and species, has one unifying characteristic: sagebrush (Taylor 2002:2). Sagebrush (*Artemisia* ssp.) and bluebunch wheat grass (*Agropyron spicatum*) predominate in the east Saddle Mountains study area. Stiff sage (*Artemisia rigida*) is present in lithosols. The upland is otherwise wholly typified by uneven florescence (Franklin and Dyrness 1973:51, 217) seen in atypical or nonconformist species that do not adhere to annual, perennial, or biennial cycles. Wenas Creek is a big sage (*Artemisia tridentata*) and Sandberg's (i.e. steppe) bluegrass (*Poa secunda*) district conjoined to a Bitterbrush (*Purshia tridentata*), sagebrush (*Artemisia* ssp.), and *Poa secunda* district. *Artemisia rigida* is also present in lowland lithosols. By virtue of location in a sheltered lowland basin, Wenas Creek straddles the shrub steppe and meadow steppe segments of an overall sage/bunchgrass ecosystem. Location at a confluence of perennial waters, the lowland additionally includes a riverine zone linked to the Yakima River and a riparian zone that moves inland to west of the creek's mouth.

The upland and lowland research environments offered a replete floral and faunal food base to humans during prehistory (Benoliel 1974; Hunn 1990; Schuster 1975). The lowland provided numerous terrestrial and aquatic foods (Hunn 1990; Schuster 1975) and rocky sandy upland soils were habitats of numerous edible plants (Taylor 1992). Highly valued camas (*Camassia quamash*) (Benoliel 1974) favored meadow steppe land (Taylor 1992) like that in the lowland study area; however, camas was often harvested from elevated rocky soils (Benoliel 1974:33), like those in the upland study area, during springtime. Bitterroot (*Lewisia rediviva*) was extensively distributed on lithosols (Taylor 1992:122). Upland faunal food resources included large and small mammals and birds (O'Connor and Wieda 2001). Topographic distribution of the archaeological record across microenvironments (Figure 6) in the east Saddles Mountains and Wenas Creek

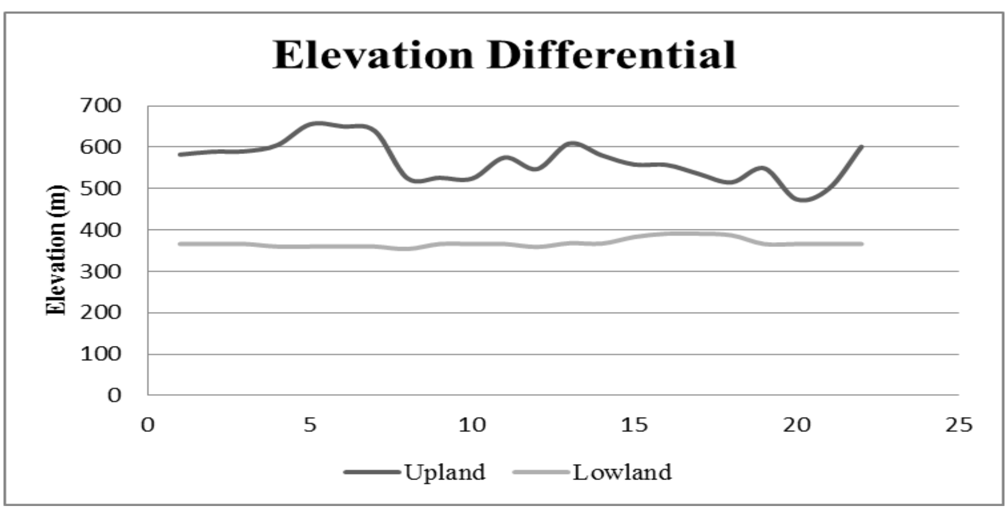

Figure 6. Archaeology deposit distribution in relation to topographic variables.

confluence, as identified above, raises the issue of elevation differentials within the upland unit and between the two study areas. Artifact deposit elevations show the least elevated upland deposit, at 474 m, exists at greater elevation than the most elevated lowland deposit, at 391 m. Vertical difference between the two areas is one hundred meters at minimum and more than one hundred meters at maximum. The uplands geomorphology is a Yakima Fold Belt anticline with, in Figure 6, less than obvious west orientation toward the Columbia River (i.e. right edge in Figure 6). The lowland is a synclinal trough carrying a perennial drainage between two anticlines oriented east toward the Yakima River (i.e. left edge in Figure 6).

Here, it is important to introduce the natural sample model upon which this research relies; archaeologists have only recently obtained the model from geographers (Patrick T. McCutcheon personal communication, 2015) and applying it to archaeology-based land use research is new. Natural samples recognize dimensions of real-world processes that produce spatial patterns influenced by *random components* (McGrew et al. 2014:150; emphasis added) in environmental systems such as physiographic forces that influence variation within physiographic processes. Atmospheric conditions described earlier in this chapter contain a number of random forces, which – tied to elevation, for example, affect terrestrial patterns of resource productivity in the study areas. One way to examine past upland and lowland resource potential considers the influence of soils and flora habitat and aspect of direction (Figure 7) on clustered artifact distributional frequencies preserved in each study area's portion of the archaeological record.

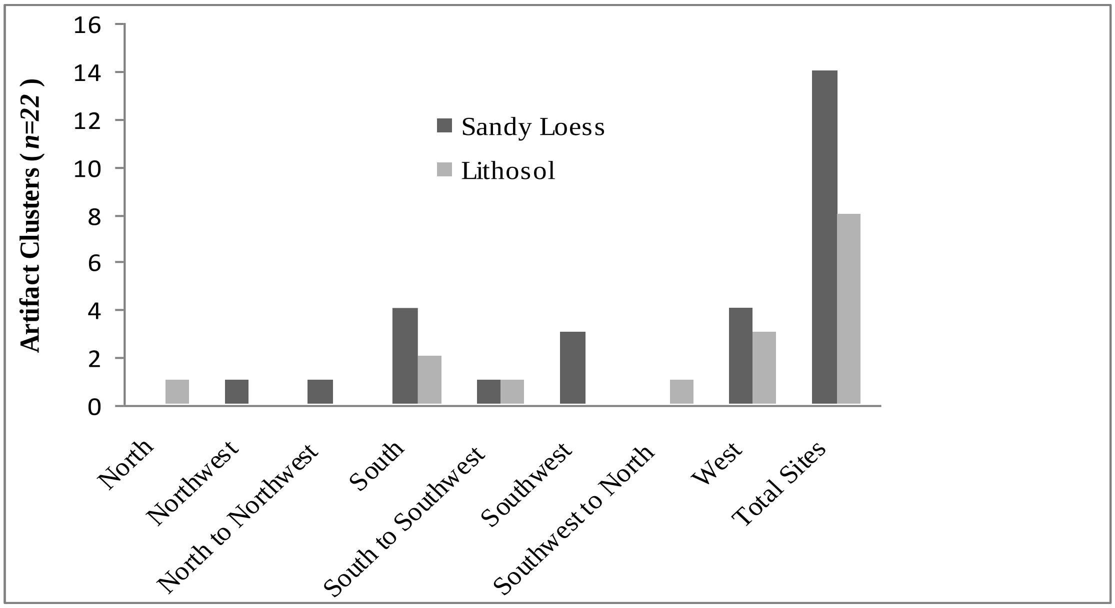

Figure 7. East Saddle Mountains archaeology deposit distribution plotted in relation to soils and aspect of direction.

Flora distributions vary by elevation (O'Conner and Wieda 2001:22) and four basic soils/flora complexes (Chatters 1982) exist across the elevation scale. Archaeology deposits graphed on elevation and soils/flora distribution conforms to what others have found. Both assemblages orient most frequently to resource-bearing habitat with south and west aspects of direction, followed closely by southwest. While organic/inorganic resources in upland and lowland varied, each sample unit contained significant elements of the "subsistence suite" (Sturtevant 1998) that sustained human life in the region.

Resources available to humans in the east Saddles Mountains study area came from the bluebunch wheat grass steppe ecosystem that supported an overall wildlife graze and forage habitat. Human botanical foods were in lithosolic rootbeds (e.g., biscuit root, bitterroot) and in surrounding rocky sediment communities of drought-tolerant (e.g., wild onion) species. O'Conner and Wieda's (2001:24) "rocky ridge crest" microenvironment described lithosols located on upland ridgetops that supported balsamroot (*Balsamorhiza* ssp.), buckwheat (*Eriogonum ssp.*), and many other edible and medicinal forbs. Abundant geologic outcrops of raw chipped stone in the upland study area were an important source of local toolstone, which was in turn vital to lithics industries throughout prehistory. It is worth reiterating Clarke and Bryce's (1997) view that ecosystem productivity potentials tied to the region's hydrology system, perennial springs in the upland for example, prior to anthropogenic modification of the system during the Historic Period. In all likelihood, water resources in the upland study area were at least marginally more plentiful prior to large scale water diversion effects, in particular, upland perennial spring exposures.

Wenas Creek was geographically located in immediate proximity to multiple terrestrial and aquatic resource habits. Perennial confluence waters generated the products of a riparian zone and the creek and river both contained aquatic flora and fauna species, along with drawing terrestrial wildlife into the study area (Figure 8). Within that well-watered context, lowland sediments produced wildlife graze and a wide range of botanical species utilized by humans. Uebelacker (1984) recognized the significance of lower Wenas Creek's connection to the Cascades physiographic province, First, people inhabiting the lowland study area had immediate fixed resources in the adjacent uplands and highlands. Second, due to geographic location in a major elk migration corridor the lowland study area accessed a significant seasonal source of prey game.

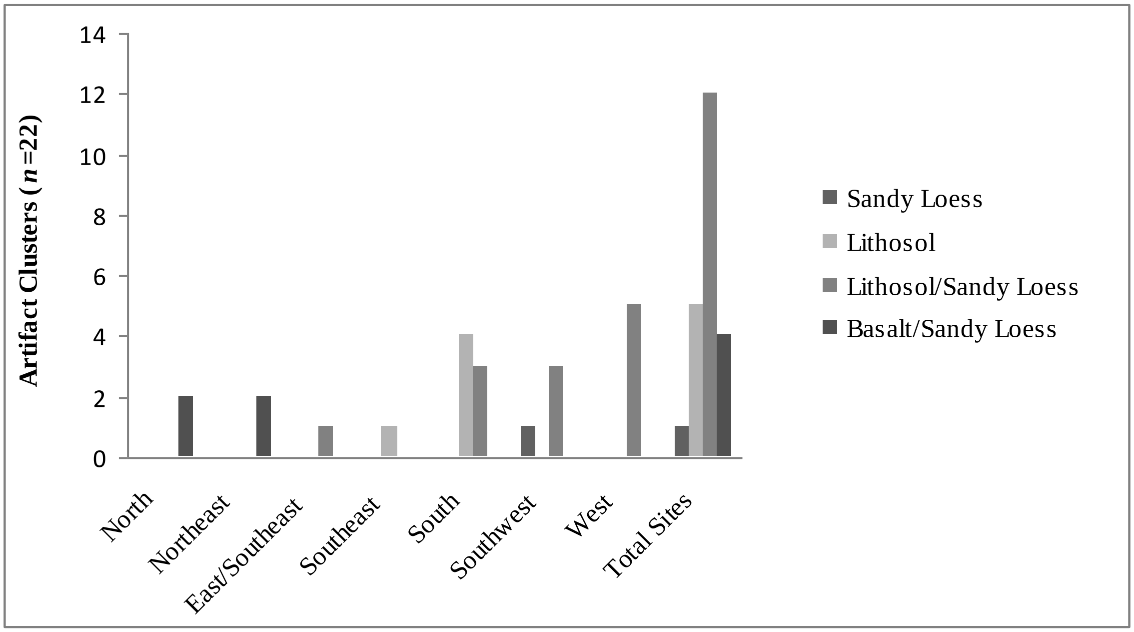

Figure 8. Wenas Creek confluence archaeology deposits plotted in relation to soils and aspect of direction.

Paleoenvironmental effects on resource availability over time in the study areas is detailed in Chapter II, under the section title Physiographic Environment of Previous Archaeological Investigation. Cultural adaptations that evolved to meet variable survival requirements linked to climate impacts on the Columbia Plateau's subsistence resource base are discussed ahead in the following section.

Differing spatial settings such as the upland and lowland study areas and their inherent influence on archaeological contexts are addressed by geoarchaeology's three-dimensional model of artifact, feature, and other debris as a systematic context (Waters 1992:11). Distribution of archaeological materials that result from past human actions, while it may be patterned, it does not follow that patterning of artifacts and that of the human behavior that produced it are identical (Wood and Johnson 1978:316). Natural perturbations (n-transforms [Schiffer 1976]) from flora, fauna, climate, and landscape systems (Waters 1992:5) interfere with the spatial integrity of the archaeological record

(Schiffer 1976). N-transforms that contribute to post-depositional disturbance include freezing and thawing (cryoturbation), animal life (faunalturbation), plant and root impact (floralturbation), and gravity (graviturbation). Human cultural (c-transforms [Schiffer 1976]) influences on the archaeological record include, in the study areas, road, farm, ranch, livestock, rock collecting, camping, and other activities (e.g., upland electrical transmission towers, lowland natural gas pipelines) on areal surfaces.

While regional biophysics and climate dictate local erosion and deposition patterns (Chernicoff and Whitney 2002), those same forces concurrently form, preserve, and alter the archaeological record (Waters 1992) in each of study area. Environments prone to n-transforms readily lose archaeological context. Regions flanking a deflating arid basin, for example, show intensified sedimentation on adjacent landscape (Waters 1992:202). Significant in the upland study area, loss of sediment sources results in increased incidence of lithosolic soils (Jack Powell 2007). Sediments also hinder visibility where intense alluvial (flowing water) and colluvial (gravity) forces have terraformed landscape along river networks (Banning 2002:48) such as in the lowland study area.

Nance (1983) stated surface visibility very much affects the ability of surface survey data to estimate artifact frequencies and identify geospatial patterning within an archaeological context. Colluvial deposits reduce visibility at the base of hill and ridge slopes (Banning 2002:48; Waters 1992:232), as seen in the upland study area. Fine-grained particles may remain stable after initial eolian (wind) deposition on terraced landscape or erode downslope on unstable hills; debris collects at landform bases (Waters 1992:202-203). In addition, coarse debris can break loose from cliffs and outcrops, which form “falls” (Waters 1992:230) or amass as talus deposits at the base of slopes. That type of surface alteration is present in both study areas. Rock falls of pebble, cobble, boulder, and columnar basalt scatters disperse downslope. Conversely, fluvial deposits have as a feature subsurface, lateral water movement and overland flow of surface waters derived from precipitation and snowmelt (Waters 1992:115-117). Previous archaeologist working in the lowland study area observed such effects in subsurface excavations. The upland study area susceptible to snowmelt and sheetflow mainly during spring runoff events.

Along with natural environmental differences, both study areas have pronounced anthropogenic footprints. Before inclusion in the habitat restoration project, the lowland was under private ownership for 142 years. Military, farm, ranch, site looting (Warren 1968), pipeline, road, and house installations resulted in non-native flora infestations, site trampling, and soil compaction. Similarly, native grasses were grazed to near extinction in the east Saddle Mountains beginning in the historic period (Mendenhall 2006). Later, recreation, oil and gas prospecting, communications and electricity transmission (Bailey 2006), roads, and off-road vehicles disturbed the areal surface. A number of electrical transmission towers bisect the Section 18 study area parcel.

Natural and anthropogenic disturbances on terrestrial surfaces both impair and enhance detection of the archaeological record. Many previous Mid-Plateau researchers described surface visibility in a project area in terms of percentiles such as 25-percent or 50-percent (and so forth) of the areal surface visible to the naked eye during pedestrian surveys. The CWU survey recordation protocol used during the fieldwork upon which this research is based used vegetation and sediments characteristics (Table 4) in order to describe upland and lowland surface visibility in the archaeological sense. Each exhibited all of the four general surface conditions defined below.

Table 4. Definition of Surface Visibility Relative to Vegetation and Sediments.

Visibility	Definition
Poor	Vegetation dominated surface, soils absent
Fair	More vegetation visible than soils
Good	More soils visible than vegetation
Excellent	Soils dominated surface, vegetation absent

Precontact Cultural-Environmental Classification

Thus far, locational, geological, and physiographic outlines of the east Saddle Mountains and Wenas Creek-Yakima River confluence terrains have placed each area's share of the archaeological record in its biophysical context. In this section, evolutionary archaeology's concept of the selective environment (Vaughn 2010:33) is introduced, as both spatial initiator and spatial receptacle of human responses to resource-bearing land. Selective environments are discrete microenvirons with spatial attractants that interface with human exploitation of resource assets. Identification of selective environments on the Mid-Plateau allows recognition of how the research data conform to or differ from regional patterns of land use identified earlier in this research.

Because landscape utilization is signified in archaeology studies by permutations of objects *in situ* seen as spatial distributions of artifact frequency and because resource assets are central in organizing artifact-landscape correlations that reflect human land use, the site *type* classification used in this research is based on microenvironmental variables to which cultural variables are tied. Existing definitions of environmental variability in

Mid-Plateau archeological settings offer an unwieldy site *type* nomenclature. Objective two serves to circumvent that terminological chaos. In response to objective one, the Mid-Plateau archaeological literature were culled to obtain a guide to regional upland and lowland environments linked to the archaeological record. Previous research identified environmental variables in upland and lowland settings as soils, vegetation, elevation, and aspect of direction. Those data were used to develop precontact land use models (Appendix A) and artifact-landscape cohorts (n = 36) distilled from the models. The revised cultural-environmental paradigms will serve as an evaluative tool with which to measure precontact human land use (Table 5) in the research database.

Table 5. Precontact Cultural-Environmental Constructs for Comparative Analysis.

Upland Cultural Deposit	Upland Environmental Setting	Site Type
Formed/broken tools Utilized flakes, groundstone Debitage	Elevated ridge with low slope, lithosol, and toolstone outcrop with or without water resources	Activity Area
Core, formed/broken tools Utilized flakes Unifaces, bifaces, projectile points Debitage	Ridge crest, slope, bench with or without toolstone outcrop	Lithic Scatter
Core, formed/broken tools Utilized/retouched flakes Debitage	Elevated ridge crest, bench, steep slope, soils/flora habitat without water resources	Lithic Reduction
Core, formed/broken tools Utilized/modified flakes Projectile points Debitage	Elevated ridge crest or slope, lithosol and toolstone outcrop without water resources	Quarry
Lowland Cultural Deposit	Lowland Environmental Setting	Site Type
House pit, rock art Core, formed/broken tools Utilized flakes Projectile points, groundstone, Debitage	Floodplain, riparian zone, or alluvial flat	Riverine Village
Formed/broken tools Utilized flakes Groundstone, hopper mortar bases Debitage	Rocky soils with springs and shrub steppe flora habitat	Field Camp
Core, formed/broken tools Utilized flakes Unifaces, bifaces, projectile points Debitage	Alluvial flat on shrub-steppe with or without toolstone outcrop	Lithic Scatter
Core, formed/broken tools Utilized flakes, bifaces, debitage	Flora/fauna shrub steppe habitat with or without toolstone outcrop	Lithic Reduction

(Benson et al. 1989; Boreson 1998; Chatters 1982; Dancey 1973; DeBoer et al. 2002; Lewarch et al. 1999; Wilde and Wilke 1984)

Previous Mid-Plateau researchers have in the main considered indigenous cultures from two land-based perspectives. In the first, artifacts grouped in clustered deposits of cultural variables represented organized work geared toward the continuous existence of human life. Variations within artifact groups supplied a basis for distinguishing between cluster *type* classes from which land use strategies were inferred. In the second, utilized areal settings implied spatial preferences for where land use was conducted. The artifact-microenvironment sets shown in Table 4 suggest Mid-Plateau cultures had three broad, interrelated agendas: (1) raw toolstone acquisition for stone tool manufacture, (2) stone tool manufacture and maintenance, and (3) stone tool use during food and other resource acquisition-related work. An ecological complex of landforms, water, soils/flora, fauna, raw toolstone and other minerals, along with interrelated areal environmental minutiae, defined selective spatial interfaces where humans convened a multitude of phenotypical and cultural activities that resulted in individual and group survival.

Chatters (1998) overviewed the ebb and flow of terrestrial and aquatic resource responses to paleoclimate fluctuations over the past 3,500 years on the Columbia Plateau. Prentiss et al. (2006:52-53) integrated that work into an assessment of hunter-gatherer adaptations. Paleoenvironments, which established selective conditions on resource-bearing terrains, were the driving force behind both human relations with the available resources and cultural changes on the Plateau (Prentiss et al. 2006:53). Lithic toolkits and residential patterns (Table 6) preserved in the archaeological record directly connected climate-related fish, game, and flora availability to the range and intensity of resource procurement endeavors practiced by human groups that inhabited the region. The fact northern hunter-gathers were dependent on scrupulous scheduling in order to successfully harvest seasonally available survival resources (Prentiss et al. 2006:51) was used to argue culture's dependent variability in relation to independent environmental variability. From that standpoint, climatic forces had significant effects on systems of culture that evolved in direct relation to resources available at a given temporal point during prehistory.

Table 6. Regional Precontact Culture and Technology Patterns (Prentiss et al. 2006).

Culture	Settlement	Subsistence	Technology
Classic Collector Period I (1600 - 500 B.C.)	Pithouse hamlet or small village; field camps near resources	Highly logistical; game, roots, river goods emphasized	Portable, long-use tools; low grade core-flake; groundstone; highly variable projectile points
Classic Collector Period II (500 B.C - A.D. 200)	Repeated/prolonged pithouse hamlets or small villages; house size declines	Mobility increase; river and root use decrease	Bifacial tools and projectile points dominate toolkit
Classic Collector Period IIa (500 B.C. - A.D. 200)	Hamlets or small villages increase; small and mid-size houses, population decline	Riverine fishery encampments in rapids/tributaries; upland game hunts; root use; bison kills	Core-flake quality improves; bifacial knives and notched projectile points; use of groundstone declines
Complex Collector Period IIb (A.D. 200 - 750)	IIa pattern persists; food cache storage pits in villages and caves; population spike	Spawning runs of salmon stimulate fisheries; camas use increases, bison kills decline	Winter village core-flake model persists; groundstone increase (net sinkers, hopper mortars)
Adapted Collector Period IIc (A.D. 750 - 1350)	Circle or rectangle houses; community-based group rituals	Salmon fishery key staple supplemented by mammal hunting; camas use peaks/falls	Side-notch and small corner-notch projectile points
Final Collector Period IId (A.D. 1350 - 1850)	Small housepit hamlets; general population decline; European diseases arrive ca. A.D. 1770	Fisheries set in river mouths and riverine villages; general fall in use of all roots	Winter village core-flake model persists; biface and specialized portable tools (end scrapers) decline

Nineteenth Century and early Twentieth Century anthropologists in contact with native inhabitants of the Columbia River watershed believed salmon were the main food staple and resource base around which every other cultural activity centered (V. Butler and S. Campbell 2004:328; cf., Hunn 1990; Schuster 1975, 1998). Additionally, social ranking was thought to result from hierarchical control of salmon harvests (V. Butler and S. Campbell 2004:329). More recent zooarchaeology and paleoclimate investigations have established the parallel between terrestrial and aquatic resource abundance or depression, including salmon, and prevailing regional climactic patterns (V. Butler and S. Campbell 2004; Chatters 1998; Schalk 1981).

Identification of the region's paleoenvironmental parameters (Clarke and Bryce 1997; Chatters 1998; Pielou 1991; others) provides an additional set of paleoecological land use models against which the archaeological records examined in this research can be interpreted in terms of climate-related resource variations and cultural-environmental patterns of resource acquisition associated with them. Considered in the context of McGrew et al.'s (2014) natural sample following Prentiss et al.'s (2006) summary of environmentally induced culture adaptations, Hackenberger (2009) synthesized research specific to Mid-Plateau paleoarchaeology. Both overviews are referenced ahead during discussion in Chapter VI, under the title Conclusions and Recommendations.

Historic Period Cultural-Environmental Classification

In this section Objective two requires contextualizing upland and lowland physiographic dimensions where historic archaeology deposits mapped onto the Mid-Plateau region. Step one toward that goal entailed selecting cultural-environmental variables from past historic archaeology studies (Benson et al. 1989; Boreson 1998;

DeBoer et al. 2002; Lewarch et al. 1999; Wilde and Wilke 1984). Those artifact-landscape correlates (n = 31) were presented as the Historic Period land use models (Appendix B) stipulated by the first thesis objective in Chapter II, under the title Literature Review. Added analysis and revision of those models serves to furnish, in this section, simplified archaeology site *type* classes that will serve as historic cultural-environmental standards for the Mid-Plateau region, which are necessary to complete the remaining objectives of this research. Comparison of these new cultural-environmental constructs to the historic database looked at in this research will assist exposing the degree to which study area land usage conformed to or differed from regional upland and lowland patterns.

Revision of the land use models removes repetitive terminology and clarifies environmental settings framing the upland and lowland historic archaeological record. In addition, in order to heighten focus on environments like the study areas, the railroad site class was removed from further consideration in this research because it does not exist in the study areas. Lewarch et al.'s (1999a) railroad-laden results represent past studies that are rendered more to the point of Objective two by eliminating the railroad class. Thus revised, Lewarch et al. (1999a) reported upland held habitation, camp, refuse, and surface features. Lowland sites were identified by Benson et al. (1989) and others cited above.

The resulting historic cultural-environmental constructs (Table 7) portray four upland *type* and four lowland *type* archaeology site classes that show human behavior shifted toward introduced non-native land use customs in the mid-nineteenth century. While foreign émigrés colonized environs that had been successfully utilized by native cultures before them (Benson et al. 1989; Boreson 1998; DeBoer et al. 2002; Lewarch et al. 1999), Euroamerican technology and cultural materiel altogether redefined human relationships with landscape (Harden 1996; Merchant 2005; Morris 1953) in the region.

The historic archaeological literature (Benson et al. 1989; others cited above) suggested non-native spatial preferences oriented toward terrain with perennial water resources and pre-existing travel corridors. Water was fundamental to the Mid-Plateau

Table 7. Historic Cultural-Environmental Constructs for Comparative Analysis.

Upland Cultural Deposit	Upland Environmental Setting	Site Type
Structure, domestic/farm gear, surface feature	Perennial/seasonal water	Homestead
Structure, domestic/farm/ranch gear, surface feature	Seasonal water	Camp
All artifact classes present[a]	Distant from water	Refuse
Farm, ranch, well	Distant from water	Feature
Lowland Cultural Deposit	Lowland Environmental Setting	Site Type
Structure, domestic/ranch gear, road	Perennial water, terrace	Homestead
No evidence present	No evidence present	Camp
All artifact classes present[a]	Perennial water, terrace	Refuse
Farm, ranch, water-related	Perennial water, terrace	Feature

(Benson et al. 1989; Boreson 1998; DeBoer et al. 2002; Lewarch et al. 1999; Wilde and Wilke 1984)
[a]See Historic Period upland (Table 12) and lowland (Table 13) data sets identified by material type.

region's primary forms of historic environmental utilization: homesteading (Benson et al. 1989), agriculture, and animal husbandry (Boreson 1998; DeBoer et al. 2002). In the earliest decades of colonization, upland was settled only after better-watered lowland was claimed (DeBoer et al. 2002).

Intra-regional roads and trails developed in antiquity (Walker 1997) were re-tailored to serve emigrating foreigners, introduced livestock herds (Benson et al. 1989; DeBoer et al. 2002) and, eventually, the region's transportation network (Boreson 1998; Lewarch et al. 1999). Water management projects (Harden 1996; Mendenhall 2006) and other landscape-scale features of the twentieth century's built environment ensued. Refuse dumps, regardless of physiographic setting, became ubiquitous in the Mid-Plateau historic archaeological record (DeBoer et al. 2002).

The resulting upland and lowland historic cultural deposits provide two discussion points. First, excessive historic cultural reconstruction (Small 1977:31; cf., Hall and Silliman 2006; Rouse 1960; Sprague 1980) have eclipsed description of environmental context in historic archaeology literature (Benson et al. 1989; cf., Boreson 1998). Too much focus on reconstructing the temporal stages of regional cultural development has resulted in less than optimal analysis of artifact-landscape associations in which emphasis on the environmental perspective is treated equally. That the "environment, as a factor in history, is a contentious issue" (Hill and Silliman 2006:8), offers a plausible explanation of the sketchy environmental analyses provided by archaeologists cited in the Historic Period portion of this research. DeBoer et al. (2002) expected to find nothing of historic significance when surveying YTC terrain separating the east Saddle Mountains from Wenas Creek confluence. Second, it is extremely problematic to define historic artifacts in terms of technological and functional attributes (see Table 5). Prehistoric archaeology classification systems are not suited to historic archaeology (Sprague 1980:251). These issues are explored further during analysis and classification of the Historic Period research database presented ahead in Chapter IV, under the title Methods and Techniques.

CHAPTER IV

METHODS AND TECHNIQUES

Thesis objectives three and four are addressed in this chapter. The third thesis objective is to develop a comparable upland-lowland classification system, which can then be used to describe the east Saddle Mountains and Wenas Creek confluence archaeological records. Objective three integrates expectations for artifact-landscape relationships from objective one with environmental profiles of the study areas in order to evaluate and describe their archaeological records. This chapter's examination of the research database is designed to shed light on the kinds of human activities that took place in each study area and assist in answering the central question of this thesis: why are land use patterns different at upland and lowland archaeology sites?

The fourth thesis objective addressed in this chapter is presented in a separate section that looks at sample size differences and deficiencies in the research database. In particular, sample size representativeness is analyzed in order to determine if definitive comparisons across environmental variables of the landform classes can be made accurately and at what scale (e.g., physiographic area or site-by-site) such analytic comparisons can be conducted.

Biases that may have affected the integrity of surface-derived archaeological data are outlined first. Techniques used to record surface-derived archaeological evidence of human land use are discussed next. Analysis and classification of the Precontact Period data are then given in order to generate information required for a statistical analysis of the precontact assemblage. Assessment of the Historic Period datasets examined in this research concludes the chapter. Outcomes of objective three facilitate comparison of the study areas to one another and to artifact-landscape constructs (Tables 4 and 6) distilled from land use models (Appendices A and B) found in the literature describing previous Mid-Columbia Plateau archaeological research.

At this point, it is important to detail the differing evaluative tools of method and technique (Dunnell 1971) applied to this research. Comparative method is a fundamental means of understanding prehistory (M. Smith and Peregrine 2012) when engaged to analyze archaeological data using land use models set in varying environments. In order to relate the whole to a problem-solving theory, research techniques expand the comparative method by organizing the data in terms derived from the theoretically informed models or method (Dunnell 1971:34-36). As applied to the archaeological record, evolutionary theory (Dunnell 1978a, 1978, 1980, 1995, 1999; Lyman and O'Brien 1997a, 1997b, 2002; McCutcheon 1997; O'Brien and Lyman 2002; O'Brien 1996a, 1996b) is the principle problem-solving hypothesis of this research.

Recent uses of evolutionary theory assume that the selective conditions of an environment affected human land use choices (O'Brien et al. 2002; Prentiss et al. 2006; Hurt and Rakita 2001; Schiffer 1976; Senn 2007; N. Smith 2003; Vaughn 2010). This research presumes Evolutionary theory played the foremost role, as the governor of interactions between selective environments and humans in past cultures (Prentiss et al. 2006). Because past human behavior was not random in space (Feder 1997:41), this research is designed accordingly in order to describe how humans used the upland and lowland study area environments.

Research Database Biases

Archaeological data derived from surface surveys are of great utility to inform our view of land use (Wandsnider and Camilli 1992:169); however, a traditional mistrust of surface deposits exists despite a growing body of literature to the contrary (Dunnell and Dancey 1983). This section identifies the most thoroughly understood sources of often-interrelated biases that affect the veracity of the database. Data recovery procedure, survey intensity, archaeological obtrusiveness, and surface visibility (Wandsnider and Camilli 1992:169-170) can bias surface derivations of the archaeological record. The environmental contexts of the archaeological record (Banning 2002; Hester et al. 1997; Schiffer 1976; Waters 1992; Wood and Johnson 1978) ramify postdepositional affects on surface data that must be addressed during data analysis (Dunnell and Dancey 1983). Environmental factors described in Chapter III, under the title Study Areas, are explicated more fully in this section relative to a range of postdepositional influences that affect the integrity of surface-derived archaeological data.

The number of deposits per acre offers one way to measure survey intensity; the more deposits the greater the thoroughness of inspection (Banning 2002:60) and artifact obtrusiveness improves if (pedestrian survey) transect spacing is 15 m (49.2 feet) or less (Wandsnider and Camilli 1992:171). Survey intensity in the study areas was enhanced by CWU field school systematic data recovery techniques and a survey interval of 10 m. Ground surface visibility, as determined by surface obstructions (Banning 2002:46-48), varied in the study areas.

Postdepositional processes (Lewarch and O'Brien 1981; Schiffer 1976; Waters 1992; Wood and Johnson 1978) reflect biophysical context as the key predictor of natural transformations (Schiffer 1976) in archaeological visibility. Surface perturbations exist in the study areas that are caused by climatic influences on local weather patterns (Waters 1992) along with plants and animals, freeze/thaw force (i.e. frost heave, toolstone ice fracture), gravitational slope effect, and wind erosion of sandy soils (Hester et al. 1997:35-37; Wood and Johnson 1978). While the upland is prone to geophysical extremes, the lowland underwent anthropogenic alteration such as plow zone effects. Research cited by Dunnell and Dancey (1983) states plow zones can provide valuable archaeological information when systematic data recovery techniques are used. Hester et al. (1997:35) contend plow zones only yield artifacts from the most recent occupation; however, if there is an ancient surface present, then the entire record is in the plow zone or on/near the surface.

Obtrusiveness, as an effect of human population size and land use intensity, can both impede and facilitate artifact detection (Feder 1997:47). Obtrusiveness also depends on the amount of time an area was utilized (Feder 1997:47). Artifact density indicates large human groups produced larger deposits than small human groups (Feder 1997:47). Visibility and obtrusiveness can vary within land use patterns relative to the locality of differing human functions (Feder 1997:49). Mid-Plateau physiography may cause biased obtrusiveness related to differential selective capacities of landscape that pressured human resource preferences (Banning 2002; Dunnell 1992; Dunnell and Dancey 1983; Hester et al. 1997). In regions like the Mid-Plateau, dispersed land use patterns reflect selective landscape resource dispersion (Hester et al. 1997:42). As a continuous distribution of varying density at a regional-scale, archaeology deposits can reflect characteristics and frequencies of land use, which can be measured through surface data (Dunnell and Dancey 1983).

A final source of bias concerns the lowland dataset generated through the CWU field school system. In order to enlarge the 2008 lowland data sample upon which this research was originally based, the results of field surveys on Wenas Creek-Yakima River confluence, done in 2007 and 2010, were added to the lowland dataset. A number of consequent bias sources result from that decision. First, the principal investigator in 2010 differed from the director of research in 2007 and 2008. In addition, various procedures during the 2010 fieldwork diverged from survey and recording protocols used in 2007 and 2008. Last, the Bureau of Reclamation barred CWU archaeologists from recording isolated artifacts during 2010 work. That point illustrates often-large differences between the perceived values of archaeological records of different densities or obtrusiveness (Banning 2002; Feder 1997; King 2008; Knudsen and Keel 1995).

Surface Survey Data Recovery Techniques

CWU archaeologists used systematic data recovery protocols and analytical units derived from logical systems (Dunnell 1971:200) for the purpose of recovering surface data from the study areas. Those techniques are provided in Appendix C. Washington State Department of Archeology and Historic Preservation (DAHP) standardized forms were used to assemble locational, cultural, and environmental information. This research examines archaeological data accrued from four separate field surveys. The United States Bureau of Land Management funded the east Saddle Mountains upland project, in 2008 (Vaughn et al. 2008). The US Bureau of Reclamation funded the Wenas Creek-Yakima River confluence lowland projects, in 2007 and 2008 (Anderson et al. 2009, unpublished manuscript in possession of Central Washington Archaeological Survey) and 2010 (Schroeder et al. 2010).

Precontact Data Analysis and Classification

This section discusses the upland and lowland Precontact Period archaeological assemblages in terms of paradigmatic classes and describes the extent to which the classes are populated as nominal counts. The data are further placed in geo-spatial classes, according to areal and microenvironmental characteristics of the upland and lowland study areas. These data result from adherence to Dunnel's (1971:24, 52-53) systematic technique for classification of the archaeological record. It stipulates qualification prior to quantification of analytic units in order to demonstrate the priority of definition during analysis and classification of archaeological data.

The archaeological and environmental database examined in this research accrued during a single east Saddle Mountains field survey, in 2008. Wenas Creek-Yakima River confluence surveys took place during three field seasons: 2007 work covered 15 acres and 2008 work covered 124 acres of landscape located immediately north of the creek; 2010 work covered 108 acres located immediately south of the creek. Those survey data are combined to form the lowland dataset this thesis research examines. Archaeological materials were defined in the field (Table 7) as either site deposit (i.e. clustered artifacts, archaeological features) or isolate deposit (i.e. single artifact independent of any other object or feature). Cultural materials in the database are portable and non-portable objects considered analytically equivalent (Dunnell 1971:148-149) to one another.

Table 8 does not reflect artifact isolate deposits that may have existed on the south side of Wenas Creek during the 2010 survey. Three isolates were recorded in 2007 and eight in 2008. Systematic use of a 10 m (32.8 feet) pedestrian survey interval during all three lowland surveys, and the single upland survey, garnered a 10 percent sample of cultural materials located on the areal surface. Archaeology deposits at each study area

Table 8. Distribution and Frequency of Artifact Bearing Deposits in the Study Areas.

Study Area	Acre Total	Site Deposit	Isolate Deposit	Total Deposit	Deposit Per Acre
East Saddle Mountains	283	27	25	52	5.44
Wenas Creek Confluence	247	34	11	45	5.49

sometimes contained temporally intermixed artifacts originating from both the Precontact and Historic Periods.

Portable objects are perhaps the most important artifact group for considering the oldest of human behaviors (Andrefsky 2009:65). Portable artifacts in the database occur as chipped stone reductive products resulting from lithic industry technologies (Steffen et al. 1998:131). Conchoidal fracture is the principal technique used to produce chipped stone tools (McCutcheon 1997:233; Odell 2004:46). Abrasive force (Odell 2004:75) is the principal technique used to produce ground stone tools. Chipped and abraded lithic materials in the research database consist of the following artifact sets.

(1) Core and debitage toolstone manufacturing debris consist of raw rock types amenable to conchoidal fracture by means of applied percussive force techniques used to produce functional chipped stone tools (Andrefsky 2009; Luedtke 1992; McCutcheon 1997; Odell 2004; Sutton and Arkush 1998).

(2) Hammerstones are angular to round, surface-damaged cobbles (Ames et al. 1998:54, Sutton and Arkush 1998:52), which were used to apply percussive force to toolstone raw materials (Odell 2004:44).

(3) Flakes are derived from cores and are classified by reduction trajectory classes such as initial, intermediate, terminal, biface thinning/resharpening (McCutcheon 1997:231), and bipolar end-damaged (Kooyman 2001) flakes.

(4) Chipped Stone tools (Table 9) are modified flakes with edge wear, crushing, retouch, rework, or edge chipping, uniface and biface flakes exhibiting reduced, thinned, or resharpened edges.

Table 9. Chipped Stone Tools and Their Surface Characteristics.

Artifact Type	Macroscopic Surface Traits
Modified Flake	Small detached flakes, polish, abrasion
Uniface	One edge altered by negative scars
Biface	Two edges altered by negative scars
Projectile Point	Pointed tip, distal stem, flake scars overall

Ames et al. (1998); Kooyman (2001); McCutcheon (1997); Odell (2004); Sutton and Arkush (1998)

(5) Groundstone tools (Table 10) are created by forces of repetitive action during use. Use wear patterns define lithic surface qualities, shape, and size (Odell 2004:75-78) by which groundstone tool class artifact modes are classified here. The hopper mortar mode, which is stationary on earthen surfaces, includes articulation with an areal surface (Ames 1999) by definition.

Table 10. Groundstone Tools and Lithic Surface Characteristics.

Artifact Type	Macroscopic Lithic Traits
Millingstone	Pecking, grinding, polishing abrasion
Mano	Pecking, grinding abrasion
Metate	Flat base stone with polish abrasion
Hopper mortar	Concave base stone with polish abrasion
Pestle	Elongated stone, one end rounded, grinding
Maul	Elongated stone, one end flat, pounded wear

Ames et al. (1998); Kooyman (2001); Odell (2004); Sutton and Arkush (1998)

Non-portable archaeological features (Table 11) are intentionally built, stationary objects located in varying study area terrains. Rock features are built from rounded and/or angular basalt bedrock gravels in size grades defined by Wentworth (1922:381): boulder (≥ 256 mm), cobble (≥ 64 mm), pebble (≥ 4mm). Cairns and barriers are built of small

Table 11. Non-Portable Archaeological Features and Their Structural Characteristics.

Feature Class	Structure Type
Rock	
Cairn	Circular mound, heap, circle on surface
Barrier	Curvilinear alignment or stack on surface
Bed	Rectangular flat concentrated pad on surface
Talus slope depression	Concavity with uneven depth below surface
Petroglyph	Image pecked into lithic surface on cliff wall
Earthen	
Depression	Circular shallow w/ even subsurface depth
Dug pit	Variable subsurface depth w/ backdirt berm

boulders and large cobbles. Talus slope depressions show signs of re-positioned boulder and cobble erosional debris. Rock beds are tightly packed cobble and pebble horizontal formations located on flat terrain. The petroglyph feature utilizes bedrock at the scale of landform (i.e. microenvironment). Earthen features consist of depressions and dug pits that appreciably alter the areal surfaces. Depressions and dug pits occur in terrain with sufficient soils depth to allow penetration of subsurface matrices. Depression features are shallow, symmetrical sinks extending below ground surfaces adjacent to their perimeters on flat expanses of landscape. Dug pits are irregular in shape and variable in depth. Such pits occur in terrains ranging from flat to extremely sloped.

Dissimilar non-portable artifact frequencies in the research database (Table 12) likely stem from numerous Historic Period features at Wenas Creek confluence where more recent use is believed to have concentrated according to lowland environmental utilization that markedly differed from land use practices in the east Saddle Mountains.

Table 12. Non-Portable Feature Frequency in the Upland and Lowland Study Areas.

Feature Type	East Saddle Mountain	Wenas Creek Confluence
Rock cairn	5	70
Rock barriers	2	7
Rock bed	—	6
Talus slope depression	—	16
Petroglyph	—	1
Earthen depression	—	8
Earthen dug pit	8	4
Total	15	112

In this analysis, non-portable features equate cultural behavior with selective environmental determinants defined as intangible spatial resources. Rock cairns in the upland study area are an example of such intangible spatial selectivity that may reflect precontact belief systems and Native American religious practices (Galm et al. 1981) that took place in the east Saddle Mountains. Alternatively, the abundance of rock cairns in the lowland are more probably Historic Period fence post mounts (i.e. rock jacks), which evidence livestock rearing. Likewise, rock barriers in the study areas are of differing types. Rock barriers atop steep upland slopes are most likely precontact hunting blinds situated at overlooks (Galm et al. 1981) that were utilized during seasonal hunts. Lowland rock barriers probably signify livestock containment used by Historic Period ranchers. Rock bed features seen in the lowland study area may have figured in resource processing work that was not conducted in the upland study area.

Talus slope depressions located in the lowland study area are analogous to other interments of Native American ancestors in the vicinity (Warren 1968). In addition, the cliff/talus landform provides another example of intangible spatial selectivity at Wenas Creek confluence. Although cliff/talus bedrock is hydrologically integral to the creek's resource-rich riparian zone, the area is soils-barren and can be loosely defined as a non-productive microenvironment (if flora and fauna habitat utility is disregarded). As an intangible resource utilized by humans during precontact times, the cliff/talus landform may have provided essential spatial contexts for establishing gravesites and a petroglyph monument. Similar cemeteries and monuments are known in the region's archaeological record (Benson et al. 1989; Boreson 1998; Bruce et al. 2001; Galm et al. 1981; Schuster 1975, 1998; U.S. Army Corps of Engineers 1996).

Earthen depressions and pits are thought to largely originate from Historic Period environmental utilization, though some of these features may be remnants of precontact land use. Earthen depressions observed in the lowland land are pit houses (Galm et al. 1981; Schuster 1975) constructed by precontact occupants of Wenas Creek confluence. Earthen depressions of this type do not exist in the upland study area; however, previous

CWU archaeological surveys in the east Saddle Mountains observed dug pits or IUAs (i.e. intensive use areas, after Hungar and McCutcheon 1998) that had large backdirt berms. Hungar and McCutcheon (1998) associated IUAs with raw toolstone resources in upland sedimentary interbed outcrops. That observation is not particularly evident in this research. Of eight surface pits in the upland dataset, three are located in proximity to interbed outcrops. Conversely, IUAs of this type are absent in the lowland study area.

Paradigmatic classification of artifact sets requires classes to differ from one another in the same manner (Dunnell 1971:74). Lithic object types provide a means to regroup artifacts in technological and functional dimensions (Table 13). Technological objects relate to stone tool production. Functional objects relate to stone tool use. In the

Table 13. Technological and Functional Classification of Portable Lithic Artifacts.

Technological Class	Functional Class
Core	Modified flake
Hammerstone	Uniface
Debitage	Biface
Flake	Projectile point
	Groundstone

(Dancey 1973; McCutcheon 1997)

context of the Precontact Period, the technological efforts gave humans the potential to transform resources from selective environments, which could later be used to perform some task within those environments (Lyman and O'Brien 2003).

Technological and functional class frequencies (Tables 14) are given as nominal artifact counts. Debitage artifact types of the technological class are problematic in the lowland dataset. Debitage frequencies were recorded as a nominal count of artifacts (Table 14) during the 2007 and 2008 lowland surveys. That data was not recorded during the 2010 Wenas Creek confluence survey. Hence, the debitage class cannot be usefully measured and it has been omitted from further analysis in this research. Lithic debris of the technological class type defined above (i.e. products of applied percussive force) was recorded as debitage scatters in certain lowland site assemblages during the 2010 survey. Those data permit stating 7 of 34 site deposits in the lowland dataset contain evidence of debitage artifacts, which are present in 14 of 27 upland site deposits.

Table 14. Technological Class Frequencies in the Upland and Lowland Study Areas.

	East Saddle Mountains	Wenas Creek Confluence
Core	44	39
Hammerstone	6	13
Debitage [a]	(1,517)	(118)
Flake	451	238
Total [b]	501	290

[a] Removed from analysis
[b] Debitage omitted

Technological class raw materials need no further definition beyond that given above. Intra-dimensional modes (Dunnell 1971:154), or artifact attribute variability within a defined artifact grouping, require additional clarification of two dimensions in the functional class (Table 15). First, intra-dimensional groundstone modes result in six mutually exclusive tool types in the lowland dataset. Second, the projectile point modes

Table 15. Functional Class Frequencies in the Upland and Lowland Study Areas.

	East Saddle Mountains	Wenas Creek Confluence
Modified Flake	4	16
Uniface	1	8
Biface	9	29
Projectile Point	4	10
Groundstone	—	16
Total	18	79

(Table 16) are identified using diagnostic typology keys (Benson et al. 1989; Carter 2002; Galm et al. 1981; C. Nelson 1969) developed from past Mid-Plateau studies. The projectile point artifact type is archaeology's most useful index fossil (Smith et al. 2013; Lyman 2000) in order to gauge temporal and chronological patterns in the archaeological record using projectile point morphology (Carter 2002:3) and radiocarbon absolute dating techniques (Carter 2010; Lyman 2000; M. Smith et al. 2013). Temporal models of land use inferred from projectile points located in the study areas are discussed in Chapter V, Results.

Table 16. Projectile Point Type, Temporal Range, and Culture History Phase.

Site/Isolate Number	Point Type	Temporal Range (Year cal BP)	Culture Phase
		East Saddle Mountains	
08-18-02s	Rabbit Island Stemmed	4,000 – 1,500	Frenchman Springs
	or Wallula Gap	2,500 – 1,500	Cayuse
08-18-19s	Columbia Stemmed A	2,000 – 150	Cayuse
2008-18-01s	Windust B	10,000 – 9,000	Windust
2008-08-03s	Lind Coulee Variant	10,000 – 9,000	Windust
		Wenas Creek Confluence	
07-18-01w	Plateau Side Notched	1,500 – 200	Cayuse
	Wallula Rectangular Stemmed	2,000 – 1,500	Cayuse
	Columbia Stemmed B	2,000 – 150	Cayuse
2007-18-03w	Quilomene Bar	4,000 – 1,500	Quilomene
08-18-02w	Columbia Corner Notched C	1,500 – 150	Cayuse
08-18-03w	Columbia Corner Notched A	5,000 – 2,500	Frenchman Springs
08-18-06w	Columbia Corner Notched A	5,000 – 2,500	Frenchman Springs
	Rabbit Island Stemmed	4,000 – 2,000	Frenchman Springs
	Rabbit Island Stemmed	4,000 – 2,000	Frenchman Springs
10-PS-1w	Cayuse III	300 – 150	Cayuse

(after Benson et al. 1989; Carter 2002, 2010; Galm et al. 1981; C. Nelson 1969)

The upland and lowland datasets disperse across spatial dimensions identified by microenvironmental characteristics of landform classes that are physiographically unique to the east Saddle Mountains and Wenas Creek confluence. The upland dataset disperses across crest, slope, bench, and drainage landforms (Figure 9). The lowland data disperse across bench, drainage, cliff/talus, and floodplain landforms (Figure 10). Geophysical

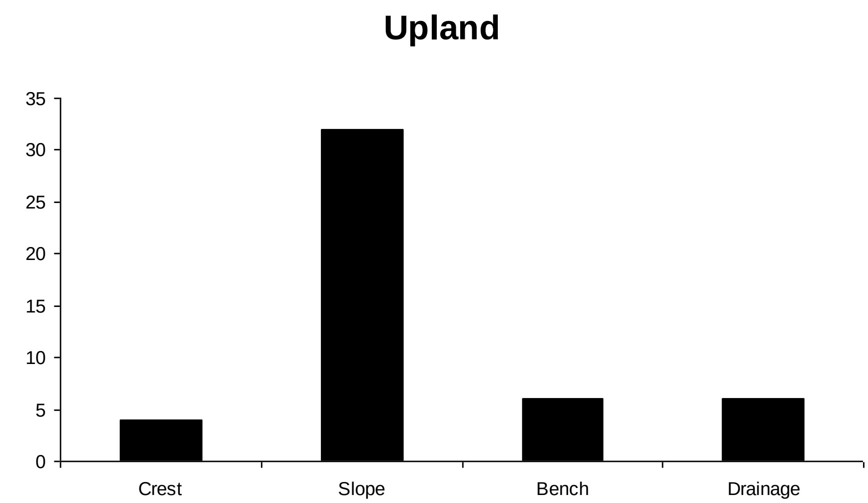

Figure 9. East Saddle Mountains landform classes correlated with frequency of archaeology site and isolate deposits (n = 52).

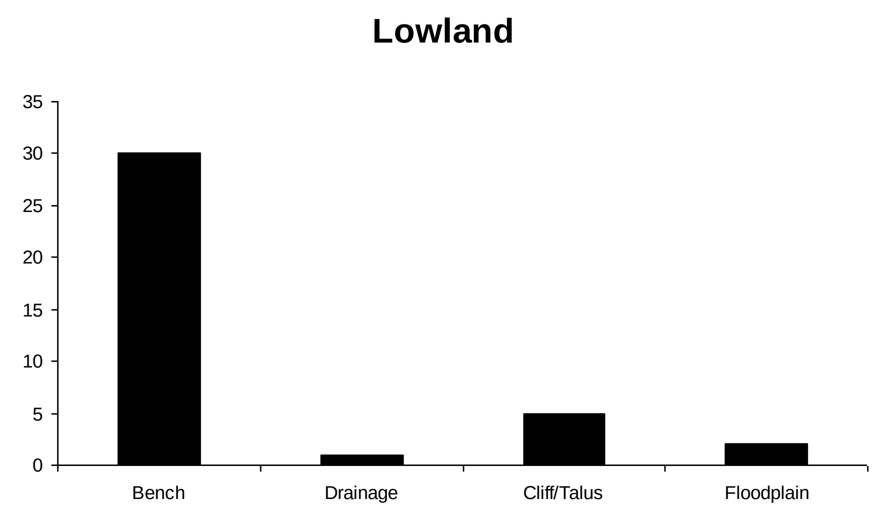

Figure 10. Wenas Creek confluence landform classes correlated with frequency of archaeology site and isolate deposits (n = 45).

divergence, described in Chapter III under the title, Study Areas, precludes contrasting the upland and lowland datasets using landform microenvironments to measure frequency and distribution of the archaeological record. Environmental contextualization of the two datasets can detect the kinds of human activities that occurred in each place. Cultural material distributions resulting from human actions may be patterned but it does not follow that artifact patterning and the patterns of human behavior that produced it are identical (Wood and Johnson 1978:316).

Selective environmental influences such as geographic location within the greater Mid-Plateau, the natural resources found in upland and lowland microenvironments, and postdepositional forces may explain artifact frequency and distributions patterns at each study area. Cultural deposits viewed in relation landforms and soils (Figure 11) reveal

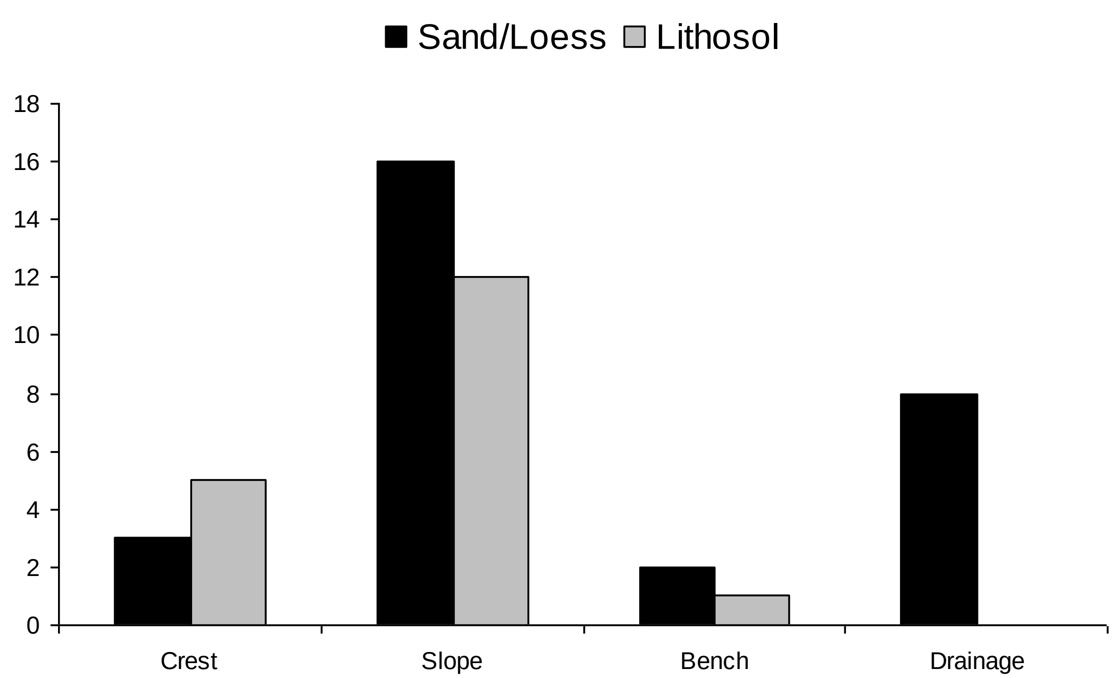

Figure 11. East Saddle Mountains landforms correlated with soils and archaeology deposit frequency.

dominant environmental characteristics in each locale that indicate human use of preferred resources in those terrains. The frequency of artifact deposits on upland slopes may reflect mountainous terrain influences on downslope artifact movement of objects originally placed on ridge crests or mid-slope benches. The upland deposits exhibit a greater range of distributional variability across landforms when correlated with soils than is seen in frequencies linked to landforms alone. Upland sandy loess soils pinpoint locations of raw toolstone resources, flora utilized by humans, and prey game habitat.

Archaeology sites in sandy loess/crest environments have dug pits from which raw toolstone can be accessed. Sites unassociated with dug pits and sediment interbeds hold unmodified toolstone cobbles (not included in this research's toolstone class), which Dancey's (1973) classification defines as artifacts. Lithosolic soils common throughout the east Saddle Mountains (O'Conner and Wieda 2001:24) hold rootbeds and other flora used by humans for food and medicine. Cultural deposits in lithosol/crest environments imply that selective habitats containing preferred floral resources attracted humans. That rationale suggests the presence of seasonal water likely induced human utilization of the upland drainages that held flora and fauna habitat, as well as erosion-exposed toolstone.

Artifact deposit frequency in the Wenas Creek confluence bench landform class may reflect the areas dominate bench landscape, which results from geographic location on a slope toe of the flanking ridge. Postdepositional flooding of the confluence (Chatters 1984a) may have removed cultural materials first placed at elevations located below the bench landform. In addition, archaeological visibility on the lowland benches might be amplified by the plow zone effect that continually disturbed areal surfaces in the study area from the Historic Period forward.

While sandy loess soils point to the presence of raw toolstone resources in upland terrains, toolstone access pits are not evident in the lowland study area. Alternatively, the sandy loess/floodplain environment adjacent to Wenas Creek holds the most inclusive assemblage in the lowland study area. The full technological class, four-of-five functional class dimensions, and a cluster of pit-houses consisting of five surface depressions are present on the lowland's floodplain landform. Such concentrated land use evidence may reflect the abundant edible and medicinal resources (O'Connor and Wieda 2001; Taylor 1992) produced by lowland meadow steppe and riparian habitats, along with species used to construct domestic goods (Densmore 1974; Tilford 1997) during the Precontact Period.

Whereas lithosolic habitat in the upland study area provides habitat for flora with edible roots, lack of artifact deposits in the lowland lithosol/bench environment suggests insufficient elevation prevents the growth of rootbed species similar to those found in the upland study area (Figure 12). The general absence of lithosolic soils in the lowland may relate to physiographic proclivities in this study area.

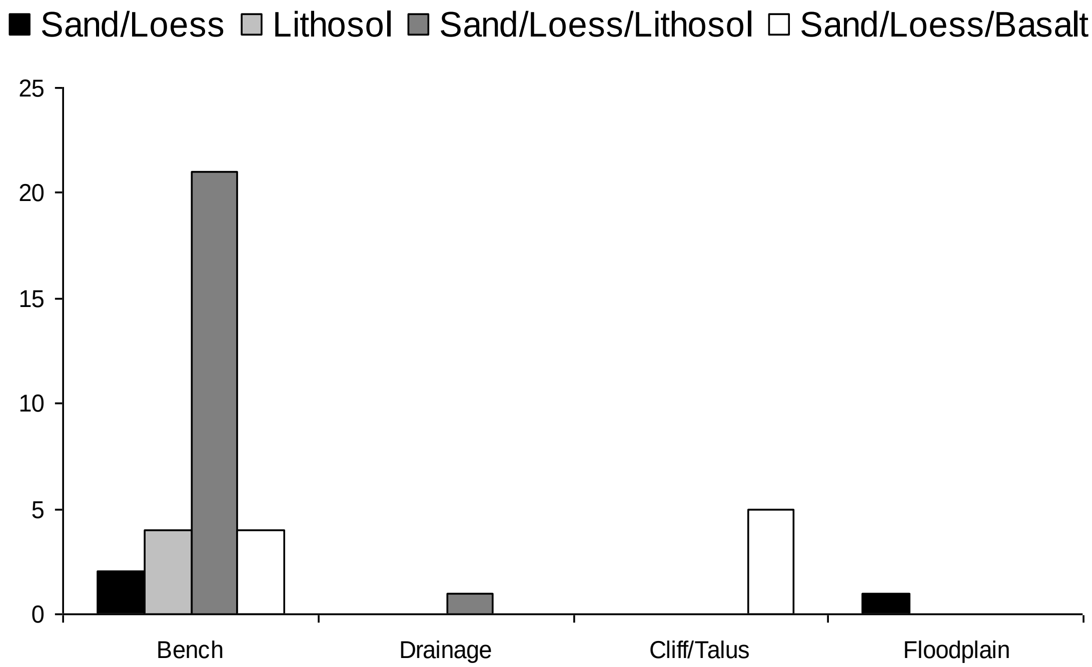

Figure 12. Wenas Creek confluence landforms correlated with soils and archaeology deposit frequency.

For example, sand deposition determines abundance or dearth of upland lithosols (Jack Powell 2007). That is, sand deposition abatement serves to increase lithosolic habitat. The lowland study areas geographic location at the base of a Cascade slope to the west and Yakima River Canyon to the north buttress Wenas Creek confluence from prevailing winds; hence, airborne sediments are not transported into the lowland study area. Additionally, the Yakima River adjacent to its confluence with the creek does not provide a local source of sand, which may have influenced lithosolic soils development in the lowland study area.

Predominance of a mixed sandy loess/lithisol soils type may reflect physiographic outcomes of geographic characteristics described above. Given the abundance of mixed soils in the area, the presence of artifact deposits in the lowland drainage landform likely reflect human use of Wenas Creek's seasonal and perennial tributaries, and downslope transport of the study areas mixed soils class. The lowland soils/landform classification includes basalt that is irregularly and thinly covered with sandy loess and basalt bedrock that is devoid of soils. Those soils/landform types are collapsed in this analysis to form a single class defined as sandy loess/basalt in order to the accommodate computer software used to graphically portray the lowland soils/landform data. However, artifact deposits in the sandy loess/basalt microenvironment are found on benches where erosional forces are manifest. Basalt bedrock devoid of soils is exclusively limited to the cliff/talus landform.

With reference to previous Mid-Plateau research into precontact occupations of riverine environments (Appendix A), the Wenas Creek assemblage is not surprising in its conformity to what others have observed in similar settings. In order to magnify artifact presence and absence in the study areas, and advance discussion ahead, in Chapter V under the title, Results, the technological and functional artifact classes are plotted by individual landform and presented in Appendix D.

Thus far, this chapter has outlined biases affecting surface-derived archaeological data and techniques used to record that evidence of human land use. An analysis and classification of the research database representing the Precontact Period have identified information for a statistical analysis of the precontact data. This conclusion of thesis objective three, and introduction of objective four's attention to sample size sufficiency, facilitates comparison of the study areas to each other and to artifact-landscape constructs distilled from land use models found in previous Columbia Plateau research literature.

Historic Period Data Analysis and Classification

This research has established that the Mid-Plateau was a final frontier in the expansion of Euroamerican civilization into a pre-existing paradigm of environmental utilization. Early historic period land use mimicked established phenotypical behaviors necessary for basic survival in the region (e.g., water-based homesteads). In addition, the initial activities of Euroamericans superimposed upon and functioned in direct relation to Indian settlement patterns (Meinig 1968, cited in Galm et al. 1981:48). However, historic archaeology deposits analyzed here reflect a cultural perspective toward utilization of the local environment that sharply diverged from aboriginal land use traditions. Agriculture-based subsistence and industrialized technology systems underpin the cultural origins of the datasets qualified and quantified in this section.

The historic database consists of elementally compounded materials generally designed for disposal versus refitting on cessation of function. Portable metal, glass, and ceramic artifacts (Table 17) reflect a point in history when exhausted functional objects

Table 17. Historic Period Portable Assemblage Classification by Material and Form.

Material Type	Artifact Form
Metal	Barrel drum, basin, bracket, bucket, bullet, can, lantern, machinery, nail, pot, saw, sheet metal, stove, spoon, car chassis/parts, wire
Glass	Bottle, jar, receptacle, window
Ceramic	Crock, cup, dish, electrical insulator[a], tobacco pipe
Other	Button, shoe sole

a Knob and tube wiring

were routinely discarded into the environment as a matter of customary land use. These historic debris scatter/concentration sites typically contain refuse and cans, which serve as means to date the artifacts that retain diagnostic hallmarks. In general, the metal, glass, and ceramic fractions of the research assemblage are highly degraded and often lack diagnostic attributes. Each set in Table 16 includes a class for miscellaneous objects too damaged to identify beyond material type; a few objects retain characteristics that suggest dates of manufacture (Table 18). For example, glass that was originally colorless, which contains manganese, changes color during prolonged exposure to sunlight and turns from clear glass into amethyst colored glass; formerly clear glass containing selenium changes to the color of amber (Curtis et al. 2007). No matter the

Table 18. Temporally Diagnostic Artifact Classification by Material Type and Form.

Material Type	Artifact Form	Manufacture Date (A.D.)
Metal	Aerosol can	1947 to 1993
	Hole-in-cap can	1810 to 1920
	Internal fold seam can	1859 to 1890s
	Overlap seam can	1840 to 1940s
	Paint can	1906 to present
	Sanitary can	1904 to 1993
	Stamped end can	1840s to 1985
	Solder dot can	1900 to 1930
	Tobacco can	1907 to —
	Enamelware (light/dark gray splatter)	Pre-1900 to 1900
	50-gallon drum (straight wall)	1907 to present
	Barbed wire	1874 to present
Glass	Bitters tonic bottle	1860 to 1915
	Liquor bottle	1893 to 1935
	Milk bottle	1880 to 1950
	Mold-made bottle	1850s to 1870s
	Aqua	1800 to 1910
	Blue	1890 to 1960
	Brown, thin wall	1860 to present
	Dk. brown, thick wall	Pre-1880 to —
	Clear	1920 to present
	Clear, with manganese	1880 to 1916
	Clear, with selenium	1916 to 1920
	Dk. olive green (aka black)	1870 to —
	Green	1860 to present
	White (aka milk glass)	1890 to 1960
	Canning (Mason) jar	1858 to 1903
Ceramic	Ironstone	1861 to 1961
Mixed	Zinc/glass canning jar lid	1916 to 1993
	Knob and tube insulator	1890 to 1930
Other	Freshwater shell button	1888 to 1930

(Curtis et al. 2007; Myers 2010; C. Redman and Watson 1970) state of fragmentation, it is possible to identify such "solarized" glass with a general function (i.e. bottle, jar) and to assign dates of manufacture.

Most of the portable, material type classes exhibit weathering from prolonged exposure to natural forces, fragmentation and crushing attributed to livestock trampling, and damage related to the use of fire for garbage disposal. Most metal objects are heavily oxidized, crushed, and broken, though several diagnostic specimens exist. Small-engine machinery is either a whole apparatus with missing parts or parts that lack association with the original machine. Automotive artifacts range from a car chassis to miscellaneous vehicle parts. Glass and ceramic fragments include a few diagnostic specimens.

Non-portable features in the database take the following forms. Combined metal and wood occur as fences and livestock containment pens. Brick and/or modified local basalt fused with cement occur as surface or sub-surface foundations for built structures that no longer exist. Brick and cement also occur as broken chunks and pieces. The rock features attributed to the Historic Period, based on a known range of functions, are cairns (i.e. fence jacks) and livestock barrier alignments. Whether a component of non-portable structures or originally intended for fuel use, wood takes the form of weathered lumber, fence posts, split rails, and splintered fragment scatters.

Ceramic material in the database is generally too damaged for recognition of diagnostic hallmarks, with one exception. A single ironstone specimen has a legible maker's mark (i.e. Stoke, Staffordshire, England), referencing a manufacturer operating from A.D. 1861 to 1961. Further analysis finds the name "England" occurred in some maker's marks during the last quarter of the 19th Century and appeared on all exported wares, subsequent to A.D. 1891, in compliance with tariff laws in the United States

(Gaston 1983, in Curtis et al. 2007). Ceramic material types include earthenware, ironstone, porcelain, and stoneware.

The Historic Period datasets were recorded in conjunction with study area surveys resulting in recordation of the precontact database; hence, the same areal parameters and pedestrian survey protocols pertain to the historic database (Table 18). For example, use of a 10 m (32.8 feet) survey interval and retrieval of a 10 percent sample. Similar to the precontact data, isolated historic artifacts were not recorded during the 2010 lowland survey and Table 19 does not reflect isolates that may have existed on the south side of Wenas Creek that year. One historic isolate was recorded in the lowland study area in 2007. Portable artifacts and non-portable features in the historic assemblage are either intermixed with precontact materials or entirely override and obscure the older deposits.

Table 19. Distribution and Frequency of Historic Period Archaeology Deposits.

Study Area	Acres Surveyed (n)	Site Deposits[a] (n)	Isolated Deposits (n)	Total Deposits (n)	Deposits Per Acre (Approximate)
East Saddle Mountains	283	7	3	10	1 per 28 acres
Wenas Creek-Yakima River Confluence	247	23	1	24	1 per 10 acres

[a]Includes site clusters with intermixed precontact artifacts

In context, it is important to note two temporal units that divide the cultural paradigm referred to as prehistory from the Historic Period. The time span between Native American and Euroamerican contact, when Mid-Plateau indigenous peoples encountered non-native influences but prior to accounts of such interactions entering the written historic record, is referred to as the Protohistoric Period (DAHP 2003:35). While this research previously outlined historical events that affected each study area (see History section in Chapter II, under Literature Review), this analysis of the post-contact database cannot detect protohistoric/historic temporal divisions in the upland and lowland datasets.

Identification of historic artifact and feature classes, as analytic units of raw material with form and function is not a speculative undertaking; however, historic artifact classes do not fit neatly into mutually exclusive dimensions (DAHP 2003:36). Artifacts and features that make up the historic database are related to three sets of Historic Period cultural behaviors. First, construction and maintenance of built structures associated with either or both the second and third sets. Second, household, personal, domestic life, and activities conducted at a distance from fixed dwellings. Third, farm and ranch enterprises integral to agrarian industries and other activities related to maintaining either or both of the first two sets. An inventory of artifacts and features constituting the Historic Period database examined in this research is given in Appendix E.

This section concludes analysis and classification of the Historic Period database according to the requirements of the third and fourth thesis objectives. Historic Period cultural materials have been qualified and quantified such that the upland and lowland datasets reflect the shift away from aboriginal land use traditions toward Euroamerican practices that included agricultural subsistence and industrialized technology systems. Information provided in this section facilitates comparison of the Historic Period upland and lowland research datasets to each other and to artifact-landscape constructs distilled from land use models (Appendix D) identified from previous Columbia Plateau research pertaining to land use practices after A.D. 1855. Those comparisons are addressed ahead in Chapter V, Results, and Chapter VI, Conclusions and Recommendations.

CHAPTER V

RESULTS

Precontact Period Results

This chapter carries out the aims of thesis objectives four and five. First, the sample size characteristics are described for the research database, particularly sample size representativeness. Then, second, the similarities and differences between the upland and lowland study area samples are compared across environmental variables using statistical tests.

Sample size sufficiency tests facilitated by “bootstrap” Resampler (Mohr et al. n.d.) computer software measured the representativeness of each research sample subset. Previous archaeological research (Lipo 2000; McCutcheon 1997) established the reliability of bootstrap tests for evaluating sample size representativeness that, in turn, influenced Central Washington University graduate research (Lewis 2015; Senn 2007; N. Smith 2003; Vaughn 2010) use of the bootstrap technique on precontact research samples. Bootstrap resampling tests are data-based simulations for exploring statistical properties estimated from research samples (Baxter 2001).

Bootstrap statistical software simulations resample size n data with replacement; that is, an input sample of the size n is selected, measured, and returned to the total sample repeatedly (Rochowicz 2010) for the duration of 1000 random trials (N. Smith 2003). The resampled data are rendered graphically as incremental sampling curves showing total sample size on the x-axis and number of kinds values on the y-axis. Resampling is means for estimating representativeness based on a particular samples characteristics (richness and evenness), which is both a function of how many observations and how many filled classes (McCutcheon 1997).

Bootstrap graphs expose statistical characters inherent to the research sample. Determining when a curve has reached a representative sample size depends on when that curve is asymptotic. A simple ranking system was first developed by McCutcheon (1997) and then later given arbitrary definition by Vaughn (2010:58-60). Bootstrap graph rankings are as follows: Rank 1 curves result when an asymptotic tangency and standard deviations reach zero ahead of the Resampler (Mohr et al. n.d.) reaching 75-percent evaluation of a sample total. Rank 2 curves result when asymptote tangency and zero standard deviations are reached at or after 75-percent of total sample is evaluated. Rank 3 curves result when size n samples lack sufficient frequency counts (see below) and symmetry of statistical distribution to satisfy the asymptote tangency and zero standard deviation rules.

Representative qualities of each research sample shown by bootstrap curves for the upland and lowland study areas (Figure 13) depict the technological and functional classes of portable artifacts and the class of non-portable archaeological features. The east Saddle Mountains and Wenas Creek confluence research sample totals created asymptotic Rank 1 bar graph curves. Rank 1 curves such as these signify the upland and lowland research samples are representative of the original populations. The bootstrap curves can be used to facilitate identifying additional statistical characteristics for both samples such as richness and evenness qualitative conditions unique to particular samples, which reflect the intrinsic statistical makeup of a population subset.

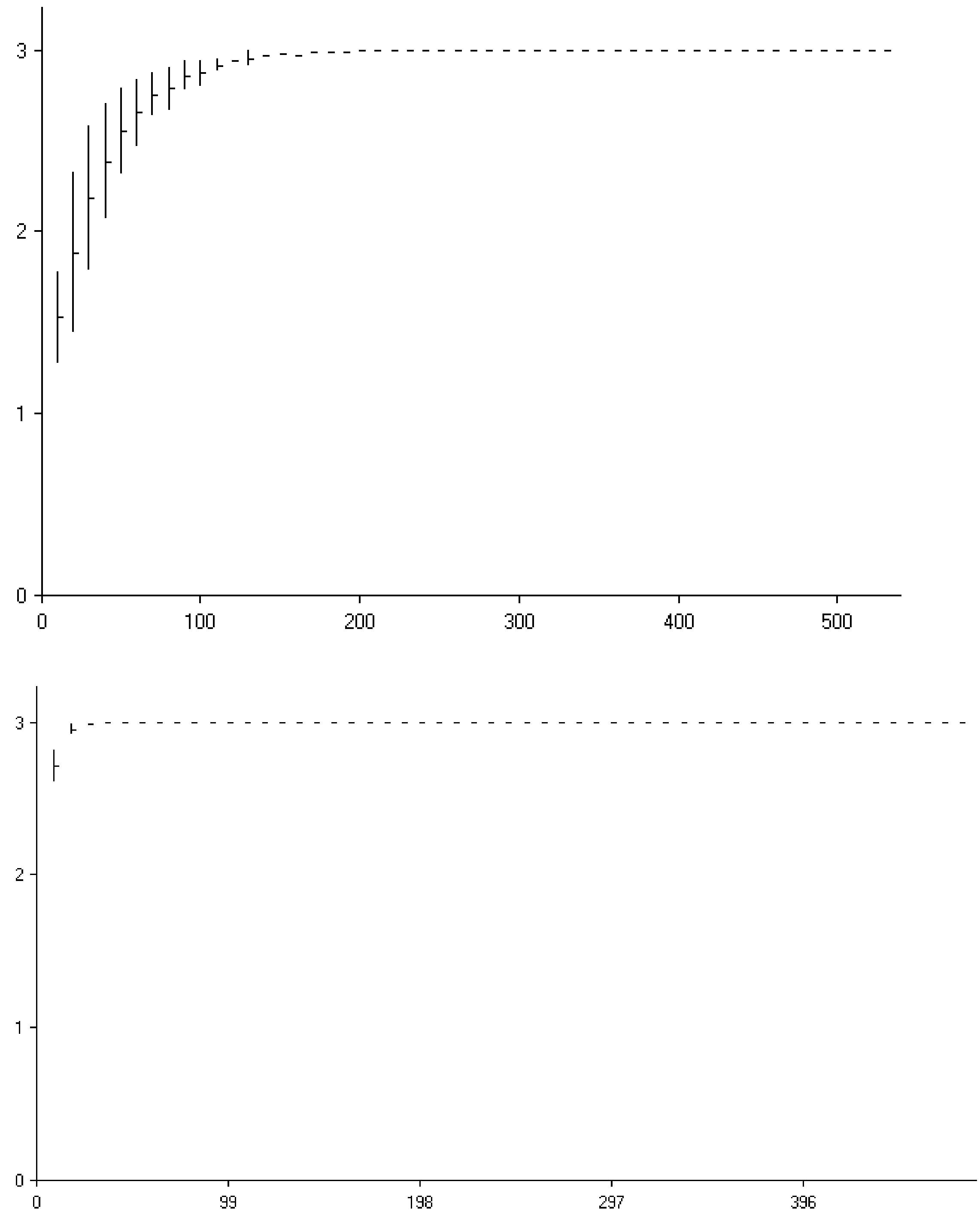

Figure 13. Rank 1 curves depiction of east Saddle Mountains (top n=534) and Wenas Creek confluence (bottom, n=481) technological, functional, and feature classes.

Sample richness is determined by total number of filled classes for a particular sample (Banning (2002:33). Evenness is a measure of sample diversity (Zar 1974:40).

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Because nominal scale data lack mean and median measures of relative variability within a statistical subset, frequency distribution across filled classes (i.e. diversity) is used to appraise a sample's "shape" (Zar 1974:40).

Vaughn (2010:56) described richness and evenness characteristics for bootstrap resample curves, as follow: Rank 1 samples have rich, evenly distributed size n modes. Rank 2 samples are rich, albeit unevenly distributed across size n modes. Rank 3 samples have extremely uneven size n distributions; although a rich number of modes might be present. Evenly distributed archaeological modes equate to high sample diversity. Low sample diversity shows up as uneven distributions congregated in a small number of filled classes. Highly diverse samples introduce an amount of uncertainty (Zar 1974:41) that may demand close analysis of each artifact mode. Measuring diversity, which is extremely sensitive to sample size, is difficult (Banning 2002:33)

Richness and evenness qualities inherent to the research samples, shown as class percentages of total assemblage classes (Figure 14), suggest the Wenas Creek confluence data exhibit higher richness than the east Saddle Mountains sample. That differential is due to an absence of groundstone artifacts in the upland functional class. Viewed in terms of sample diversity, both samples have uneven bar graph shapes indicating distributions with low internal diversity. In addition, low evenness is visible in irregularly congregated distributions within the three classes. Differential richness and evenness characteristics of each sample relate to the majority of observations occurring in the technological class of portable artifacts. Technological class dominance in the upland and lowland samples may reflect the foremost role of chipped stone tool production in human life during antiquity.

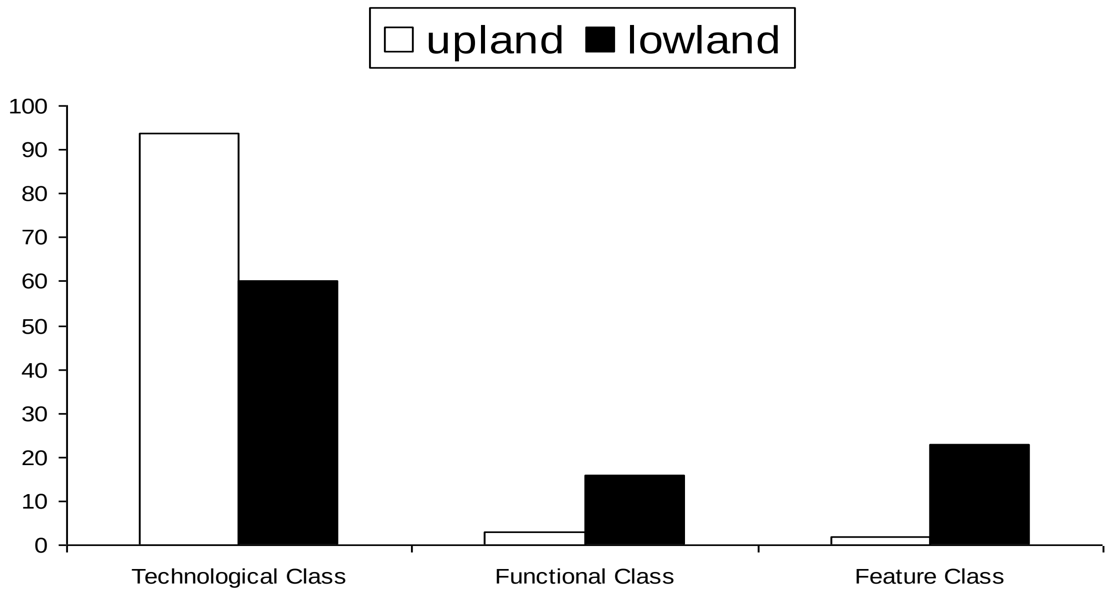

Figure 14. Portable and non-portable artifact classes shown as percentages of east Saddle Mountains (n = 534) and Wenas Creek confluence (n = 481) total samples.

The technological class consists of three artifact modes (Table 20), which created Rank 1 curves (Figures 16a and 16b) for both study areas. Differences and similarities

Table 20. Technological Class Frequency in the Upland and Lowland Study Areas.

	East Saddle Mountains	Wenas Creek Confluence
Core	44	39
Hammerstone	6	13
Flake[a]	451	238
Total	501	290

[a]Cortical and bifacial reduction

therein are inferred to be representative of the original upland and lowland populations. Each sample is rich by virtue of containing a complete set of technological class modes (Figure 15). In terms of overall sample diversity, the datasets are similarly rich, despite unevenly shaped distributions. The focal point here is the relative proportion differentials (Figure 16) seen in technological artifact frequencies between the two study areas.

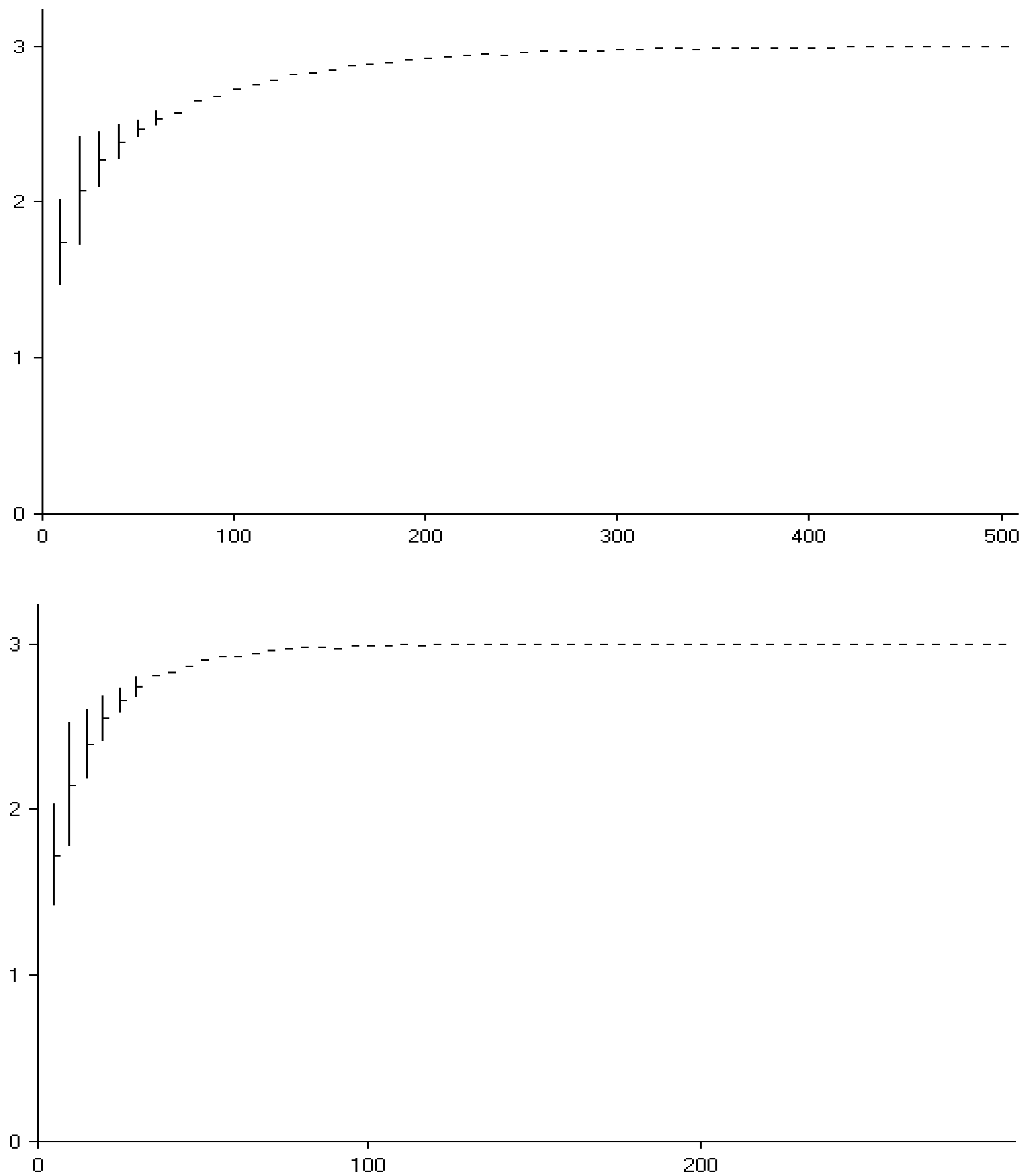

Figure 15. East Saddle Mountains (top) and Wenas Creek confluence (bottom) technological classes Rank 1 curves.

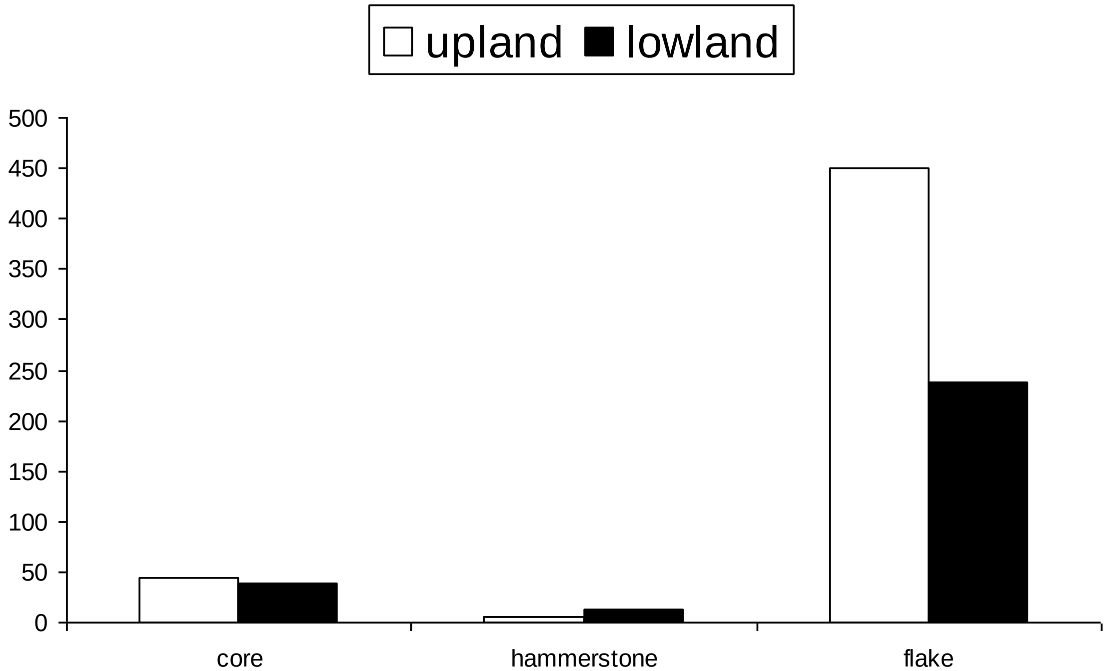

Figure 16. Technological class frequency comparison of the research samples.

The upland functional class sample contains four of five artifact modes, while the lowland sample contains all functional class modes (Table 21). The upland functional class sample produced an asymptotic Rank 3 curve (Figure 17), which requires the

Table 21. Functional Class Frequency in the Upland and Lowland Study Areas.

	East Saddle Mountains	Wenas Creek Confluence
Modified flake	4	16
Uniface	1	8
Biface[a]	9	29
Projectile Point	4	10
Groundstone	0	16
Total	18	79

[a]Two edges altered by negative scars

upland sample be considered unrepresentative and comparisons made here regarded only as suggestive rather than definitive. The lowland functional class sample produced a Rank 2 curve (Figure 17). Both study area sample sizes are not sufficiently even for

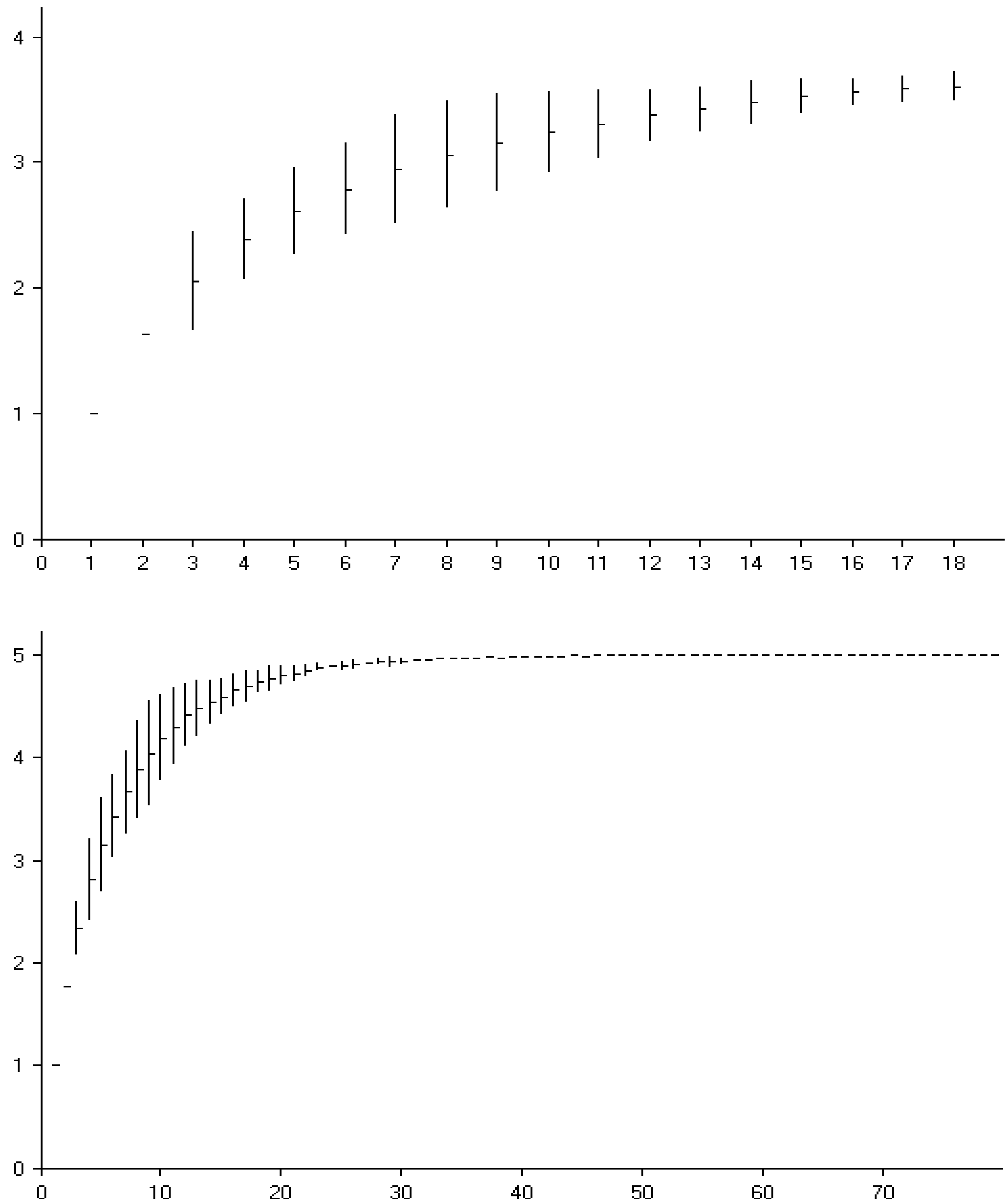

Figure 17. East Saddle Mountains (top, Rank 3) and Wenas Creek confluence (bottom, Rank 2) functional classes.

either one to be considered representative of their parent populations. Similarities and differences between the functional class samples shown in Table 21 and Figure 18 are therefore to be considered suggestive rather than definitive.

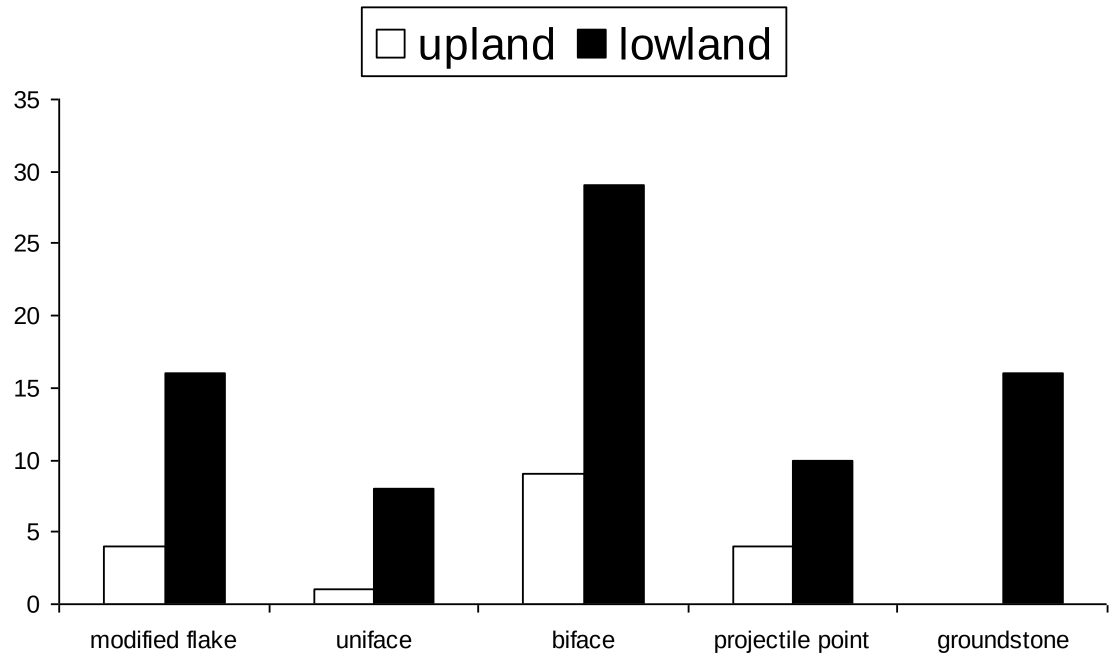

Figure 18. Functional class frequency comparison of the research samples.

While Wenas Creek confluence displays the full set of functional class modes, the absence of groundstone in the east Saddle Mountains sample diminishes the richness of the upland functional class. Viewed in terms of evenness, artifact frequency is similarly distributed across the functional class modes in each sample, with the exception of groundstone. Differential upland and lowland modified flake modes, which include several forms of use wear, may reflect differing resource procurement and utilization activities carried out in the two study areas. The differential uniface frequencies are interesting but with these unrepresentative sample data those differences could be a function of sample size alone.

Alternatively, absence or lack of unifacial tools in an assemblage suggests such artifacts underwent additional reductive modifications on-site (Kooyman 2001; Odell 2004) and assumed new identities. That logic may also apply to the transformation of biface tools into projectile points. Upland and lowland projectile point sample fractions (Figure 19) mirror distribution of the technological and functional class samples. The upland and lowland samples, when combined, represent 10 classes of projectile point

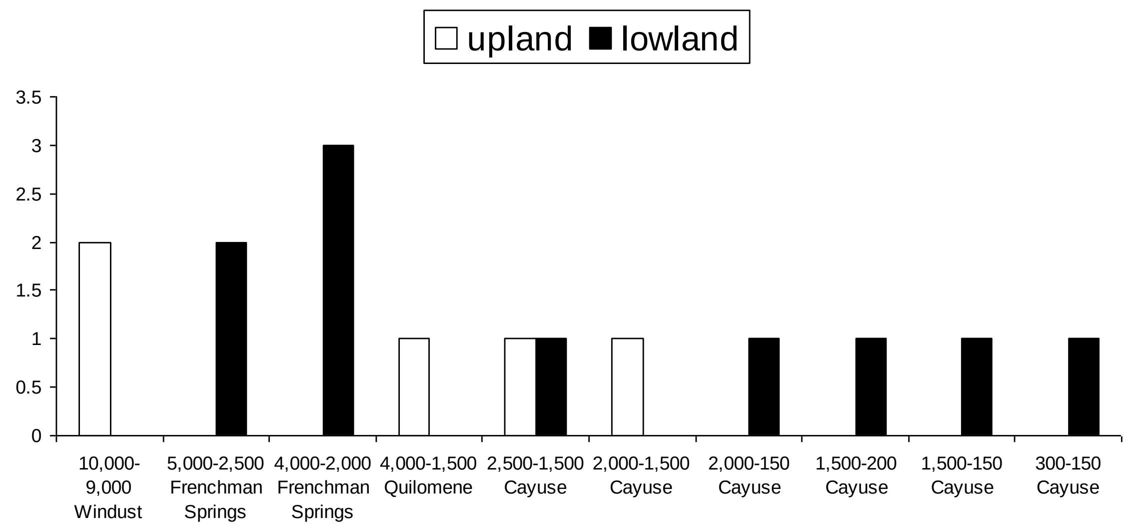

Figure 19. Projectile point temporal ranges and cultural phases calibrated in years before present (after Benson et al. 1989; Carter 2002; Galm et al. 1981; Nelson 1969).

temporal/cultural phases known for the Mid-Plateau (Benson et al. 1989; 2002, 2010; Galm et al. 1981; C. Nelson 1969).

Lowland sample richness seen in seven filled classes is high compared to much lower richness of the uplands four filled classes. Nonetheless, the upland contains three classes not seen in the lowland sample, while the lowland contains six classes not seen in the upland sample. Of added note, only the earliest Cayuse phase (2,500 B.P. to 1,500 B.P.) occurs in both samples. Taken as a whole, the research samples' depict about

10,000 years of land use, though greater diversity appears in Wenas Creek confluence's evenness of frequency and distribution, and in its relative proportion of the total projectile point sample. The east Saddle Mountains occurrence in the earliest temporal/cultural phases of land use identified thus far for the region serves as evidence of this study area's selective environmental connection to human presence since antiquity.

Environmental variables with which cultural variables articulate in each study area (

area (

Table 22) are topographic landforms sustaining resource-bearing habitats in the

Table 22. Site and Isolate Artifact Distributions across Study Area Landform Classes.

East Saddle Mountains	Crest	Slope	Bench	Drainage	Total
Precontact site	5	14	3	3	25
Precontact isolate	1	20	0	1	22
Total	6	34	3	4	47
Wenas Creek Confluence	**Bench**	**Drainage**	**Cliff/Talus**	**Floodplain**	**Total**
Precontact site	23	1	5	1	30
Precontact isolate[a]	9	0	0	1	10
Total	32	1	5	2	40

[a]2007 and 2008 survey data

two places. These microenvironments exemplify four landform types unique to the east Saddle Mountains and four landform types distinctive of Wenas Creek confluence.

The bar plots shown here (Figure 20 and Figure 21) depict the research samples as unnamed objects mapped onto landforms and distributed across microenvironments in patterns separate from artifact inventories contained in discrete site and isolate deposits.

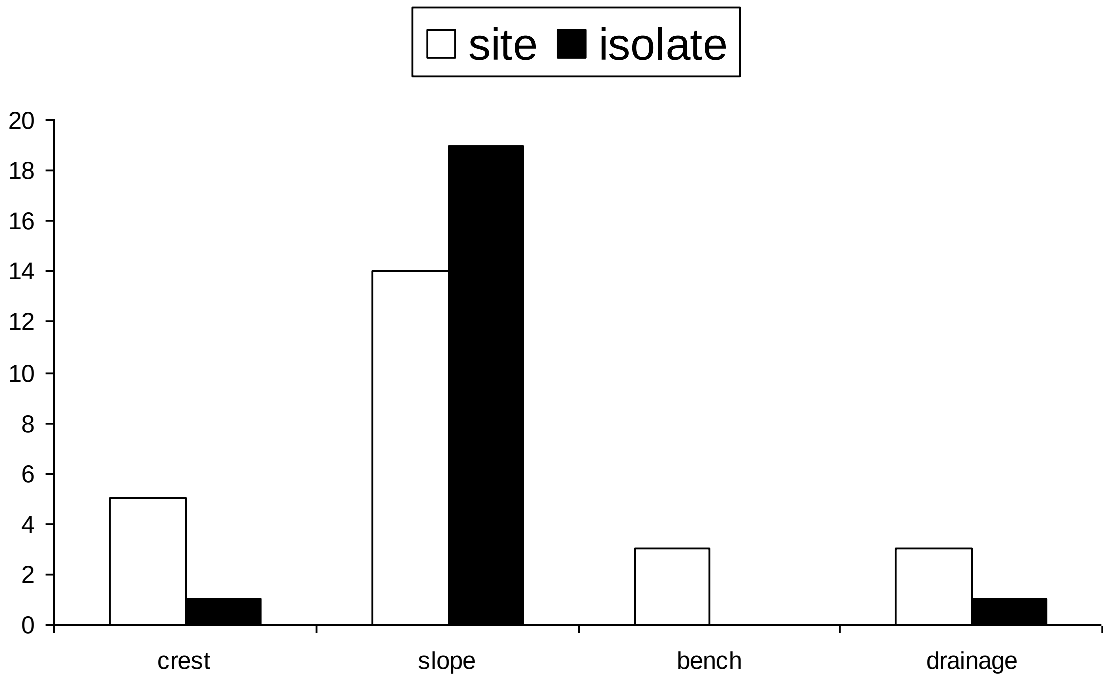

Figure 20. East Saddle Mountains cultural deposit distribution across landforms.

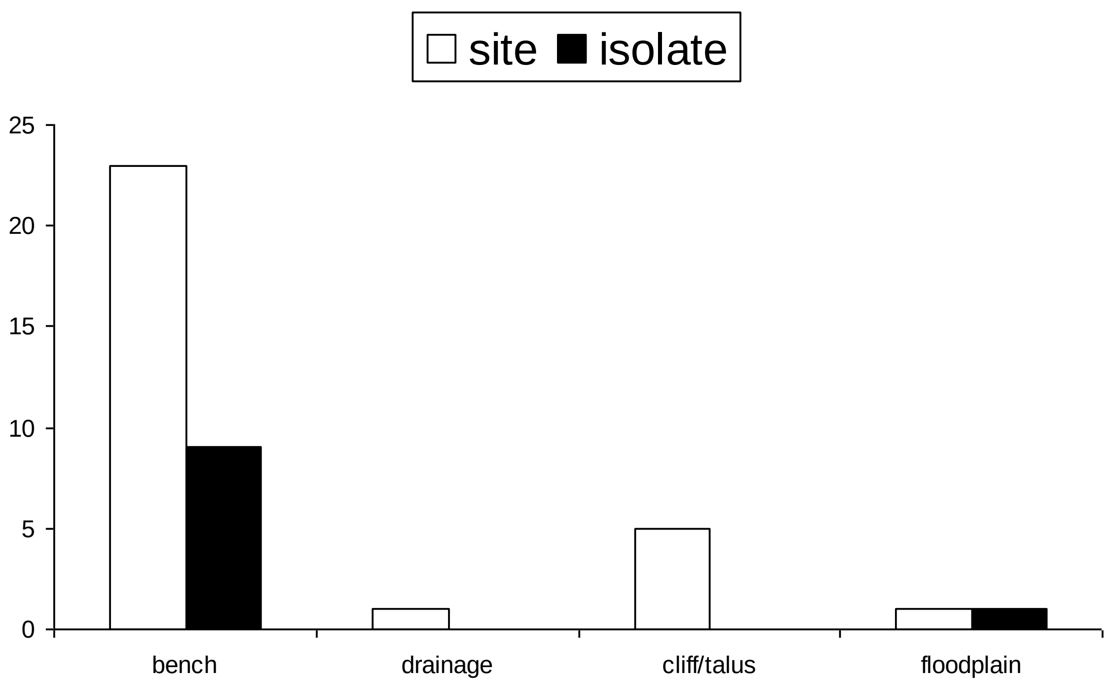

Figure 21. Wenas Creek confluence cultural deposit distribution across landforms.

East Saddle Mountains crest, slope, bench, and drainage landforms are exclusive to the upland study area's arid and precipitous shrub steppe. Clustered artifact sites and single, isolated artifacts most often occur on slopes with slope angles of 9-degrees to 90-degrees. Of 25 sites, 56-percent are on slopes (n = 14), 20-percent on crests (n = 5), 12-percent on benches (n = 3), and 12-percent in drainages (n = 3). Of 21 isolates, 90-percent are located on slopes (n = 19), one on a crest, and one in a drainage. The bench class is devoid of isolates. Slope angles at isolated artifact locations were not recorded during the 2008 upland survey.

Wenas Creek confluence bench, drainage, cliff/talus, and floodplain landforms are exclusive to the lowland study area's abundantly watered riverine and riparian zones and meadow steppe. Clustered artifact sites and single, isolated artifacts most often occur on benches with slope angles of zero degrees to 26-degrees. Of 30 sites, 77-percent are on benches (n = 23), 17-percent on a cliff/talus landform (n = 5) where slope angles range from 16-degrees to 56-degrees, 3-percent in a drainage (n = 1), and 3-percent on the creek's floodplain (n = 1). Slope angles at isolated artifact locations were not recorded during the 2007 and 2008 lowland surveys. Because isolates were not recorded at all during the 2010 survey, the presence of isolated artifacts is underrepresented in the lowland study area and the existing data is biased. Nevertheless, the 2007 dataset contains a single isolate on the creek's floodplain and another on a bench. In 2008, eight isolates were recorded on bench landforms.

Thus far, each study area's similarity to regional upland and lowland resource-bearing terrains has been established. The extent to which upland and lowland ecology and resources differ limits directly comparing east Saddle Mountains to Wenas Creek confluence landforms. Because the two study areas diverge appreciably at the scale of microenvironment, comparing environmental variables alone is an impractical means to identify human land use patterns in the two areas. In addition to cliff/talus and floodplain absence in the upland, and crest and slope absence in the lowland, the two types of bench and drainage are fundamentally different environmental elements of each study area.

Hence, cultural variation within those differentially selective environments is used in order to expose additional characteristics of the upland and lowland research samples. Data gaps within the samples are made visible through graphical portrayals of each study area’s site and isolated artifact deposit inventories. The following bar graph series shows frequency and distribution of the technological and functional class (Figures 22, 23, 24, and 25) plotted according to environmental context defined by landforms. As explained

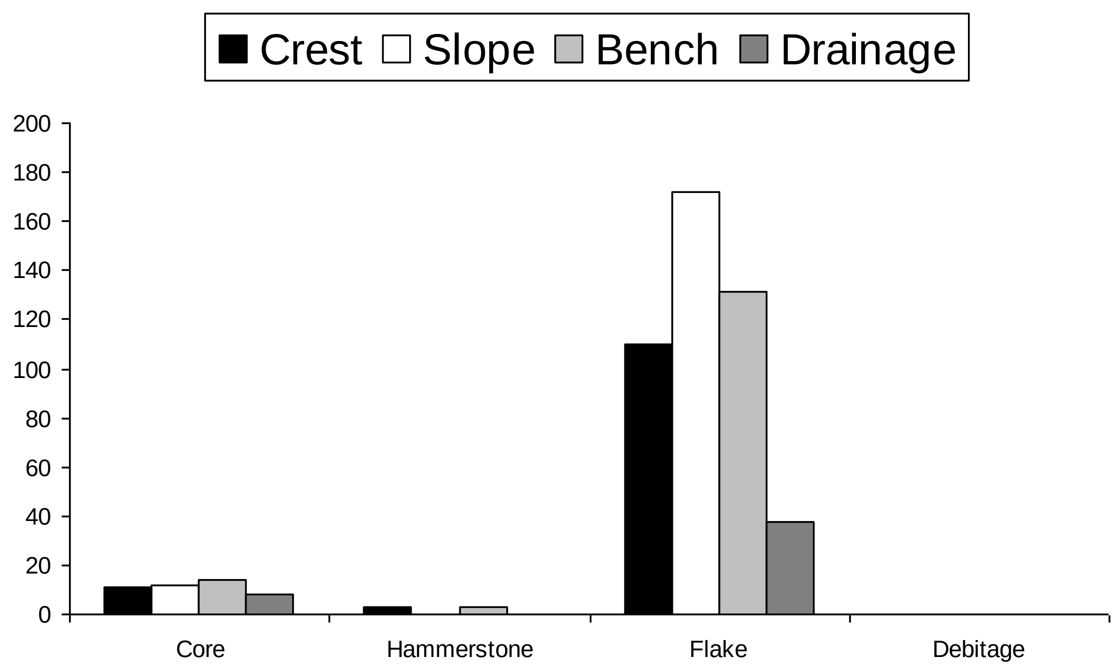

Figure 22. Upland technological class frequency and distribution relative to microenvironmental settings defined by landform types.

previously (see Chapter IV, Methods and Techniques), biased technological class data for debitage artifacts have been withdrawn from this analysis. Debitage is included above as an unfilled mode in the technological class to which it belongs.

The upland technological class exhibits sample richness by filling all landform categories. A low degree of sample diversity is depicted by uneven artifact frequencies and irregular distributions across the environment. The presence of cores and flakes in all upland microenvironments may signify stone tool production took place throughout the contiguous landscape as a matter of course when utilizing upland resources. The scant hammerstone frequency may reflect their role in stone tool production. For example, the research sample hammerstones are igneous (e.g., quartzite) cobbles transported into the area from remote sources. Their low frequency may indicate they were exhausted on site during prolonged use or that their value and portability caused toolmakers to retain them.

Hammerstones exist in each of only two artifact clusters, both of which flank raw toolstone access pits. Each deposit contains the complete technological class. Flake frequencies in all but drainage landforms (Table 23) point primarily to testing and preparation of toolstone raw material near geologic outcrops in those terrains.

Table 23. Technological Class Frequency Relative to Upland Environmental Variables.

East Saddle Mountains	Crest	Slope	Bench	Drainage	Total
Core	11	12	13	8	44
Hammerstone	3	—	3	—	6
Flake	110	172	131	38	451
Total	124	184	147	46	501

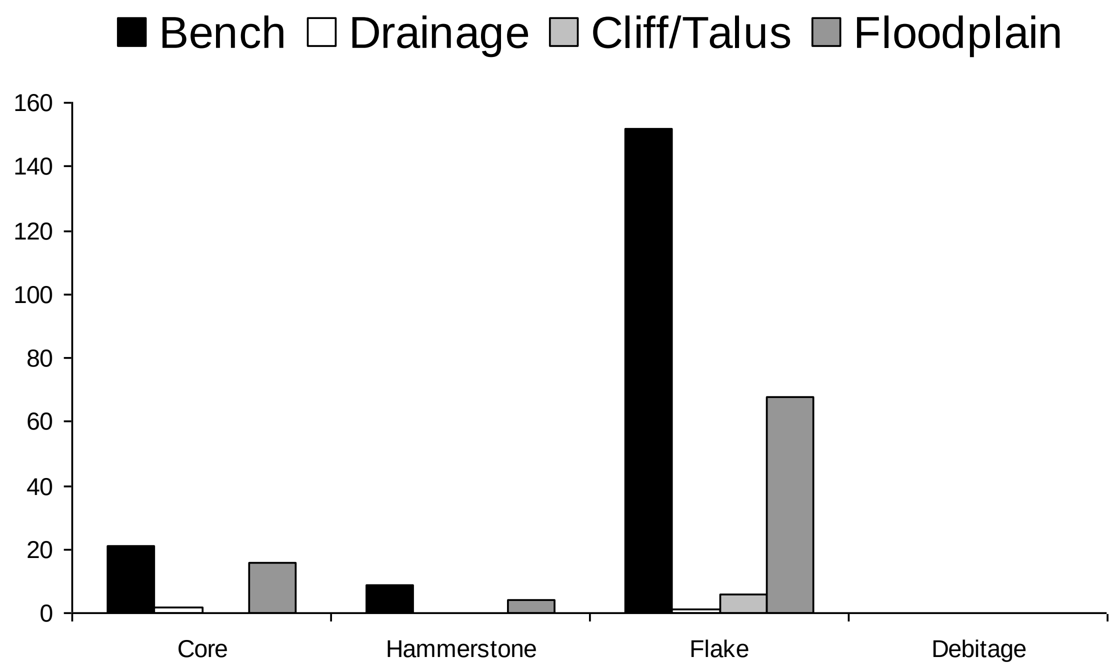

Figure 23. Lowland technological class frequency and distribution relative to microenvironmental settings defined by landform types.

The lowland technological class displays little sample richness in the irregularly filled landform class. With the exception of flakes, the technological class has fairly even though small frequency distributions across the landform categories that are filled, which implies low sample diversity. Flake deposits on benches and the floodplain suggest stone tool production. Unproductive soils/flora in the cliff/talus zone may explain the near total absence of technological artifacts from the landform. The exception is a small deposit of obsidian flakes that directly connect to a petroglyph symbol on a basalt cliff face. Both are likely emblematic of talus slope depressions considered human interments located all through the cliff/talus landform.

Given the terrestrial and aquatic flora and fauna habitats in which the lowland study area is set, overall technological class distributions (Table 24) suggest a range of resource acquisition, preparation, use, and domestic activities carried out at permanent habitation sites. A complete set of technological artifacts exists in the only floodplain site deposit, which includes numerous functional class tools and a pit house depression. A bench site also contains the entire technological class of artifacts, though at much lower frequencies.

Table 24. Technological Class Frequency Relative to Lowland Environmental Variables.

Wenas Creek Confluence	Bench	Drainage	Cliff/Talus	Floodplain	Total
Core	21	2	—	16	39
Hammerstone	9	—	—	4	13
Flake	152	1	6	68	227
Total	182	3	6	88	279

The upland functional class is deficient in sample richness first, because the set of artifact modes are irregularly distributed across landforms and second, for the reason that

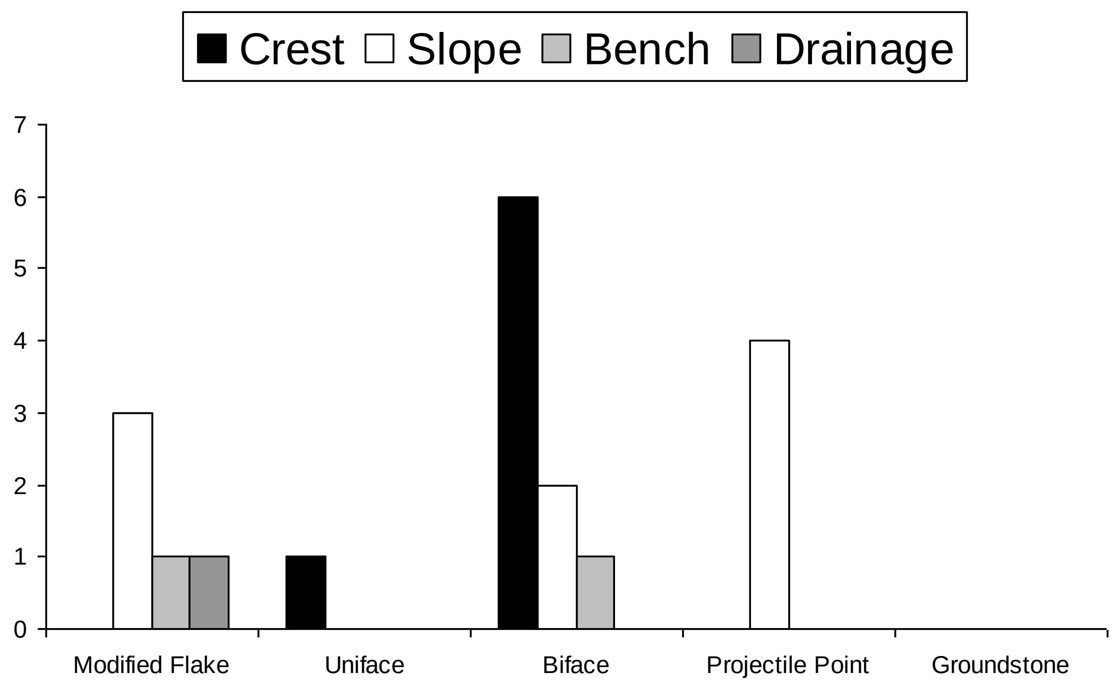

Figure 24. Upland functional class frequency and distribution relative to microenvironmental settings defined by landform types.

groundstone tools are absent. Generally low and uneven artifact frequencies within the landform class signifies low diversity within the sample. Only modified flake and biface tools fill three of four environmental dimensions (Table 25), while a single uniface tool and a few projectile points exist in one landform environment apiece. The presence of projectile points in seasonal game habitat on upland slopes indicates hunting took place in that portion of the study area.

Table 25. Functional Class Frequency Relative to Upland Environmental Variables.

East Saddle Mountains	Crest	Slope	Bench	Drainage	Total
Modified flake	—	3	1	1	5
Uniface	1	—	—	—	1
Biface	6	2	1	—	9
Projectile point	—	4	—	—	4
Groundstone	—	—	—	—	—
Total	7	9	2	1	19

The upland research sample's functional class fraction scarcely exhibits a trace of the stone tools it might otherwise contain. The inference here is that functional tools were desired end-products of raw material acquisition, no matter whether tool production took place at the time and place of raw material acquisition or elsewhere at another time. That is, the prospect of acquiring functional tools may have been what most attracted humans who utilized the area. Tools produced on-site during the course of securing raw material likely facilitated local flora or fauna harvests; however, the low frequencies and irregular functional class distributions in the research sample suggest the potential for stone tool acquisition was the primary motive for upland land use vis-à-vis relatively less important resources located in the study area.

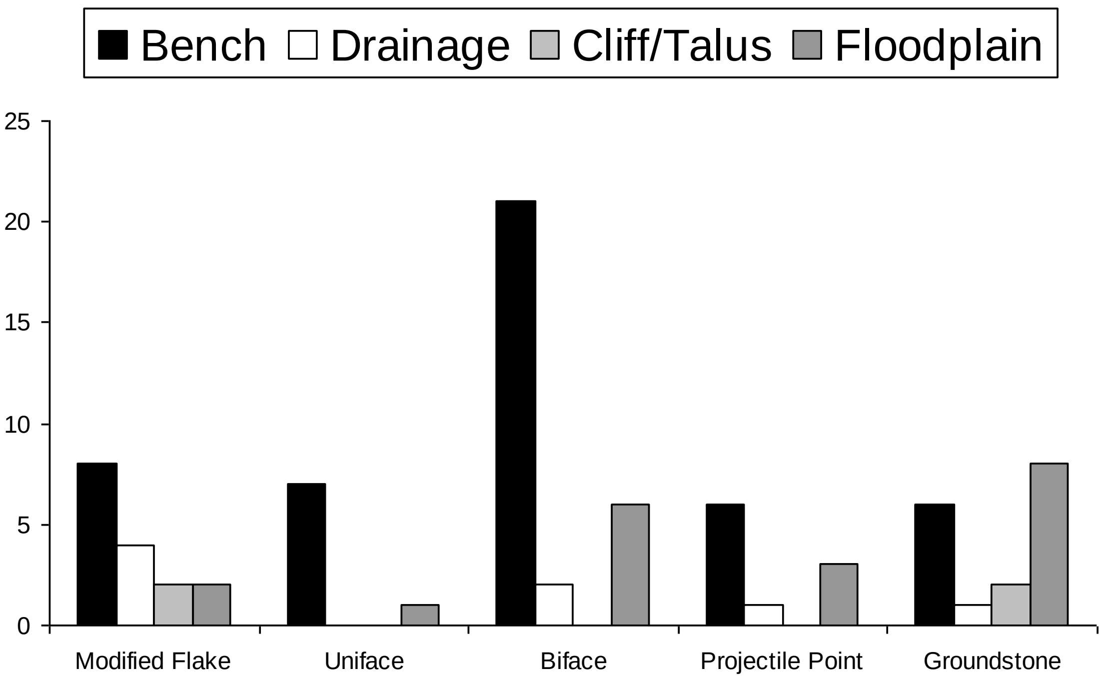

Figure 25. Lowland functional artifact frequency and distribution relative to microenvironmental settings defined by landform types.

The lowland functional class shows abundant sample richness by filling the landform class and high sample diversity in its evenly distributed artifact frequencies (Table 26) within each microenvironmental type. Apparently preferential use of lowland

Table 26. Functional Class Frequency Relative to Lowland Environmental Variables.

Wenas Creek Confluence	Bench	Drainage	Cliff/Talus	Floodplain	Total
Modified flake	8	4	2	2	16
Uniface	7	—	—	1	8
Biface	21	2	—	6	29
Projectile Point	6	1	—	3	10
Groundstone	6	1	1	8	16
Total	48	8	3	20	79

benches reflects both the main landscape characteristic in this study area and the on-site location of terrestrial resources and permanent dwellings. An absence of most functional tool modes from the cliff/talus zone signifies utility of this landform was directed toward familial and sacred activities linked to burial of the deceased at riverine villages (Schuster 1975). The cliff/talus landform is an indigenous ancestral cemetery; the modified flakes and single groundstone that exist there may be related to exclusively ritualistic practices.

Modified flakes and groundstones that occur throughout the lowland environment, followed closely by bifaces and projectile points, imply concentrated functional tool use during various stages of resource processing, consumption, and storage at a permanent activity site. Low uniface frequencies, compared to high biface, modified flake, and projectile point frequencies, may support the notion unifaces were transformed into other tool forms (Kooyman 2001; Odell 2004) during on-going tool maintenance and use.

Low relative proportions of artifacts located in drainage landforms stem in all likelihood from the microenvironmental functions of these smaller tributaries in Wenas Creek's macroenvironment. They incise bench landforms, issue perennial and ephemeral water, supply ecological interfaces linking terrestrial and aquatic habitats, and flood on an intermittent basis. Such channels probably served as resource pockets and water-related food processing and domestic activity sites where that evidence was periodically scoured downslope or buried in sediment. While tool frequency in these drainages is low, all class modes are present save unifaces; hence, sample richness is moderately high. Distribution is slightly even but shows moderately high sample diversity.

The class of archaeological features and technological, functional, and mixed technological/functional artifact site deposits represent land use as a function of human existence (Dancey 1973) wherein site deposits equate to kinds of land use. The feature class (Figure 26) represents concurrent utilization of particular resources within a specific environmental context.

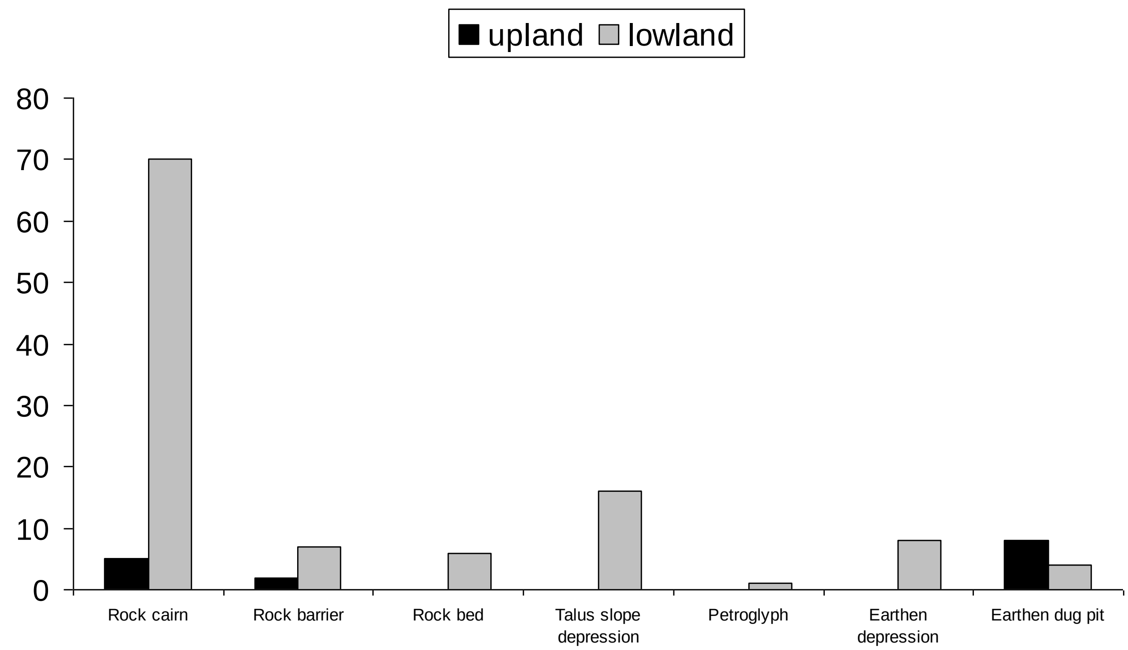

Figure 26. Rock and earthen feature class frequency.

Rock and earthen features built on areal surfaces in the east Saddle Mountains and Wenas Creek confluence study areas contrast one another strikingly. The upland sample fills less than half (43-percent) of the feature class, indicating low sample richness based on minimal resource and environmental utilization. The lowland sample fills the whole feature class and suggests intensive, simultaneous environmental utilization of the Wenas Creek confluence study area.

Unlike artifacts we can directly attribute to the precontact lithics industry, such as technological elements in or functional products of stone tool technological systems, the class of archaeological features poses interpretive challenges. As previous researchers of the Mid-Columbia Plateau (Benson et al. 1989; Galm et al. 1981; Galm and Hartmann 1975; Hartmann and Galm 1976) have found, regionally ubiquitous rock and earthen features are often inscrutable edifices of uncertain cultural origin or function.

Statistical Results of Analysis and Classification

Chi-square analysis is useful when working with nominal scale research samples; mutually exclusive classes are mandatory but other assumptions about the data are not made (VanPool and Leonard 2011), except with regard to sample size (Lewis 2015; Senn 2007; Thomas 1997; Woodard 2008; Vaughn 2010). If sample size of any class is adequate, then chi-square testing can be done (Spatz 1993; Thomas 1997; Zar 1974). An adequate sample size has expected statistical values of at least one, 80-percent of expected totals are greater than five, and 50 or more total samples (Zar 1974). The two samples examined in this research are insufficient by that definition. Due to data gaps where culture variables are absent relative to environmental variables that are present, pursuit of statistical analysis using chi-square was abandoned and my research results report shifted from an inferential to a descriptive statistical perspective.

Presence/absence inventory is an alternative classification approach for nominal scale data. Benson et al. (1989) used a presence/absence assemblage evaluation system from which site type characteristics were deduced based on the contents of archaeology deposits. Such presence/absence testing is, in effect, an inventory system used to render paradigmatic classes into coded classes. This classification centers on an assumption that certain classes are more likely to exist in environmental settings where humans used them when acquiring resources (Benson et al. 1989; McCutcheon et al. 2015). In addition, this form of data analysis does not rule out incidences of artifacts occurring in unexpected environments (McCutcheon et al. 2015). This technique for analyzing nominal scale data provides this research with means to statistically describe the database.

The east Saddle Mountains and Wenas Creek confluence samples underwent presence/absence inventorying (Table 27) by using Microsoft Excel data processing software. The portable and non-portable contents of site and isolated artifact deposits were systematically tallied in terms of artifact presence (numeral 1) or absence (numeral 2), then recorded as paradigmatic classes on Excel spreadsheets. Varying combinations of

Table 27. Hypothetical Presence/Absence Record for Artifact and Feature Site Deposits.

Site	Core	Flake	Feature	Other	Total Code
Deposit X	1	1	2	2	1122
Deposit Y	2	1	1	2	2112
Deposit Z	2	2	2	1	2221

nine object types contained in the research database resulted in the identification of 38 presence/absence codes. These codes served as input for creating bar graphs (Figure 27) of the filled and unfilled technological, functional, and feature classes in the research samples.

Graphical representation of the presence/absence data requires clarification with regard to frequency distributions plotted on these bar graphs. When formatting Excel's graph generator, object type categories where input at random rather than according to the established order of technological class, functional class, and feature class. Therefore, apparent frequencies on the x-axis do not clearly portray patterns such as the occurrence of purely technological, purely functional, or mixed class artifacts. To better understand the data, as plotted, it is useful to know the object type categories are arranged, as follow: flake, modified flake, biface, projectile point, hammerstone, groundstone, core, feature,

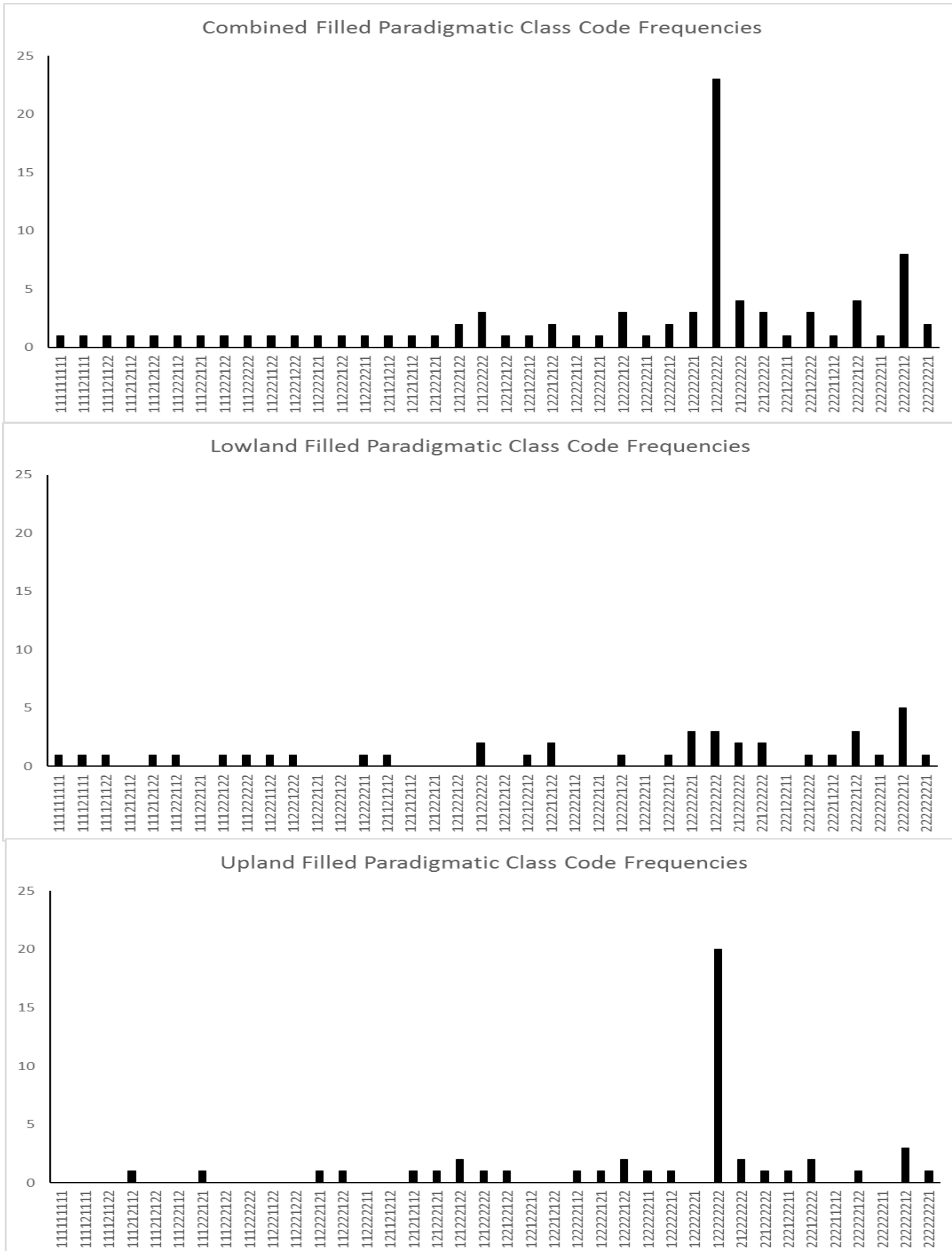

Figure 27. Presence/absence inventories for the combined and individual east Saddle Mountains and Wenas Creek confluence archaeological assemblages.

and other. Unifacial flakes are included in the modified flake set. Shell, a shell bead, debitage, pit houses, perennial spring waters, and a geologic interbed of toolstone-bearing sediments fill the other class and are not included in percentage results below.

The topmost graph depicts the combined east Saddle Mountains and Wenas Creek confluence research samples. The extent to which the coded classes are filled shows the database exhibits low sample diversity suggestive of specialized or single event land use within the upland and lowland environments. Examples include: (a) only one site holds all code class members (i.e. 111111111), (b) the most frequent code class has unmodified chipped stone flakes only (i.e. 122222222), and (c) the second most frequent code class is populated with rock and earthen features (i.e. 222222212). (Numerous artifact deposits in the total research database include one or more non-portable archaeological features.)

Within those parameters, varying artifact combinations imply diverse land use in each study area. Purely technological, purely functional, and variable technological and functional class mixtures are distributed through the range of possible code classes in low but provocative frequencies. That trend may be an effect of sample size or of variation in the representative quality of each sample. The extent of land use diversity ascribed to the cultural-environmental relationships described throughout this research is discussed in the following thesis chapter.

The middle graph depicts Wenas Creek confluence code class frequencies that are moderately high in sample richness by filling 26 of 37 code categories (70-percent). For the most part, absent code dimensions in the lowland sample (n = 12) consist of purely technological artifacts such as flakes, cores, and bifaces indicative of raw material testing and preparation. The bottom graph shows east Saddle Mountains frequencies that fall in a middle range of sample richness by filling 22 of 37 code categories (59-percent). Code classes absent in the upland sample (n = 16) are the hammerstone/core/flake complex of purely technological artifacts, which include the functional class biface and projectile point modes that indicate formal tool production.

Ramifications of comparing the presence/absence differentials exhibited by the upland and lowland research samples are presented in Chapter VI, Conclusions and Recommendations. The discussion of results given in this chapter are fundamental to comparing cultural-environmental variation in each study area to each other and to other segments of the archaeological record located in Mid-Columbia Plateau settings like the east Saddle Mountains and Wenas Creek confluence study areas.

Historic Period Results

Archaeological databases originating from Historic Period land use are ill suited to analysis systems that can be applied effectively to precontact assemblages (Sprague 1980). Historic objects do not fit mutually exclusive artifact classes very well (DAHP 2003). Hence, east Saddle Mountains and Wenas Creek confluence results of Historic Period analysis in this section derive from three approaches to discussion of research outcomes. First, these results are couched in terms taken from the literature describing the historic database (Benson et al. 1989; Boreson 1998; DeBoer et al. 2002; others) that was superimposed on the Mid-Plateau archaeological record of prehistory. Second, temporal origins of the upland and lowland samples are briefly considered. Third, land use agendas leading to a built environment on the Mid-Plateau are discussed in relation to the upland and lowland historic assemblages (see Appendix E).

About 13-percent of total upland deposits are intermixed precontact and historic objects, while 45-percent of total lowland deposits hold mixed material. Arid upland was settled after watered lowland (DeBoer et al. 2002) throughout early phases of regional colonization; human relationships with landscape changed (Harden 1996; Merchant 2005; Morris 1953). Undo focus on temporal stages of the region's culture shift has been condemned (Benson et al. 1989; Small 1977) for directing historic archaeology's interest away from inquiry into interactions with the environment (Hill and Silliman 2006). The historic material examined in this research imparts a modest perspective of Euroamerican land use from a temporal perspective.

Temporal data given here were exposed through scrutiny of diagnostic artifacts (Table 28) contained in the combined upland and lowland research assemblages. These results are best viewed within Historic Period temporal contexts outlined earlier in this research (see History section in Chapter II, Literature Review) relative to Euroamerican

Table 28. Historic Period Temporal Parameters Derived From Diagnostic Artifacts.

Material Class	Manufacture Date Range (A.D.)
Metals	1810 to Present
Glass	1850s to 1950
Ceramic	1861 to 1961
Mixed material	1890 to 1993
Shell (button)	1888 to 1930

(Curtis et al. 2007; Myers 2010; C. Redman and Watson 1970) activity in the region following colonization and settlement from A.D. 1855 forward. Interestingly, with the exception of metals and shell buttons, the material class evidences a century's length of time in the form of portable historic material located in the upland and lowland study areas. In context, although the subject is well beyond the purview of this research, it can be reasonably argued the historic archaeological dimension falls into at least two or more temporal periods punctuated and distinctly set apart from one another by developments in technology, industry, commerce, and world events.

Artifacts and features that make up the historic database relate to Historic Period cultural imperatives and land use agendas involving largely unified activities. The list below briefly summarizes historic assemblage discussions in Mid-Plateau archaeological literature (Benson et al. 1989; Benson and Riche 1993; Bicchieri 1999a; Boreson 1998; DeBoer et al. 2002; Galm et al. 1981; Galm and Hartmann 1975; Lewarch et al. 1999; see also Previous Historic Period Archaeological Research in Chapter II, Literature Review):

- built structure construction and maintenance
- household, personal, and domestic pursuits
- farming, ranching, and agrarian industry
- activity at a distance from fixed dwellings

Historic Period cultural materials contained in the research samples (Appendix E) not only reflect land use paradigms outlined above but also the shift from agriculture and subsistence farming and ranching to industrialized technology. This cultural makeover is referenced through the historic record cited previously in this research. Examples of that shift in the research samples include kerosene lantern and woodstove parts together with knob and tube electrical wiring insulators in use from 1880 until the 1930s (Myers 2010; C. Redman and Watson 1970) in the lowland study area and canned food containers dating from the early 19th Century together with automobile parts in the upland. In total, the historic database represents land use spanning from the horse and wagon era to the advent of rural electrification and motorized vehicles on the Mid-Columbia Plateau.

Previous investigators (Benson et al. 1989; Hill and Silliman 2006; Small 1977; and others) lament a lack of research focus on the natural versus built environment in historic archaeology studies. That data gap is addressed ahead in Chapter VI, Conclusions and Recommendations, which is an evaluative discussion of archaeology sites in the east Saddle Mountains and Wenas Creek confluence study areas presented in terms stipulated by the finishing objective of this thesis research.

Thesis objective six requires interpretation of research results for the precontact and historic datasets sets forth in this chapter. In that context, how east Saddle Mountains and Wenas Creek confluence archaeological-environmental units of analysis compare to the region's pattern of environmental utilization in selective upland and lowland settings like the study areas. Objective six is accomplished in the following chapter through the use of interpretive tools derived from thesis objective one, which created precontact and historic period land use models (Appendices A and B) presented in Chapter II, Literature Review, and objective three, which created cultural-environmental classifications for the precontact and historic temporal periods (Tables 4 and 6) presented in Chapter III, Study Areas.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

This chapter carries out the aim of objective six by interpreting the Precontact and Historic Period data defined in objective five. Cultural-environmental classifications and land use models derived from objectives one and three provide a means to determine how the results of this research measure up to artifact-landscape relationships seen in regional upland and lowland like the study areas. Those archaeological expectations serve to guide inferences predicated on the research database relative to what other researchers have found during previous Mid-Columbia Plateau investigations (Benson et al. 1989; Boreson 1998; Chatters 1982; Dancey 1973; DeBoer et al. 2002; Lewarch et al. 1999; Wilde and Wilke 1984). Upland and lowland cultural-environmental classifications (Tables 4 and 6) that summarize land use models (Appendices A and B) drawn from that literature are used in the following sections to complete the final objective of this research thesis.

Precontact Period Overview

Cultural-environmental reconstructions of upland archaeology sites (Table 4) hold more overall functional class (modified flakes, unifaces, bifaces, projectile points) than technological class objects. Although lithic scatter, lithic reduction, and quarry sites all contain cores and flakes, hammerstones are absent from the complex that is fundamental to technological class stone tool production. The east Saddle Mountains upland study site deposits have low hammerstone frequency (Figure 17), but the entire technological class complex is present. Activity area site types contain technological class flakes along with functional class modified flakes and groundstone. The upland study area deposits contain high technological flake frequencies, but functional class frequencies are quite low and groundstone is entirely absent from the east Saddle Mountains dataset.

Upland study area deposits occur least frequently on crests, most frequently on slopes, and at relatively low frequencies on benches and in drainages. The upland site type constructs shown in Table 4 suggest water resources may be associated with activity area and quarry sites; however, water is absent in the upland study area, except as winter snow runoff and at scattered spring waters like those described by Galm and Hartman (1975). The upland study area artifacts linked to such seasonal water resources occur in an ephemeral drainage that can only cautiously be construed as an occasional source of water. However, upland deposits on this landform are technological class cores and chipped stone flakes.

Upland activity area, lithic scatter, lithic reduction, and quarry site type constructs universally occur on ridge crests linked to geologic outcrops of raw toolstone. The fact lithic reduction sites do not exist on slopes, and activity areas and quarries do not exist on benches, is likely related to the restriction of toolstone outcrop restriction to crests and slopes where erosional forces are greatest. Of the three upland study area deposits linked to off-site interbeds with toolstone resources, all are located on slopes. These sites do not conform to the quarry site type construct because upland study area deposits hold cores and unmodified flakes only; functional class tools, including projectile points, that are present in the quarry site construct are completely absent from the study area deposits.

Lithic scatter site types that are typified by technological cores and flakes, along with functional tools seen in the quarry construct, are not duplicated in upland study area, which generally lack functional class artifacts altogether. The upland study area deposits, which bear minimal resemblance to the lithic scatter construct largely consist of cores, flakes, and a mere trace of biface and projectile point artifacts only. In addition, these deposits have exceptionally low artifact frequencies. Similarly, lithic reduction sites lack the full range of functional tools seen in lithic scatter deposits, while containing cores and flakes. Despite the reduced presence of functional class tools at lithic reduction sites, the upland study area deposits do not conform to the lithic reduction site type construct.

Cultural-environmental reconstructions of lowland archaeology sites (Table 6) hold more functional class (modified flake, uniface, biface, projectile point, groundstone) than technological class objects. Although the lithic scatter and lithic reduction site type constructs contain cores and flakes, hammerstones are absent. While the frequency of hammerstones in lowland study area deposits is low (Figure 17), the entire technological class complex is present. The lithic scatter site type constructs additionally hold the total functional class, with the exception of groundstone. The lithic reduction site constructs differ only in that they lack the range of functional class tools seen in lithic scatter site types. The lowland study area deposits look like lithic scatters based on high frequencies of functional tools, however these sites have hammerstone and groundstone artifacts not present in the site type constructs.

Field camps hold technological flakes only and, including groundstone and hopper mortar bases, a limited range of functional class artifacts (e.g., formed tools, utilized flakes). In the lowland study area dataset, just three deposits resemble the field camp site type construct. Overall, the riverine village site constructs is represented in the lowland study area deposits based on the presence of technological class cores and flakes, and functional class flakes, formed tools and projectile points, rock art, and the kind of earthen surface depressions identified as pit houses. Taken as a whole, the lowland sites display a greater range of both technological and functional class artifacts.

The lowland site type constructs make no mention of landforms but do reference soils/flora habitats associated with either toolstone outcrops or water resources. Toolstone raw material outcrops do not exist in the lowland study area. Soils/flora habitats linked to water resources, however, are in abundance.

Lowland study area deposits are most frequent on bench landforms, which hold plentiful flora species associated with human and fauna food resources. The lowland also includes aquatic flora and fauna food resources. Otherwise, the lowland study area sites are barely seen in the drainage, cliff/talus, and floodplain landforms that typify the area.

Historic Period Overview

Sprague's (1980) classification assists to interpret the set of historic cultural-environmental site type constructs (Table 6) that summarize land use models (Appendix B) taken from previous regional studies (Benson et al. 1989; Boreson 1998; Chatters 1982; Dancey 1973; DeBoer et al. 2002; Lewarch et al. 1999; Wilde and Wilke 1984), which encountered Historic Period material during the course of surveying lands adjacent to the two study areas. Sprague (1980) identified eight functional classes representing human behavior during the Historic Period.

When compared to historic site type constructs, the upland study area has refuse deposits and rock feature. Refuse sites in the study area consist of heavily oxidized can scatters. A single camp site is characterized by a low frequency of objects associated with ranch activities conducted at a distance from a fixed dwellings. Livestock containment pens, fragmented wood, diagnostic food cans, an enamelware basin, and a derelict road typify this site. Rock features in the area that can be attributed to historic origins include rock alignments, which held bullet casings, food cans, and a can opener, considered to be indicative of contemporary recreational hunting. The homestead site type construct is absent in the upland study area likely because terrain is topographically inhospitable and access to reliable water resources is seasonally brief at best.

When compared to lowland historic site constructs, the study area evidences homestead, refuse, and feature site type deposits. The lowland study area's assemblage of Historic Period material occurs at high frequencies and is most densely distributed on the north side of Wenas Creek, although historic deposits exist on the creek's south side. A range of artifacts in all of the material classes (e.g., glass, metal, ceramic) are present in the lowland study area deposits. Fixed subsurface and surface rock and brick and mortar features indicate previously existing architectural structures. Unlike the upland site type constructs, which provide landform descriptions for the various site types, environmental contexts for the lowland site constructs consist soils/flora description. That element of the research database has been described earlier in this research. Overall, the lowland study area's historic archaeological record reflects likely homesteads that were modernized over time, as technological developments allowed for rural electrification and other evidence of modernity contained in the lowland dataset.

As Sprague (1980:253) states, historic archaeologists encounter classification challenges around technological artifacts of the Historic Period cultural paradigm. The historic archaeological record is only suited to analysis from a perspectives that view the whole assemblage in terms of non-mutually exclusive categories. In addition, as identified in the History section of Chapter II, Literature Review, historic archaeology has neglected to incorporate environmental context in site deposit descriptions. Hence, there is little to be said for the upland and lowland datasets that has not been thoroughly identified throughout previous discussion of the two study areas.

Recommendations

The topics discussed here recommend three future avenues of investigation. An obvious improvement to this thesis research would be larger samples sizes both in terms of numbers of sites/isolates and areas considered. A comparison between the east Saddle Mountains and the site/isolate records of the Yakima Training Center would provide a direct comparison of similar environmental settings. Additional samples from similar settings to Wenas Creek confluence where lowland habitats clearly appear to have different conditions and archaeology would make a more robust comparison for lowland settings. Finally, sample sizes for the historic components are neither robust or necessarily representative of all that was going on in that period and additional areas and samples would improve the outcomes of research into the Historic Period.

A second future avenue of research should consider the cultural-environmental site type constructs and the presence/absence classification. Creating a key between the land use constructs and the presence/absence filled classes will not only show how the two interrelate but also the variation that is ignored when using the site type approach inherent in the land use models.

My final recommendation for future research is the development of an indigenous archaeological approach in order to interpret the archeological record. None of the land use models identified thus far in this thesis were the work of Native Americans trained in archaeological research. While those same land use models are based in part on the ethnographic record that too was written by non-native anthropologists. The native perspective is entirely lacking from the land use models examined in this research

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Appendix A: Mid-Columbia Plateau Precontact Land Use Models

Mid-Columbia Plateau precontact land use models based on archaeology site type, two variables, and inferred human activities.

Research	Site Type	Environmental Variable	Cultural Variable	Activity Inferred
Dancey (1973)	Riverine Village	Lowland floodplain	Debitage, cores, formed tools, hearth, charcoal, organic residue, bone	Permanent habitation, food processing and consumption
	Specialty Camp	Upland alluvial flat	Debitage, cores, root processing tools, hearth, earth oven	Temporary spring camas harvest and processing
	Acquisition Site	Upland flat	Debitage, utilized flakes, formed tools	Resource procurement
	Specialized Camp	Upland flat, bench, slope, saddle, head of drainage	Fire-cracked rock, charcoal, charred bone	Game hunting
Chatters (1982)	Multifunctional 1	Rocky scabland soils	Retouched and/or worn lithics >1%, flakes from more than one core	One or more intensively performed activities
	Multifunctional 2	Rocky scabland soils, spring water present	Hopper mortar present, retouched and/or worn lithics >1%, flakes from more than one core, rock cairn present	Temporary campsite

Research	Site Type	Environmental Variable	Cultural Variable	Activity Inferred
Chatters (1982)	Secondary Lithic Reduction Station	Upland and/or lowland, soil type specific to flora and/or fauna habitat	Same as quarry but toolstone outcrop absent	Lithic reduction sequence debris present, flora and/or fauna procurement
	Single Event Lithic Reduction Station	Upland and/or lowland, soil type specific to flora and/or fauna habitat	Same as quarry but flakes from one core only and toolstone outcrop absent	Lithic reduction sequence debris present, flora and/or fauna procurement
	Quarry	Upland, rocky scabland soil type with or without rootbed habitat, outcrop of toolstone present	Flakes from more than one core, <1% artifacts retouched or worn, with toolstone outcrop	Toolstone procurement, Lithic reduction sequence debris present
	Cairn	Upland and/or lowland	Cairns only	Storage and/or burial
Wilde and Wilke (1984)	Pit House	Lowland alluvial flat	Formed tools, ground stone, projectile points	Temporary habitation, game/plant consumption
	Lithic Scatter	5 upland microenvirons 1 lowland microenviron	Debitage, uniface/biface, cores, projectile points,	___
	Reduction Site	Upland hill/ridgetop, bench	Debitage, cores, blades, retouched flakes	___

Research	Site Type	Environmental Variable	Cultural Variable	Activity Inferred
Wilde and Wilke (1984)	Flaking Station	Upland slope or saddle, no direct association with toolstone outcrop	Densely concentrated debitage within lower density distribution of raw material	Core reduction, tool production
	Quarry Quarry/Flaking Station	Upland, lithosolic soils, rootbed habitat	Debitage, cores, retouched flakes, projectile points	Quarrying, core and tool manufacture associated with plant collecting
Benson et al. (1989)	Riverine Base Camp	Lowland floodplain	Lithic reduction areas, debitage, utilized flakes, formed and broken tools	Permanent village and/or specialty camp
	Camp	Lowland distant from river, spring or seep, gentle slope, game/plant resource habitat present	Debitage, tools, fire-cracked rock, organic remains	Procurement and processing
	Location	Upland away from river, spring, or seep, high elevation, gentle slope, no toolstone outcrop	Debitage, utilized flakes, formed tools, broken tools, no cores	Tool manufacture and/or sharpening, hunting, butchering, plant collection/processing, non-residential resource extraction site

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Research	Site Type	Environmental Variable	Cultural Variable	Activity Inferred
Benson et al. (1989)	Lithic Reduction	Upland far from river and all other H_2O, high elevation, steep slope, no toolstone outcrop	Core, debitage, preforms, formed tools, broken tools	Core reduction sequence and tool preparation
	Residence and/or Field Camp	___	Debitage, formed tools, utilized flakes, hearths, fire modified rock, bone, shell	Food preparation, processing, tool use, tool fabrication
	Quarry	Upland distant from river, spring or seep, high elevation, steep slope, ridgetop	Toolstone outcrop present, cores, debitage, preforms, broken and formed tools, utilized flakes	Quarrying, test, select, extract raw material, manufacture cores and tools, reduction sequence debris present
Boreson (1998)	Lithic Scatter	Shrub-steppe	10 or more modified lithics within 10-meter or less area	___
	Lithic Procurement Area	Lithosolic habitat and adjacent toolstone outcrop	Lithic scatter, debitage	___
	Lithic Reduction Area	Shrub-steppe	Flake, core, unfinished biface, lithic reduction sequence debris present	___

Research	Site Type	Environmental Variable	Cultural Variable	Activity Inferred
Boreson (1998)	Tool Manufacturing Area	___	Lithic reduction sequence debris, biface fragments, preforms	___
	Lithic Quarry	Toolstone outcrop	Lithic scatter near raw	___
	Campsite	Shrub-steppe flora zone	Debitage, formed tools, fire modified rock, bone and charcoal optional	___
Lewarch et al. (1999)	Residence and/or Field Camp	Riparian lowland and/or upland near headwater	Debitage, formed tools, fired rock, bone/charcoal	Food acquisition, tool fabrication and use
	Activity Area	Upland, slope, ridge, lithosolic root habitat, toolstone outcrop	Debitage, utilized flakes, formed tools	Hunt/butcher, plant collecting/processing, tool fabrication
	Lithic Reduction Site	Upland, slope, interfluvial ridgetop	Debitage, cores, preforms, formed tools	Tool manufacture and use, hunting and plant collecting
	Quarry	Upland slope, interfluvial ridgetop	Toolstone outcrop, Debitage/core/preform, broken and formed tools	Quarrying, core and tool manufacturing, hunting and plant collecting

Research	Site Type	Environmental Variable	Cultural Variable	Activity Inferred
DeBoer et al. (2002)	Base Camp	Lowland floodplain	Formed tools, debitage, bone, shell, ground stone, house pits, storage pits, hearths, rock art	Habitation, food related activities, river resource collecting, chipped and ground tool use, tool fabrication
	Field Camp	Lowland/upland 6 miles from river	Formed tools, debitage, bone, shell, ground stone, hearths, shelters	Food processing, preparation/consumption chipped, ground tool use, tool fabrication
	Lithic Scatter	Lowland/upland 6 miles from river, toolstone outcrop optional	Formed tools, preforms, utilized flakes, cores, debitage	Hunting, plant gathering, tool production
	Lithic Reduction	Lowland/upland 6 miles from river, toolstone outcrop optional	Formed tools, preforms, cores, utilized flakes, debitage	Core and tool production for hunting and plant gathering
	Lithic Procurement	Upland within or beyond 6 miles from river with toolstone outcrop	Formed tools, preforms, utilized flakes, cores, debitage, quarry pits	Quarrying toolstone, core, tool manufacture and maintenance, hunting, plant gathering,

(Benson et al. 1989; Boreson 1998; Chatters 1982; Dancey 1973; DeBoer et al. 2002; Lewarch et al. 1999; Wilde and Wilke 1984)

Appendix B: Historic Period Mid-Columbia Plateau land use models based on archaeology site type, two variables, and inferred human activities.

Research	Site Type	Environmental Variable	Cultural Variable	Activity Inferred
Wilde and Wilke (1984)	Homestead	Upland headwaters perennial drainage	House/barn, root cellar, building material	Domestic habitation
Boreson (1998)	Habitation and Debris	Perennial water absent or present	Personal/domestic gear, houseware, farm gear, building material, root cellar, well	Homestead household, ranching, architecture
	Campsite and Debris	Upland drainage with seasonal water	Personal/domestic gear, houseware, farm/ranch gear, building material, tools, surface depression	Temporary habitation linked to homestead, farming, ranching
	Refuse Dump and Debris	Upland	Personal/domestic gear, houseware, farm/ranch gear, building material, surface depression	Temporary habitation, refuse disposal
	Earthen Feature and Debris	Springs	Refuse scatter, surface depression, dam, reservoir	Water impoundment, land development
Lewarch et al. (1999)	Homestead	Upland	Structure, houseware, farm gear, rock/pit features	Permanent habitation

Research	Site Type	Environmental Variable	Cultural Variable	Activity Inferred
Wilde and Wilke (1984)	Homestead	Upland headwaters perennial drainage	House/barn, root cellar, building material	Domestic habitation
DeBoer et al. (2002)	Ranch Camp	Upland	Structure, houseware, root cellar, privy	Seasonal ranch work
	Refuse Area	Upland	Personal/domestic/house-ware, farm/ranch gear	Refuse disposal
	Rock Feature	Upland	Cairn/alignment, debris	Property survey marker, fence support
	Agricultural	Upland ridge, terrace, perennial or seasonal drainage	Domestic/houseware, building material, earthen dam	1910 to 1940
	Refuse Scatter	Upland slope, bench or terrace, perennial or seasonal drainage	Personal/domestic gear, houseware	Late 1880s to 1930s
	Refuse Scatter	Lowland terrace at confluence of spring-fed perennial creeks	Personal/domestic gear, houseware, tools	1940s
	Agricultural-Homestead		Domestic gear, houseware, root cellar, fruit trees	Early 1900s permanent domestic habitation

Research	Site Type	Environmental Variable	Cultural Variable	Activity Inferred
Wilde and Wilke (1984)	Homestead	Upland headwaters perennial drainage	House/barn, root cellar, building material	Domestic habitation

(Benson et al. 1989; Boreson 1998; DeBoer et al.2002; Lewarch et al. 1999; Wilde and Wilke 1984)

Appendix C: Surface Survey Data Recovery Techniques

Surface Survey Field Protocol

This section explains systematic pedestrian survey techniques implemented during the fieldwork upon which this research is based. The following set of units and definitions was employed during systematic surveys of areal surfaces in the study areas and during identification and recordation of archaeological sites, isolates, and features.

Definitions

The archaeological record is the surviving physical remains of past human activity. The archaeological record contains artifacts that are located on the landscape in the form of sites, isolates, and archaeologically significant physical features.

1. Artifact(s): any portable object with form or location resulting from human activity and, if moved (once discovered), will not be altered in form.
2. Feature(s): any non-portable object with form or location resulting from human activity and, if moved (once discovered), will be altered in form.
3. Isolate(s): single artifact occurring within a circle that is 10 meters in diameter.
4. Site(s): two or more artifacts occurring within a circle that is 10 meters in diameter or features occurring alone or in groups of two or more.
5. Prehistoric: objects believed to date to before 1800.
6. Historic: objects believed to date to 1800 - 1998*
7. Survey: visual inspection of ground surfaces along a pedestrian survey transect.

*All artifacts and features are of potential value as indicators of human land use in this area. In particular, "rock hounding" continues on a daily basis.

Pedestrian Survey

All of our survey is 'site-based.' A siteless survey would record the exact location of every artifact and feature and not employ an artifact density definition to place arbitrary lines around artifacts (i.e. sites). Siteless survey is not financially feasible in most cases when artifact density is high. In addition, it is important that our protocol be comparable to those used in previous fieldwork in this region so that comparisons across the region can be made with some degree of confidence.

Surveyor

Each member of the survey party is a 'surveyor.' Each surveyor possesses a pair of eyes to be used as the detectors for locating artifacts and/or features on the ground surface. Each surveyor is responsible for continuously scanning an approximately one-meter area in front of them, as they walk along the survey transect.

Survey Transect

Each survey transect is walked in a **straight** line at a predetermined azimuth (e.g., 180^{o}). If a surveyor leaves their transect position before finishing they must mark their location and return to it before rejoining the survey party. Each surveyor samples the ground surface in each transect for artifacts and features. All artifacts and features recorded along the survey transect are ‘transect finds’ and should be noted as such on all documents and in log entries. Artifacts and features found off the survey transect are not ‘transect finds’ and should be noted as such on all documents and in log entries. The surveyor who identifies an artifact or feature is responsible for notifying the supervisor whether a particular find is or is not a ‘transect find.’

Survey Interval

All surveyors should be spaced 10 meters apart from each other. Great effort should be expended to maintain this distance by monitoring your location in relation to other surveyors on either side of you during the survey transect. By maintaining a constant interval, we are insuring that an accurate and precise 10 percent sample will be acquired during fieldwork.

Survey Speed

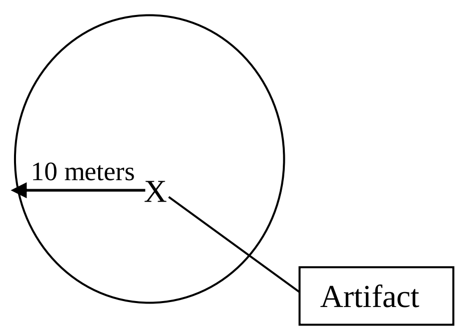
All surveyors should do their best to maintain a constant speed while walking. Each surveyor should maintain a walking rate of 2 to 3 miles per hour; however, topography, slope, and other environmental conditions will affect this rate. When another surveyor yells-out that they are seeing chert that probably means the survey line will slow down and so should you.

What to Do When an Artifact is Found

The surveyor that identifies the artifact/feature announces the find to the survey crew, which will stop the survey line. Every surveyor marks their spot and helps to determine if the artifact is an isolated find (less than 10 artifacts within a circle with a 10-meter diameter) or site. If the find is a feature (non-portable artifact), it is recorded as a site after following the steps below:

1. The first thing you do is mark your survey transect location.

2. Next, you commence a search a circle around the location of the artifact for a distance of 10 meters.



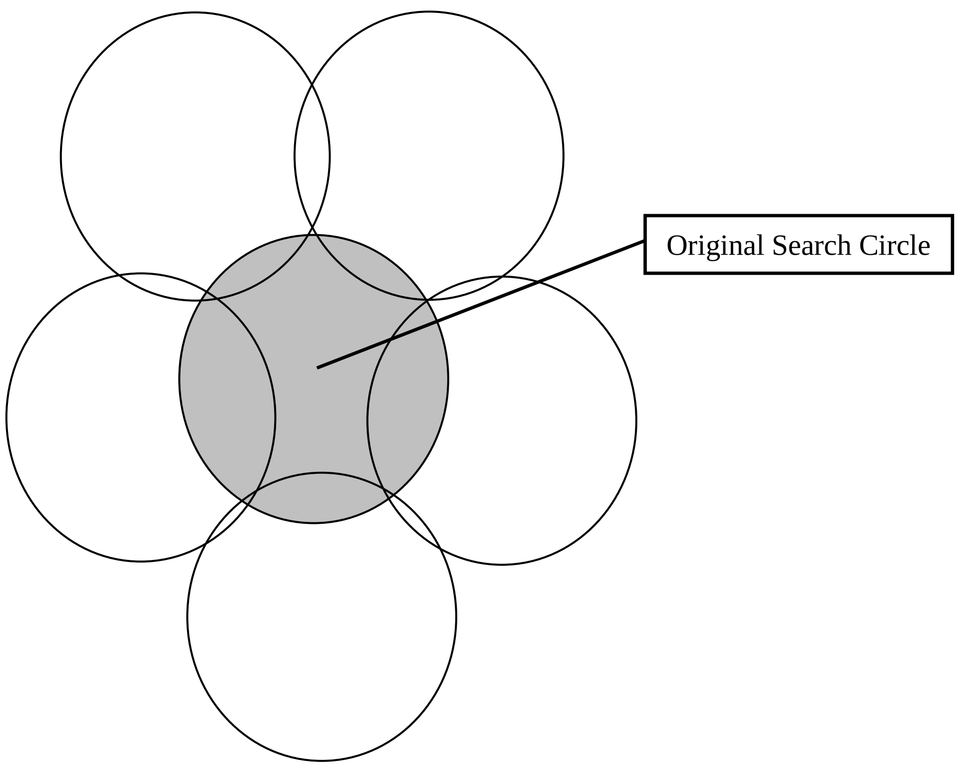
360º search circle

3. During the search, a pink flag is placed at each artifact seen within the search circle. The goal is to determine whether artifact density is sufficient to warrant a 'site' designation (i.e. 10 or more artifacts within a 10-meter diameter circle).

a. The circle can be moved to accommodate nearby artifacts (i.e. artifacts within 10 meters).
b. If there are less than two artifacts, and none of them are features, the artifact cluster is recorded as an isolate.
c. Alternatively, if there are two or more artifacts within the circle the artifact cluster is recorded as a 'site.'
d. Recording a site requires determining its boundaries, if any, beyond the original concentration (see 4 below).

4. Once artifact density is determined to be sufficient for site status, additional searches are undertaken using the 10-meter rule to determine the site boundaries.

a. An additional 10 meters should be searched around each of the artifacts within the original search circle.



b. Once the boundaries of a site are determined a pace map may be generated. Artifacts within 10 meters of the site cluster are used to establish boundary points for the site.

c. The location of the original concentration of two or more artifacts within a 10-meter diameter circle should be noted on pace map.

5. Once the status of the artifact cluster is determined, the remaining information for each site, isolate, or feature is recorded.

Central Washington University (CWU) archaeologists observed the following surface survey protocol in the field:

1. Crewmembers spaced at a 10 m pedestrian survey interval followed compass headings across linear surface transects and placed pin-flag surface markers at cultural deposits as encountered.

2. Flagged locales were examined and cultural material was classified using a “hand specimen” (Odell 2004:28) technique wherein objects are visually assessed.

3. Density squares, measuring 1m-x-1m, were judgmentally placed on site surfaces with dense precontact lithic scatters and materials within each square were analyzed and classified. Lithic materials with a bulb of percussion and striking platform were counted as flakes and all other material was counted as lithic debris. Artifacts remained *in situ*, except projectile points, which were collected.

4. Sites and isolates were recorded by collecting cultural and environmental data in the form of written accounts, hand-drawn archaeological specimens and site maps, photographs, and Global Positioning System files. All information was recorded using Washington State Department of Archaeology and Historic Preservation (DAHP) site and isolate forms and in crewmember logbooks.

5. All data were transferred to electronic DAHP forms in the laboratory by teaching assistants and projectile points were analyzed and assigned to temporal classes stipulated by Carter’s (2002) Mid-Plateau chronology (for both study areas in 2007 and 2008) and Nelson’s (1969) chronology for the lowland survey, in 2010. CWU field school staff produced project summaries (Anderson et al. 2009, unpublished manuscript in possession of Central Washington Archaeological Survey; Schroeder 2010; Vaughn et al. 2008) that augmented information taken from DAHP site and isolate forms in order to compile the archaeological database examined in this research.

Appendix D: Precontact Database of Artifacts and Features

East Saddle Mountains Site/Isolate	Landform	Artifact	Feature
08-08-01s[a]/hd[b]	Drainage	flakes, cores	
08-08-02s	Drainage	flakes	
08-08-03s	Drainage	flakes, core	
08-08-04s	Slope	flakes	
08-18-01s/hd	Crest	flake	2 cairns
08-18-02s/hd	Crest	projectile point	2 cairns
08-18-03s	Bench	flakes, core	
08-18-05s	Crest	flakes, cores	
08-18-06s	Drainage	flakes	
08-18-07s	Slope	flakes, biface fragment, core	
08-18-08s	Slope	flakes	dug pit
08-18-09s	Slope	flakes, core	dug pit
08-18-10s	Slope	flakes, flake tool, cores	sediment interbed
08-18-11s	Bench	flakes	
08-18-12s	Slope	flakes, biface fragment, cores	sediment interbed
08-18-13s	Drainage		dug pit
08-18-14s	Slope	flakes	
08-18-15s	Slope	flakes, cores, hammerstones	4 dug pits
08-18-16s	Bench	flakes	
08-18-17s	Slope	flakes, cores, hammerstones, flake tools	dug pit
08-18-18s	Slope		cairn
08-18-19s	Slope	flakes, core, projectile point	
08-18-20s	Bench		cairn
08-18-21s	Slope	flakes, core	
08-18-22s	Slope	flakes, cores	
2008-08-01s	Slope	flake	
2008-08-02s	Drainage	core	
2008-08-03s	Slope	projectile point	

East Saddle Mountains Site/Isolate	Landform	Artifact	Feature
2008-08-04s	Slope	flake	
2008-18-01s	Slope	projectile point	
2008-18-02s	Slope	shell bead	
2008-18-03s	Crest	flake	
2008-18-04s	Slope	flake	
2008-18-05s	Slope	biface	
2008-18-06s	Slope	flake	
2008-18-07s	Slope	flake	
2008-18-08s	Slope	worn flake	
2008-18-09s	Slope	flake	
2008-18-10s	Slope	flake	
2008-18-11s	Slope	flake	
2008-18-12s	Slope	flake	
2008-18-13s	Slope	flake	
2008-18-14s	Slope	flake	
2008-18-15s	Slope	flake	
2008-18-16s	Slope	flake	
2008-18-17s	Slope	flake	
2008-18-18s	Slope	flake	
Wenas Creek-Yakima River Confluence Site/Isolate	Landform	Artifact	Feature
07-18-01w[c]	Floodplain	flake, uniface, biface, core, core tool, projectile point, metate	
07-18-02w	Floodplain	flake, uniface, flake tool, core, obsidian chunk	
07-18-03w	Floodplain	flake, uniface, biface	
07-18-04w	Floodplain	battered cobble, metate, ochre cobble	cairn

East Saddle Mountains Site/Isolate	Landform	Artifact	Feature
07-18-05w	Floodplain	flake, core, hammerstone, battered cobble	
07-18-06w/hd[d]	Bench	debitage, flake, core, battered cobble	
07-18-07w/hd	Bench	flake, uniface, biface, core, battered cobble	
07-18-08w	Cliff/Talus	obsidian flakes	petroglyph
08-18-02w/hd	Bench	flake, biface, projectile point, mano	5 talus slope depressions
08-18-03w/hd	Bench	flake, projectile point	rock feature
08-18-04w	Bench	flakes	
08-18-06w/hd	Floodplain	flake, biface, core, groundstone, pestle, hopper mortar, shell fragment	5 pit house depressions
08-18-07w/hd	Bench	flake, biface, core	talus slope depression
08-18-08w/hd	Bench	flake, core, groundstone	
08-18-09w/hd	Bench	flake, shell fragment	
08-18-10w	Cliff/Talus		talus slope depression
08-18-11w/hd	Bench	flake, core	
08-18-12w	Bench	flake, biface	
08-18-13w/hd	Bench	flakes	
08-18-14w/hd	Cliff/Talus		rock alignment
08-18-15w/hd	Cliff/Talus		rock cairn, rock alignment
08-18-16/hd	Cliff/Talus		rock cairn, rock alignment
08-18-17w/hd	Bench		rock cairn, rock alignment
10-HS-01[e]	Bench	flakes, pestle	
10-HS-02	Bench	flakes	spring
10-PS-01[f]	Bench	flake, flake tool, projectile point, core,	pit house depression, rock

East Saddle Mountains Site/Isolate	Landform	Artifact	Feature
		debitage, mano	features, spring
10-PS-02	Bench	obsidian flake, debitage	pit house depression, basalt feature
10-PS-03	Bench	flake, lithic scatter	spring
10-PS-04/hd	Bench		pit house depression, rock feature
10-PS-06	Bench		cairn, rock feature, spring
10-PS-07/hd	Bench	flakes, flake fragments	
2007-18-01w	Floodplain	flake	
2007-18-03w	Bench	projectile point	
2008-18-01w	Bench	core	
2008-18-02w	Bench	flake tool	
2008-18-03w	Bench	core	
2008-18-04w	Bench	biface	
2008-18-05w	Bench	flake	
2008-18-06w	Bench	core	
2008-18-07w	Bench	flake	
2008-18-08w	Bench	biface	

[a]2008 Saddle Mountains identifier
[b]Historic intermixed with precontact
[c]2007 and 2008 Wenas Creek Confluence identifier
[d]Historic intermixed with precontact
[e]2010 Wenas Creek-Yakima River confluence historic site
[f]2010 Wenas Creek-Yakima River confluence precontact site

Appendix E: Historic Period Database of Artifacts and Features

East Saddle Mountains Site/Isolate	Artifact	Feature
08-08-01s	bullet casings, fuel drum, exhaust pipe, iron rod, barbed wire, sheet metal	1 rock ring fire pit milled lumber scatter
08-08-05s	cans, enamelware basin, chicken/pasture/insulated wire	2 wood livestock pens wood fragment scatter derelict 2-track road
08-18-01s	can, bullet casings	2 rock alignments
08-18-02s	field can opener, bullet casings	2 rock alignments
08-18-04s	cans	
08-18-18s		1 cairn
08-18-20s		1 cairn
2008-08-05s	can	
2008-17-01s	can	
2008-18-19s	glass fragment	

[a] Unique identifier 2008 East Saddle Mountains data set

Wenas Creek Confluence Site/Isolate	Artifact	Feature
07-18-06w[a]	spoon, metal/glass fragments, nails	
07-18-07w		9 fence cairns
07-18-09w	cans, metal brackets/strap, woodstove part, barbed wire	rock/mortar structure foundation brick fragments
2007-18-02w	can	
08-18-01w	cans, enamelware, machine part, jar/bottle/receptacle, stoneware, shoe soles with cobblers nails	rock/brick/mortar subsurface structure foundation 1 rectangular rock bed
08-18-02w	cans, enamelware basins, canning jar lid, patent medicine/liquor bottles, glass/ceramic fragments, woodstove pipe/parts, lantern handle w/ chimney bales, handsaw blade, buckets, small engine machine parts, vehicle license plate/muffler, fuel drums, pasture/bailing/barbed wire	rock/brick/mortar subsurface structure foundation 53 fence jack cairns 1 livestock barrier alignment lumber/split rails
08-18-03w	can, nail, wire	1 cairn, milled lumber wood fragment scatter
08-18-05w	bailing wire fragments	2 cairns
08-18-06w	metal fragments glass fragments	
08-18-07w	can	1 rock cairn
08-18-08w	can fragments	
08-18-09w	cans, metal strap, brass fragments, glass fragments	brick fragment
08-18-11w	can, bottle, glass fragments, barbed wire	1 rock ring fire pit

08-18-13w	barbed wire	3 fence jack cairns
08-18-14w	barbed wire, metal brace	2 livestock barrier alignments
08-18-15w		1 livestock barrier alignment
08-18-16w		1 livestock barrier alignment
08-18-17w		1 fence jack cairn
10-HS-01w	spoon, can fragments, metal pot, buttons, glass/ceramic fragments, nails, electrical insulator[b], barrel strap, car chassis	structure foundation cement fragments
10-HS-02w	cans, glass/ceramic fragments	
10-HS-05w		3 fence jack cairns fence post scatter
10-PS-02w	bullet casing	11 rock cairns
10-PS-04w	ceramic tobacco pipe fragment	
10-PS-07w	glass/ceramic fragments	

[a] Unique identifier for 2007 and 2008 Wenas Creek-Yakima River Confluence data set
b Knob and tube wiring