Environment, Prehistory & Archaeology of Mount Rainier National Park, Washington

by

Greg C. Burtchard

with contributions by

Stephen C. Hamilton
and
Richard H. McClure, Jr.

a report prepared for

NATIONAL PARK SERVICE, Seattle, Washington
International Archaeological Research Institute,Inc.
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Subalpine parkland at “Summerland” looking northwest into Fryingpan Creek drainage during an August 16, 1995 snowstorm. Because they afforded access to upper elevation resources, moderated distance to lowland residence and provided relief from unpredictable severe weather, base camps in forest/subalpine ecotonal settings may have been an important element of prehistoric use of Mount Rainier. Fryingpan Rockshelter (45PI43) is situated near Fryingpan Creek below the snowline at photo right.

The cover photograph shows Mount Rainier and its early evening reflection in a tarn lake in Spray Park. Photo taken September 1, 1995.

This document is printed on acid-free archival paper. It is intended to be a long-term record of the archaeology of Mount Rainier National Park.

FOREWORD TO THE 2003 EDITION

Environment, Prehistory and Archaeology of Mount Rainier National Park is the park's most comprehensive archaeological overview and research design. Based on the results of field and archival research through 1997, it draws together the park's known prehistoric archaeological record, and evaluates it in light of its place within broader regional subsistence and settlement patterns. The 2003 edition remains unchanged except for this foreword, use of color graphics where available, addition of Appendix C containing an otherwise hard-to-get citation in support of ecological arguments made in the body of the text, minor editorial corrections, and production in both paper and compact disk (CD) format.

As the following *Preface* notes, two historical sites, 20 prehistoric sites and 18 prehistoric isolated finds were documented within park boundaries when the original report was written. These totals account for data available during the overview's preparation period. Text and tabular information included in this reprinted volume is limited to this earlier record. Subsequent archaeological surveys and tests by park service archaeologists, and by Central Washington University's archaeological field school, have increased the site inventory; thereby enhancing our understanding of site age, content, and stratigraphy. At the beginning of 2003, Mount Rainier's archaeological inventory stands at 40 prehistoric and multi-component sites, 29 prehistoric isolated finds, and 31 historical sites and isolates. Firmly dated cultural deposits document human use of Mount Rainier to 3,500 radiocarbon years ago. Test results from two open sites and two rockshelter sites have revealed surprisingly high densities of lithic debris, suggesting repeated use of park landscapes since at least that time. Stratigraphic sequences from Sunrise Ridge in the park's northeastern quadrant indicate the presence of a glacier-free, wooded environment at 6,400 feet by 8,500 years ago. Results of these ongoing studies will be made available as separate technical reports as they are completed. Preliminary results tend to support this overview's findings, and suggest a substantial human presence on the mountain dating to *at least* the mid-Holocene as indicated by the available radiocarbon record, and very likely to the early Holocene as indicated in stratigraphic profiles.

It is important to note that doubling the size of the park's prehistoric site inventory has not changed basic site location or site type patterns emphasized in this overview. As with the original data, a preponderance of prehistoric sites and isolates are found in subalpine habitats: fifty-one (74%) of the current total are located in patchy subalpine parklands, eleven (16%) in alpine settings, and seven (10%) in montane forest contexts—most near the upper elevation forest/subalpine ecotone. No sites have been documented on Mount Rainier's high energy floodplains. In this report, I suggest that the relatively high site count in subalpine to alpine settings reflects focused use of those habitats due to the relatively high abundance of economically useful plant animal species that tend to aggregate there during the summer season. The reality of the pattern and, in my opinion, the basic reasons underlying it have only grown stronger in the intervening years.

Because it has attracted interest and generated much discussion, the notion that prehistoric people directed their activities preferentially toward high elevation subalpine habitats, rather than to lower, more densely forested settings, warrants clarification. In making this argument, it should be noted, that even under the best conditions, archaeological remains are difficult to find on Mount Rainier. Lithic artifacts tend to be small and are obscured by the park's multiple volcanic deposits. They are even more difficult to locate in heavily wooded settings. There is little doubt that the subalpine versus forest pattern reflects, in part, differences in site discovery potential between different vegetation regimes. That said, I am convinced that Mount Rainier site location patterning reflects genuine variation in resource potential, human use patterns, and the archaeological record of that use during the prehistoric past. This is not to say that lower elevation, forested landscapes were avoided altogether; but rather that 1) subalpine and alpine environments constitute the largest expanse of naturally maintained, productive, early seral-stage habitat available within park boundaries; and that 2) in the absence of productive low-elevation salmon bearing streams, these environments were sought out and maintained because of their high resource potential relative to the lower, but more resource-impoverished, wet maritime forests.

Mount Rainier's prehistoric site distribution model, temporal land-use model, and other issues germane to long-term use of high-elevation Cascade landscapes are developed at several points in the body of the text (see, for example, pages 15-16, 44-50, and summary discussion on pages 158-172). Much of the ecological argument included in these discussions, and especially that relevant to site distribution, is built on site location patterns first recognized in an earlier study for Mount Hood National Forest in the northern Oregon Cascades; and refined further through discussions with archaeologists such as Randall Schalk and Bob Mierendorf, who had prepared earlier overviews that modeled human use of high-elevation landscapes in Olympic National Park and North Cascade National Park Complex respectively. In both the Mount Hood report and the present report, I couch arguments relevant to variation in edible resource potential in terms of *relative forest maturity.* In retrospect, I believe that points would have been better made, and more easily applied to a wider variety of environmental circumstances, if I had referred to differences in seral-stage productivity as summarized above, rather than using the more restrictive and ambiguously interpretable ecosystem maturity concept. Resulting expectations for Mount Rainier, however, are identical. Readers wishing to delve more deeply into the ecological basis for variation in resource productivity, and ultimately site density, in montane habitats may wish to refer to Appendix C which has been added to this printing. Appendix C provides relevant text from the Mount Hood report that was referenced in the original version, but was difficult for many readers to locate.

Prehistoric sites and site types also warrant brief discussion. A prehistoric archaeological site at Mount Rainier, as well as at North Cascades and Olympic National Parks, is identified by the presence of two or more artifacts or features co-occurring within 50 meters or less on the same landform (reduced from the three artifact minimum employed when this report originally was written). The number is low compared to definitions typically employed by archaeologists working in arid lands or where mineral soil visibility is high, but it is one that fairly reflects sustained use of the landscape in this environment. Because knappable stone sources are rare at Mount Rainier, tool kits tended to be highly curated and characterized by late-stage manufacture, resulting in low density assemblages with a high fraction of small, difficult to see, artifacts. Furthermore, use was dominated by small, mobile groups with relatively short-duration stays as reflected in the site type model presented in the body of the text. These factors, combined with the park's active depositional landscape and heavy vegetation, limit the count of artifacts observable through normal surface survey techniques. More recent sub-surface reconnaissance and site testing procedures using fine screen techniques have demonstrated that these sites typically are associated with a higher density of sub-surface remains than would be expected on the basis of surface evidence alone. Failure to record low surface density assemblages as archaeological sites would effectively preclude protection of these sites, as well as meaningful study of long-term human use of the mountain.

Finally, I encourage interested readers to go beyond park-specific information and consider wider implications of the environmental model presented in Chapter 2, the Holocene land-use intensification model offered in Chapter 5, and site type and distribution patterns presented throughout.

Importantly, I urge readers to consider the place of Mount Rainier within its regional context and the long sweep of time that humans have lived in its shadow. The mountain does not stand apart from river valleys, prairies, and drier foothill and basin settings that surround it, but rather fits into a complex pattern of land-use strategies that vary in broadly predictable ways across space and through time. I hope that this report assists those who seek a greater understanding of the long history of Mount Rainier and its indigenous inhabitants.

PREFACE

Mount Rainier's upper elevation landscapes have been used seasonally by hunting and gathering people for at least 3,400 and perhaps as many as 8,500 years. However, the importance of montane landscapes to prehistoric people has only recently become widely recognized in the Pacific Northwest. Perhaps because of elevation, unpredictable weather and rugged terrain, places like Mount Rainier were regarded by many as only marginal to subsistence and settlement strategies that focused instead on lowland settings east and west of the Cascades.

By the 1970s, a growing body of reported archaeological finds was beginning to suggest a higher level of prehistoric use of the mountains than heretofore appreciated. Even though only one Mount Rainier site had been formally recorded (a rockshelter on Fryingpan Creek), employees and visitors for years had collected and reported chipped stone artifacts from various locations. While they remained unconfirmed, 11 of these finds were noted in some form at Park headquarters in Longmire. In addition to these hints of prehistoric use were various written accounts and commonly accepted stories that alluded to presence of Indian people on the mountain during the late 19th and early 20th centuries.

Formal interest in Mount Rainier's prehistoric record increased in the 1980s. During this decade, two additional sites were recorded formally (a lithic concentration near Frozen Lake and a second rockshelter in Berkeley Park). Test excavations at the rockshelter returned fragmented bone and chipped stone remains. Radiocarbon ages suggested repeated use of the shelter between about 2,000 and 900 years ago. Other sightings of archaeological remains continued to accumulate, raising the number of unconfirmed archaeological locations from 11 to over 20—almost all in subalpine and alpine settings on all sides of the mountain.

Efforts to formally organize and expand Mount Rainier's prehistoric database began in 1990 and culminated in the present project. The Mount Rainier project reported here and in site forms bound separately as *Archaeological Resources of Mount Rainier National Park* (Burtchard and Hamilton 1998) was designed to 1) consolidate and field evaluate the accumulated body of reports and other site data relevant to the Park's prehistoric archaeological record; 2) expand on that corpus of information through new archaeological reconnaissance designed to sample a variety of landforms and environmental zones on all sides of the mountain; and 3) use those data to generate an overview of the Park's archaeology and prehistory, and develop research guidelines for continuing archaeological resource management. The two volume format is intended to separate site specific technical information from more general considerations of Mount Rainier's geology, ecology and archaeology offered here.

Consolidation of previously reported finds and new archaeological reconnaissance was completed by the author and Stephen Hamilton during a six week period between August 1 and September 21, 1995. New archaeological surface reconnaissance covered approximately 3,550 acres in survey parcels selected to maximize landform diversity, open exposure and access efficiency.

Reevaluation and new reconnaissance efforts documented 14 previously unrecorded sites and 18 isolated finds. Added to sites recorded previously, these results brought to 22 the number of known archaeological places documented through the close of 1995. Twenty of these were prehistoric sites (four with historical components) and two were historical sites. Records for all 40 of these sites and isolated finds, including site maps, photographs and relevant topographic maps, are included in the project's companion *Archaeological Resources* volume. It should be noted, however, that survey and site testing efforts taking place under Park auspices after the 1995 calendar year are not included here.

The present volume also summarizes reconnaissance field procedures and results. However, its primary concern is directed toward clarifying implications of these data for long-term human use of Mount Rainier National Park. The initial chapters discuss Holocene geology and environmental patterns, drawing attention to the manner in which these events and patterns conditioned hunter-gatherer use of the mountain during the prehistoric past. In essence, these arguments hold that, because they support relatively abundant populations of economically useful animals and plants, subalpine and alpine environmental zones have been the prime focus of human activity throughout the prehistoric past. High maturity characteristics of dense maritime forests and salmon poor, lahar prone, Mount Rainier river valleys were used primarily as travel routes and irregular foraging areas where tree cover was broken by fire or other forest disturbing events.

Environmental discussions also include consideration of Holocene climate change with implications for human land-use patterns. A Holocene climate curve charts changes through time, and predicts effects to Mount Rainier floral patterns with consideration of implications for resource abundance and, hence, human use of the mountain.

This volume also provides an historical summary of the archeology of Mount Rainier National Park and adjacent parts of the southern Washington Cascades. The Mount Rainier section provides a detailed account of the Park's archaeological history. Rick McClure's synopsis of archaeological research in the nearby Cascades places the Park's prehistoric cultural resources within a broader context. His contribution also draws attention to implications of a suite of radiocarbon dates spanning circa 8,500 year period.

The fourth chapter outlines field procedures and summarizes results of the present project. Included are results of Steve Hamilton's lithic analyses conducted during the project. These data suggest substantial functional variability among Mount Rainier's archaeological sites, including indications of residential, butchering, hunting, and lithic reduction locations. The chapter also addresses temporal indicators in the extant site database and site distribution patterns as they relate to various environmental and landform characteristics. Results indicate a strong site association with upper forest ecotone, subalpine and alpine habitats, and land-use extending at least to 3,400 years into the prehistoric past.

Chapter 5 establishes the interpretive framework for the prehistory of Mount Rainier and the southern Washington Cascades through 1) a site type taxonomy, and 2) long-term regional subsistence and settlement model. The site type taxonomy incorporates present data with that from similar montane contexts to propose a ten-part preliminary model. Based in part on extant lithic assemblage data, the model distinguishes a series of limited task locations (e.g., short-stay hunting camps, butchering sites and lithic procurement and reduction places) in subalpine and alpine context tethered to residential base camps situated at the ecotonal margin between upper forest and subalpine habitats.

The second model addresses development and change in regional subsistence and settlement systems through time, emphasizing implications for Holocene land-use patterns on Mount Rainier. The presentation reviews related ecological approaches toward modeling land-use strategies in Northwest montane environments, and offers a newly refined forager to collector model for Mount Rainier and the southern Washington Cascades. In essence, it suggests that Mount Rainier's upland habitats were incorporated into a normal seasonal subsistence round by early Holocene foragers, employing a strategy of high residential mobility, with minimal dependence on over winter storage. Primary attractors to Mount Rainier are believed to have been large ungulates—principally elk and deer—supplemented by other animal and plant resources—such as goats, game birds, marmots and huckleberries—sharing the subalpine habitat. During the mid-Holocene, increasing population density and elevated resource pressure is believed to underlie a region-wide shift to critical reliance on mass harvest and over winter storage of lowland resources—especially salmon. Group sizes became larger and more nearly sedentary, and social and redistributive mechanisms more complex. Acquisition of montane resources increasingly relied on limited task sub-groups emanating from and returning to the lowland villages. The model anticipates continuing use of Mount Rainier throughout the Holocene, but with tasks redirected toward territorial protection of upland resource areas supplemented by limited use high value resources such as goat and perhaps marmots. Mass harvested and dried huckleberry gathering is expected to date to the very late Holocene, primarily post-dating introduction of the horse between 400 and 200 years ago.

The report closes with specific research recommendations designed to expand and refine Mount Rainier's archaeological record, and to examine further implications of the site type/distribution and subsistence/settlement models offered here. Recommendations are also made for enhancing public interpretation of the Park's emerging prehistoric record. I hope that the report will draw attention to the importance of high elevation landscapes to prehistoric people in the Pacific Northwest. I also hope that it will stimulate thought and discussion about the intricate relationships between environment, population, and resource variables as they relate to development and change in human land-use systems, and that it will offer some insight into how these patterns apply to montane habitats in the Pacific Northwest.

Many people offered generous assistance with various parts of the Mount Rainier project. First, special thanks go to the many employees and volunteers of Mount Rainier National Park whose advice, logistical assistance and obvious enthusiasm for the Park and its history/prehistory helped to make the effort a pleasure to undertake. Indeed, so many persons took an interest in the project that I hesitate to single out particular individuals for fear of overlooking others. Even so, I wish to express appreciation to a number of people who particularly contributed to successful completion of the project. Special thanks in this regard go to Gary Ahlstrand and Rhea Gillispie for coordinating efforts between the Park and the International Archaeological Research Institute, Inc. (IARII), for facilitating field entry, for arranging Park accommodations, and answering numerous naive questions. I very much value the comments and contributions of Carl and Denise Fabiani, Rick Kirschner, Debbie Brenchley and Pam Cox, all of whom provided important information on potential site locations. Margaret Yates assisted with use of the Park library in Longmire, and Ron Warfield arranged for review of existing museum collections. Maggie Magee made collections available to us for illustration. Barbara Samora provided information on fish in Mount Rainier streams and rivers. Darrin Swinney and Doug Roth provided expert assistance with our global positioning system (GPS) and took charge of integrating site location results into the Park's geographic information system (GIS). Color GIS maps included in this report should be credited to the patient efforts of Darrin Swinney. Jack Morrison provided useful background information, and Michele Morseth provided good humor and field assistance in the Sunrise Ridge area. Melanie Adams helped us to fit our base camp needs into the busy Mount Rainier backcountry schedule. Park Archaeologist Gregg Sullivan assited with the survey, and provided administrative and editorial assistance.

Columbia-Cascades regional archaeologist Jim Thomson recognized the value of a Mount Rainier cultural resource overview study and was instrumental in expanding the scope from a three to a six week project. Jim also deserves special thanks for his exceptional patience and faith in the final outcome of this project.

Geologist Patrick Pringle provided valuable help in sorting out Mount Rainier's volcanic history; important to understanding natural stratigraphy and its impact on site visibility across the Park. Thanks go to Emma Krzeminski and Paul Campbell who volunteered their time to help with surveys of upper Huckleberry Basin/lower Burroughs Mountain and Elysian Fields/Vernal Park respectively.

Contributors to this report—Steve Hamilton and Rick McClure—deserve much credit for their diligence and attention to detail. Steve completed lithic analyses and wrote associated sections. He also worked on the field reconnaissance and co-authored the *Archaeological Resources* companion volume. His extraordinary survey skill, active mind and companionship were invaluable to the project and helped to make the work a pleasure overall. Rick was most generous in sharing information, notes and advice gained during his earlier survey effort in the Park. His thorough synopsis of regional archaeology included in this report shows the benefit of his years of professional experience in the southern Washington Cascades.

A number of IARII staff members helped with the difficult job of editing and producing the two volumes of the Mount Rainier report. Particular thanks go to Joan Clarke and Roger Blankfein. Joan served as copy editor and took overall charge of production. I much appreciate her obvious concern with the quality of the presentation and her continuing good humor in the face of numerous technical inconsistencies, poor spelling and much more. Roger Blankfein deserves equal praise for the quality of the report's graphic presentations. He also exhibited great patience in accommodating numerous revisions as the work progressed. Thanks too, to Kent Smolik, Kimberly Wade and Coral Magnuson for assistence with report copy and assembly tasks.

Though he passed away prior to the present project, special recognition should be given to the invaluable contributions of former Park Ranger John Dalle-Molle. John's interest in archaeology and singular efforts at searching out and reporting archaeological finds is of critical importance to the success of the present effort. I hope that this report can serve as a small tribute to his legacy.

Finally, I wish to extend my deep appreciation to colleagues and long-standing friends whose advice and intellectual stimulation have helped to shape my approach and sustained my enthusiasm for archaeology's potential to improve our understanding of human land-use processes across space and through time. Combined ideas of Randall Schalk, Steve Athens, Bob Mierendorf and Alston Thoms on archaeology, subsistence and settlement patterning, ecology, montane land-use patterns, field procedures and more have become so much a part of my own thinking that it is difficult to separate them out to give proper credit where due. I owe these and all individuals named above a debt of gratitude for whatever success this project may have achieved. Its shortcomings are my own. To everyone who participated in the effort, and to those with genuine concern for the archeology of Mount Rainier, I offer my sincere thanks.

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INTRODUCTION TO THE MOUNT RAINIER PROJECT

The mountain locally known as *Tahoma*[1] was renamed Mount Rainier by George Vancouver. It is the highest and most massive of the stratovolcanos that form the eastern spine of the 700 mile long Cascade range from Mt. Giribaldi in southern British Columbia to Mt. Lassen in northern California. For at least the last 75,000 years, Rainier has loomed above the surrounding western Cascade peaks, dominating the landscape from the Puget Trough to the Cowlitz River valley on the west, and from the Kittitas to Yakama valleys on the east (Figure 1.1).

Beginning with its European discovery in 1792 and continuing through the 1800s, Mount Rainier figured prominently in the notes of explorers, military observers, adventurers and settlers. Early exploration and climbing efforts encountered, and frequently were guided by, various ethnically distinct Indian groups already familiar with the mountain's lower to mid-elevation landforms. To the Europeans, Mount Rainier was regarded variously as a feature of monumental natural beauty, an irksome travel barrier, and a peak to be conquered for personal satisfaction and gain. The mountain probably represented these things to Indian people as well, but with fundamental differences. To indigenous populations, *Tahoma's* forest and riverine approaches and mid to upper elevation landscapes also were recognized as places where plant and animal resources could be acquired—places to be visited seasonally as part of the normal course of life in and around the southern Washington Cascades.[2] As will be seen, there is ample reason to believe that such use extended for thousands of years into the prehistoric past as well.

Mount Rainier and its immediately surrounding terrain was incorporated into the National Park system in 1899. The Park was founded primarily to preserve the unique scenic and geological character of the mountain and its associated glaciers, alpine landforms, fringing forested slopes and river valleys. Unrelated to the primary purpose of its founding, little attention was paid to Rainier's historic and more distant prehistoric past. Despite historic and ethnographic accounts of native use, and reports of prehistoric artifacts, until recently there existed a sense that "...Indians never lived on the mountain and seldom hunted there..." (Schmoe 1967:128; cf., Bohannon 1974) and, hence, a belief that archaeological remains—particularly *prehistoric* remains—were poorly represented within Park boundaries. Now, a growing body of evidence suggests that Mount Rainier's subalpine and alpine landscapes were used throughout much of the Holocene as a part of seasonal plant and animal foraging strategies common to the Cascades generally. This volume and the *1995 Reconnaissance Data* volume (Burtchard and Hamilton 1998), bring together extant information and new inventory data relevant to prehistoric use of the mountain in order to improve our understanding of *Tahoma's* place in long-term human use of the broader region; clarify basic patterns in the archaeological record of that use; and develop options to better interpret, protect and research Mount Rainier's archaeological heritage.

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[1] *Tahoma* is employed here as a proxy for a wide variety of similar names pronounced somewhat differently by the region's Sahaptin and Salishan speaking Indian groups (see Smith 1964:42).

[2] Edmund Meany (1916) and Allan Smith (1964) offer interesting and useful accounts of early explorations and ethnohistory of Mount Rainier respectively.

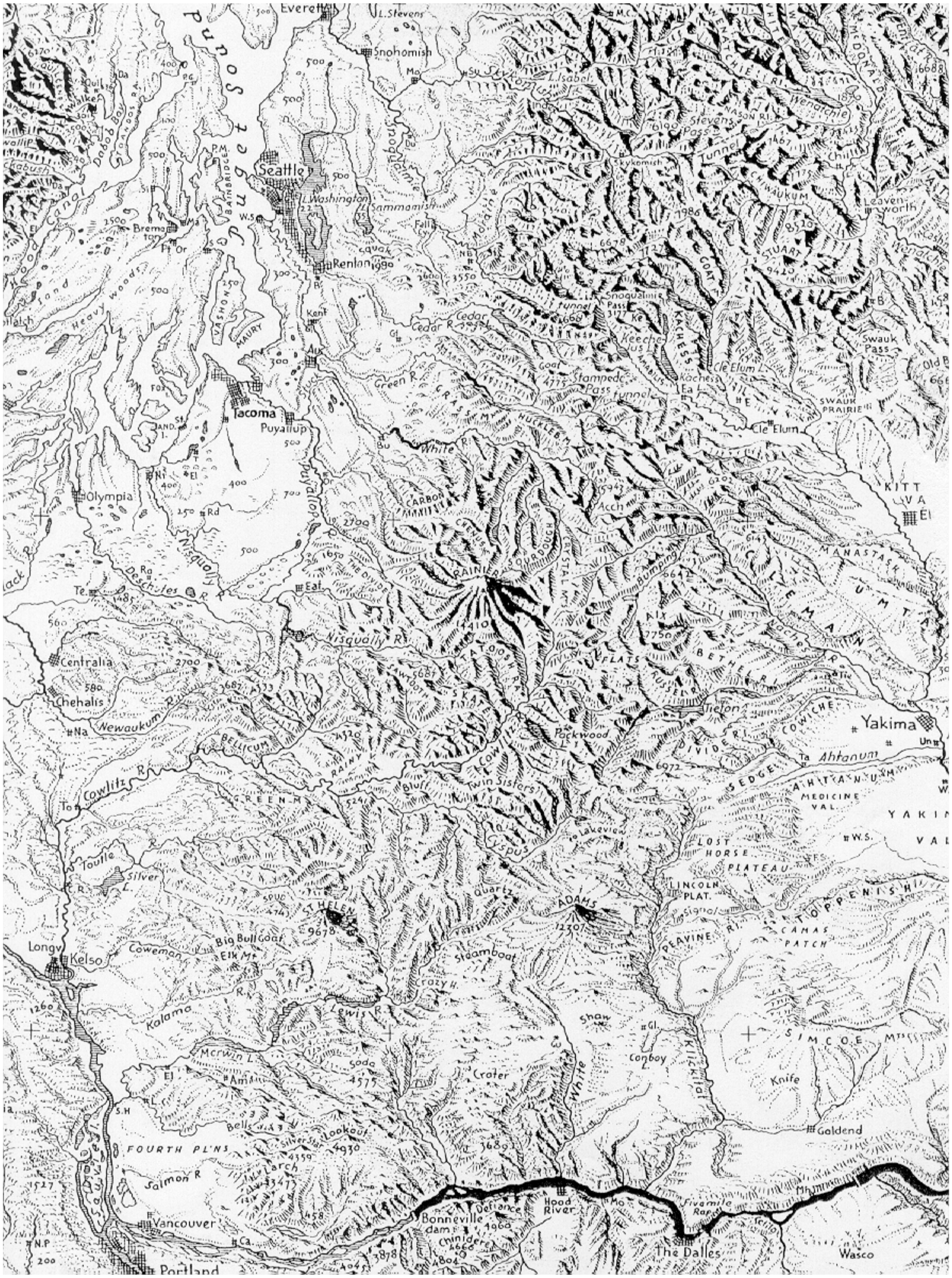

Figure 1.1 Mount Rainier and the Southern to Northern Washington Cascades
(after Raisz 1965; courtesy *Raisz Landform Maps*, Melrose, MA)

PREVIOUS ARCHAEOLOGY

Prior to completion of the present project, information regarding early historic and prehistoric use of the Park was limited to brief glimpses in historic and ethnographic accounts, to reported artifact finds and speculation by interested Park employees (e.g., Schmoe 1925 and 1967; Dalle-Molle 1971 and 1988; and Dalle-Molle and Dalle-Molle 1978), and to several small-scale archaeological survey and test efforts. The first systematic sample inventory of the Park was a combined ethnographic-archaeological effort conducted in 1963 under the joint direction of Allan Smith and Richard Daugherty of Washington State University's Department of Anthropology. Smith's (1964) meticulous ethnographic account documented seasonal use by Indian groups on all sides of the mountain, and directed particular attention to hunting and gathering in subalpine parkland and alpine landscapes. Unfortunately, Daugherty's (1963) follow-up survey emphasized river valleys and documented only two archaeological localities. One of these, Fryingpan Rockshelter (45PI43), was test excavated the following year, producing artifact and faunal remains related to hunting and short-term residence about 1,000 or more years ago (Rice 1965).[3]

Subsequent archaeological efforts and informal reports completed during the 1970s and 1980s led to formal documentation of several additional sites. Two of these, 45PI407 at Frozen Lake and talus boulder rockshelter site 45PI303 in Berkeley Park (Bergland 1986, 1988), demonstrated prehistoric human presence in alpine tundra and subalpine parkland habitats respectively. Surface exposed artifacts at Frozen Lake suggested hunting, butchering and tool making activities. Test excavations at the Berkeley rockshelters produced hunting remains dated to between 2,000 and 1,000 years ago with possible reuse about 300 years ago and in historic times. While not investigated in detail, a third site near Tipsoo Lakes on the east-central Park boundary (45PI406) also contained scattered lithic remains in subalpine environmental context.

By the close of the 1980s only the four localities noted above had been formally documented as *bona fide* prehistoric sites. However, at least 26 additional prehistoric finds had been reported by various Park employees and interested individuals. Information about them was widely scattered. A few reports were accompanied by artifacts turned in to Park headquarters in Longmire. Other artifacts disappeared into private collections. Some reported finds were accompanied by maps, many were not. Clearly, however, a picture of substantially greater prehistoric use of Park landscapes than heretofore supposed was beginning to emerge.

The present project has its roots in 1990. That year, a Park Service contract was issued to consolidate existing Mount Rainier cultural resource records, verify reported site locations in the field, and conduct limited new survey. During that project, four additional prehistoric sites were recorded, a draft basemap and associated site report information assembled, and an introductory overview prepared (McClure 1990). Cultural remains exposed in a borrow pit cut-bank on the south flank of Sunrise Ridge (45PI408) provided the earliest firm evidence for human use of the Park presently available—chipped stone debitage eroding from sediments sandwiched between circa 3,500 and 2,300 volcanic deposits. Even prior to formal testing, visible remains underscored the notion that prehistoric use of the mountain extended at least to the mid-Holocene, and probably beyond.

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[3] Rice suggested use between 300 and 1,000 years ago. Radiocarbon dating, however, was not used to establish this estimate. Judging from cave deposit descriptions, it appears that some cultural materials underlie Mount Rainier series C volcanic debris deposited about 2,300 years ago (Pringle, pers. com. 1995). Accordingly, use of the shelter may be substantially older than previously thought. Firmer determination awaits more refined site analysis.

Unfortunately, the project begun in 1990 was not completed. Even so, enough work was done to clarify further a picture of Mount Rainier archaeology that had been emerging slowly since Schmoe's observations in the 1920s. That is, McClure's results further eroded the view that Park landscapes were little used in the prehistoric past. Rather, accumulating evidence suggested that the mountain preserved at least a moderate density of prehistoric remains, and that these remains appeared to be located predominantly in subalpine to alpine habitats as emphasized by Smith's Indian and ethnohistoric sources 27 years before.

THE PRESENT PROJECT

The present overview and research design project was intended to expand and complete the work begun in 1990. The contract to do so was awarded to the International Archaeological Research Institute, Inc. (IARII) in 1994 (Park Service Contract 1443-CX9000-93-020, Task 5) and implemented in the summer of 1995. We pursued four specific project goals.

1. Prepare an archaeological overview for Mount Rainier National Park emphasizing environmental structure, archaeological and ethnographic investigations in and adjacent to the Park, and discussing the relationship between the montane environment and prehistoric land-use practices;
2. Develop a research design including stratification of the Park into meaningful research and management units, a predictive prehistoric site distribution model, and continuing management and research recommendations;
3. Complete new archeological sample survey structured to provide a more complete view of the Park's prehistoric archaeological record; and
4. Prepare archaeological base maps and supporting site data for prehistoric localities documented within Mount Rainier National Park boundaries.

Six weeks of fieldwork were completed in late summer 1995. During the project, the author and Stephen Hamilton were charged with 1) consolidating and investigating as many previously identified finds as practical, and 2) expanding the database through new reconnaissance survey structured to widely sample Park landforms and environmental zones. These efforts resulted in formal documentation of 14 archaeological sites (12 prehistoric and 2 historic) and 18 isolated finds for which formal site designation was not warranted, pending subsurface reconnaissance techniques. Combined new and previous surveys brought the number of formally documented prehistoric sites and isolated finds to 38. Formal documentation for each of these, and the two newly documented historic sites, is included in the separately bound *1995 Reconnaissance Data* volume (Burtchard and Hamilton 1998).

In addition to formally documented prehistoric places, at the close of 1995 the Park had 24 unconfirmed prehistoric or early historic localities for which location and artifact information are sufficient to warrant confirmation survey. In sum, the total formally documented and solid, but unconfirmed, sites and isolates stood at 62. Figure 1.2 shows the presently known distribution of prehistoric localities in relation to the Park's general environmental zones. Undoubtedly, by the time this report is read, the number will have increased further.

The salient point to be taken in this brief introduction is that the Park's prehistoric archeological record is robust, represented on all sides of the mountain, and biased toward subalpine to alpine habitats and the subalpine/forest ecotone. A complete account of the Park's archaeological history and summary results of the present effort is presented in Chapters 3 and 4 of this report. Appendix A lists all reported prehistoric sites and isolated finds in Mount Rainier National Park through 1995. Detailed site-specific description of 1995 survey results with map, verbal and photographic documentation of the Park's prehistoric (and two historic) localities is the primary focus of the separately bound *1995 Reconnaissance Data* companion volume (Burtchard and Hamilton 1998). In essence, that volume addresses project goals 3 and 4 above. It is intended for professional audiences requiring detailed site specific information for management or research purposes.

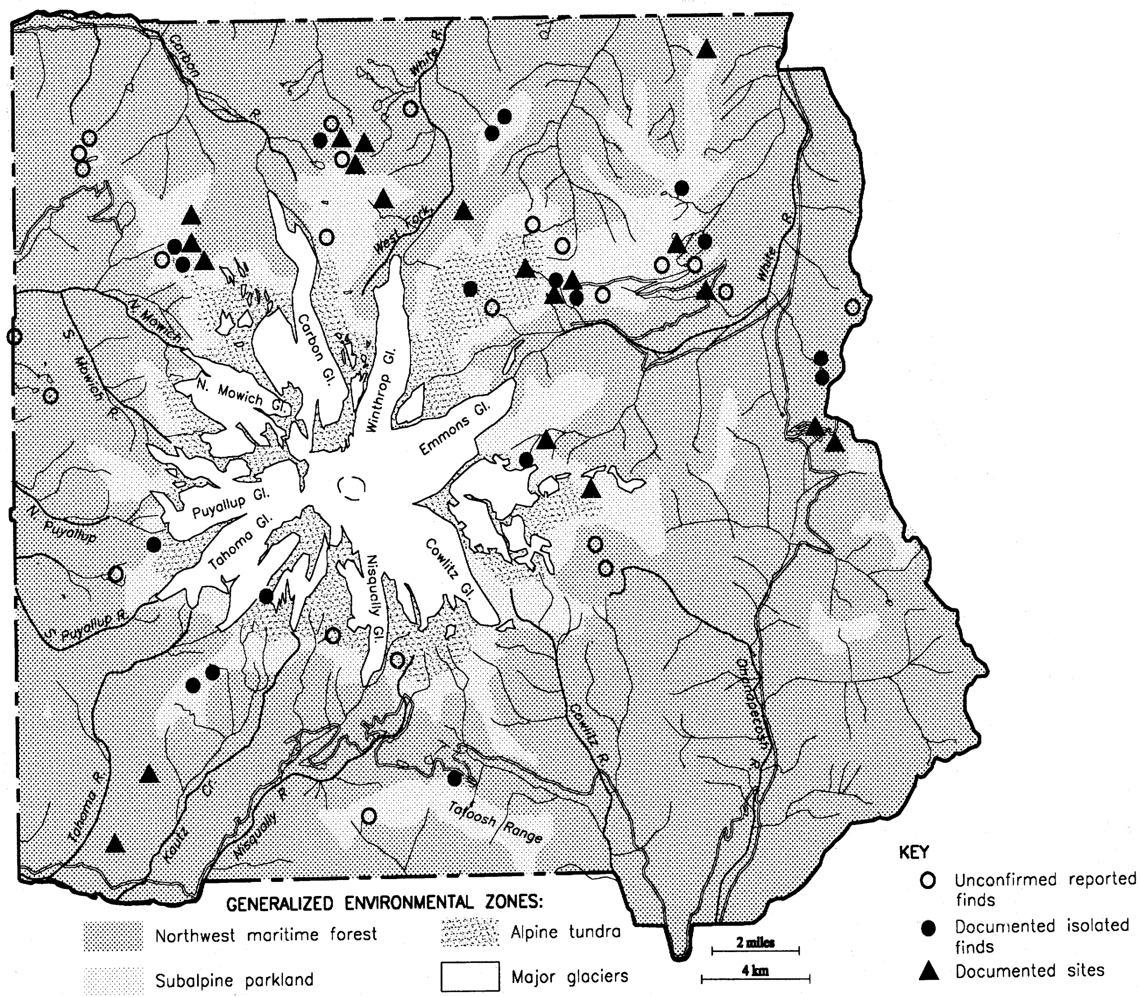

Figure 1.2 Sites, Isolates and Reported Prehistoric Finds in Mount Rainier National Park

The second half of the report emphasizes the manner in which the Park's prehistoric record relates to larger environmental, archaeological and land-use issues (goals 1 and 2 above). The primary intent is to describe and model long-term environmental and human land-use patterns, evaluate the extent to which these patterns are consistent with the Park's known archaeological record, and use combined results as a foundation for continuing inventory and data recovery recommendations.

The present report is organized into six chapters. Chapter 2 describes Mount Rainier's physiography, climate, floral and faunal patterns; emphasizing elements considered most critical for attracting and conditioning prehistoric human use. Chapter 3 is divided into two sections. The first, written by Rick McClure, provides archaeological background of the southern Washington Cascades in the near vicinity of Mount Rainier National Park. The second section summarizes cultural resource efforts that took place in the Park prior to the present reconnaissance. Initial sections of Chapter 4 describe current reconnaissance procedures and summarize results. The third section of that chapter, co-authored by Steve Hamilton, uses field analyzed lithic data to characterize assemblage and site variability on Mount Rainier. The fourth section summarizes relationships between specific environmental and landform characteristics and prehistoric site density. Chapter 5 focuses on land-use patterns. Its first section is a preliminary model of site types and distribution patterns in the Park. The second part draws on environmental data, and population and evolutionary ecology to develop an intensification model of changing subsistence and settlement patterns for Mount Rainier and the southern Washington Cascades. Chapter 6 pulls together what is known about Mount Rainier archaeology to develop long range interpretive, protection and research recommendations. Appendices provide supporting detail for information included in the body of the report. It is hoped that combined results will improve our understanding of the manner in which the montane environment has been used over long stretches of time, and in so doing will broaden our appreciation of *Tahoma's* multi-faceted character.

Chapter 2

ENVIRONMENT AND LAND-USE ON MOUNT RAINIER & IN THE SOUTHERN WASHINGTON CASCADES

At 14,410 ft, Mount Rainier is the highest, most massive peak in the Cascade Range. It is surrounded by a relatively broad massif of lesser, though locally precipitous mountains, most in the range of 6,000 to 7,000 ft in elevation. Because of combined effects of elevation, mass, latitude and position relative to Pacific westerlies, Mount Rainier sustains the single largest glacier system in the 48 contiguous states. These glaciers are the source of several major Northwest rivers—the Nisqually, Mowich/Puyallup, Carbon and White Rivers draining into Puget Sound; and the Ohanapecosh/Cowlitz system emptying into the Columbia River at Longview north of Portland (Harris 1988:231). Figure 1.1 on page 2 shows a simplified projection of the mountain and its relationship to surrounding landforms and rivers.

Park boundaries form an approximately square 235,612 acre box around the base of the mountain and the northern fringe of the Tatoosh Range on Rainier's southern flank. Environmental characteristics vary with elevation, relative moisture (that is, lee versus windward flanks) and landform. Over the years, different taxonomic systems have been employed to characterize environmental patterns across Mount Rainier and its surrounding terrain (e.g., Brockman's [1947] use of elevational life zones, Franklin and Dyrness' [1973] classic vegetation zones of Oregon and Washington, and Moir's [1989] matrix treatment of Mount Rainier forests). Such schemes emphasize gross patterns in floral, principally forest, composition to present a complex reality in a simpler more comprehensible form.

In this chapter, Mount Rainier's environmental characteristics are classified in a five-part system that draws on existing environmental models—particularly Franklin and Dyrness (1973), but does so in a manner that emphasizes vegetation/resource zones of differential value to prehistoric human populations. Zones used here include 1) expansive low to mid-elevation Northwest maritime forests; 2) major river systems and associated floodplains; 3) subalpine parklands; 4) alpine tundra; and 5) perpetual snowfields, glaciers and glacial scree slopes. While not a vegetation zone *per se,* the rivers and floodplains distinction accommodates resources (especially anadromous fish) and land-use practices not otherwise expected in the forest to alpine environment. The system is similar to that employed by the author to examine archaeological/environmental associations on the flanks of Mt. Hood in the northern Oregon Cascades (Burtchard and Keeler 1991), and is compatible with systems used to characterize Olympic National Park (Schalk 1988) and North Cascades National Park (Mierendorf 1986) environments. With the addition of lower elevation or more xeric associations, the system can readily be extended to other landforms in and adjacent to the Cascades.

Use of an environmental zone model to characterize Holocene floral and faunal associations (and human land-use patterns) is complicated by at least two variables—dynamic Mount Rainier geology, and Holocene climate change. To gain some control over these issues, this chapter is organized into sections that describe the nature and archaeological implications of each. The first section, is a discussion of local geology with general implications for environment, land-use and the archaeological record. The second describes basic environmental/resource patterns, emphasizing resources believed to be particularly important for attracting systematic human use during prehistoric times. The third section discusses the possible impact of Holocene environmental changes on land-use patterns, and suggests means to improve our understanding of regional paleoclimate. A summary of Mount Rainier environment and long-term use by human populations concludes the chapter.

MOUNT RAINIER AND SOUTHERN WASHINGTON CASCADES GEOLOGY

The Cascade Range may be divided into two north to south physiographic provinces with Mount Rainier in the middle. The broad *North Cascades* province extends from the Frazier River in southern British Columbia to Snoqualamie Pass between Glacier Peak and Mount Rainier. The more elongate, narrower *South Cascades* province extends from the pass (or Mount Rainier) south, across the Columbia River, ultimately terminating at California's Mount Lassen (see Harris 1988 and Whitney 1983:15-30; Burtchard 1990:33-36). Partially due to its position at the northern extreme of the southern province, Mount Rainier's geology shares certain characteristics of each.

Environmental Implications of General Cascades Geology

There are substantial differences between North and South Cascade physiographic provinces that influence environmental and resource patterns in each.[4] The **North Cascades Province** is a massive area of old metamorphic and sedimentary rock rafted ashore over 50 million years ago. In origin, these mountains are more closely related to British Columbia's Coast Mountains and Washington's Olympics than to the Cascades further south. The North Cascades also are a substantially broader and higher massif composed of rugged high elevation peaks with deeply incised valleys. Vertical relief tends to be high with elevations ranging from near sea level in major valleys to over 9,000 ft on many of the North Cascade peaks. Due to elevation, breadth, and proximity to moist Pacific storms, the province supports the largest overall number of active glaciers in the lower 48 states.

North Cascades geomorphology has had a marked influence on regional climate, exploitable resource structure and, hence, human use throughout the Holocene. Regional rock types include a variety of geologically distinct exposures, a number of which are suitable for tool manufacture. Forest cover is influenced by exposure and elevation. Maritime forests blanket the western slopes from sea level to timberline at about 5,500 ft. On the eastern slope, forests extend from about 1,000 ft to timberline at 6,500 ft. Timberline on both sides is controlled by deep snow pack that persists into mid-summer. It is possible that presence of expansive open habitat supported abundance and variety of floral and faunal resources throughout the Holocene. As in the south, rivers and tributary systems provide entry for anadromous fish. There is little doubt that available resources were sufficient for seasonal use by local populations, provided strategies could accommodate the short growing season and logistical difficulties imposed by rugged terrain, relatively massive breadth and unstable high elevation weather. While not part of the North Cascades *per se*, it is important to note that most of these environmental qualities and land-use implications apply to Mount Rainier as well.

The **South Cascades Province** is a generally narrower band of old, highly weathered volcanic mountains, tilted and partially overlain by younger and higher, spatially isolated stratovolcanos along its eastern axis (e.g., Rainier, Adams, Hood, Jefferson, McLoughlin, Shasta and Lassen among others). Most high Cascade mountain building volcanism took place in the Pliocene and Pleistocene 4½ to 3 million years ago, with localized, but significant, activity throughout the Holocene. Except for the high peaks,

[4] Robert Mierendorf, North Cascades National Park archaeologist, contributed to the North Cascades discussion, originally written for inclusion in Columbia Cascade Systems Support Office's Systemwide Archeological Inventory Program report (Schalk 1997).

few of the South Cascade mountains rise above timberline. Forest cover tends to be dense on the western slope grading to more open fir and pine forests on mid to lower elevation eastern slopes. The high peaks, however, are ringed by subalpine and alpine zones that support a variety of floral and faunal resources. Unlike the north, however, parkland and tundra zones are seldom interconnected, but tend to occur as independent, island-like patches within a more uniform forest cover.[5] The South Cascades also have complex drainage systems, many of which support anadromous fish populations.

At a very general level, the entire Cascade Range offered roughly similar economic opportunities and posed comparable constraints to prehistoric people. Both northern and southern provinces offered seasonally available food, fiber, and lithic resources. Severe weather effectively precluded over winter residence in both, and montane landscapes posed varying degrees of logistical difficulty. However, because of their narrower breadth and gentler physiography, the South Cascades probably posed less severe impediments to seasonal use. Vertical relief and distances were less imposing; and with the exception of the highest Cascade peaks, weather was more predictable; making possible longer seasonal use. These effects were counterbalanced to an unknown extent by the small size and isolated character of productive subalpine and alpine resource zones.

Situated near the boundary of the two provinces, Mount Rainier shares characteristics of both. Indeed it is reasonable to refer to montane landscapes from Rainier south to the Columbia River as the **southern Washington Cascades** physiographic region. Doing so recognizes the area's distinct geological and environmental qualities that distinguish it from its Cascade neighbors to the north and south. Franklin and Dyrness (1973:21-23) offer perhaps the best general summary of these characteristics. Near Mount Rainier, they emphasize the North Cascades-like pattern of accordant ridge crests separated by steep, deeply dissected valleys. Here, ridge crests are relatively high (averaging circa 2,000 m [6,560 ft]), decreasing abruptly to the south (circa 1,200 m [3,936 ft]). Volcanic rock dominates lithic exposures. To a greater extent than elsewhere, southern Washington Cascade landforms are mantled with pumice deposits of variable age, origin and thickness (Franklin and Dyrness 1973:22). Most of these deposits are from Holocene eruptions on Mount Rainier and St. Helens—events which periodically buried the material remains of prehistoric populations using these mountains. Figure 2.1 shows the southern Washington Cascades in relation to surrounding physiographic provinces/regions.

The contrast between the southern Washington Cascades and mountains south of the Columbia River is most sharply visible near Mount Rainier. Mount Rainier's great height and mass supports larger glacial, alpine and subalpine expanses than its southern counterparts. The mountain's size also creates a pronounced rainshadow effect on its northeastern flank, making for more open, patchy forest cover than would otherwise be expected. Furthermore, the breadth, elevation and deeply incised character of the surrounding mountain and ridge system is greater than that further south, mimicking the North Cascades pattern. These qualities make for expansive subalpine and alpine habitats (particularly on Mount Rainier) but make them more logistically challenging to exploit by lowland-based populations. To a greater extent than most of the Southern Cascades, Holocene vulcanism altered the character of the archaeological record through repeated tephra deposits and by destructive mass wasting events (especially lahars).

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[5] Perhaps because of these characteristics, there presently is no unequivocal evidence for mountain goats or sheep south of the Columbia River.

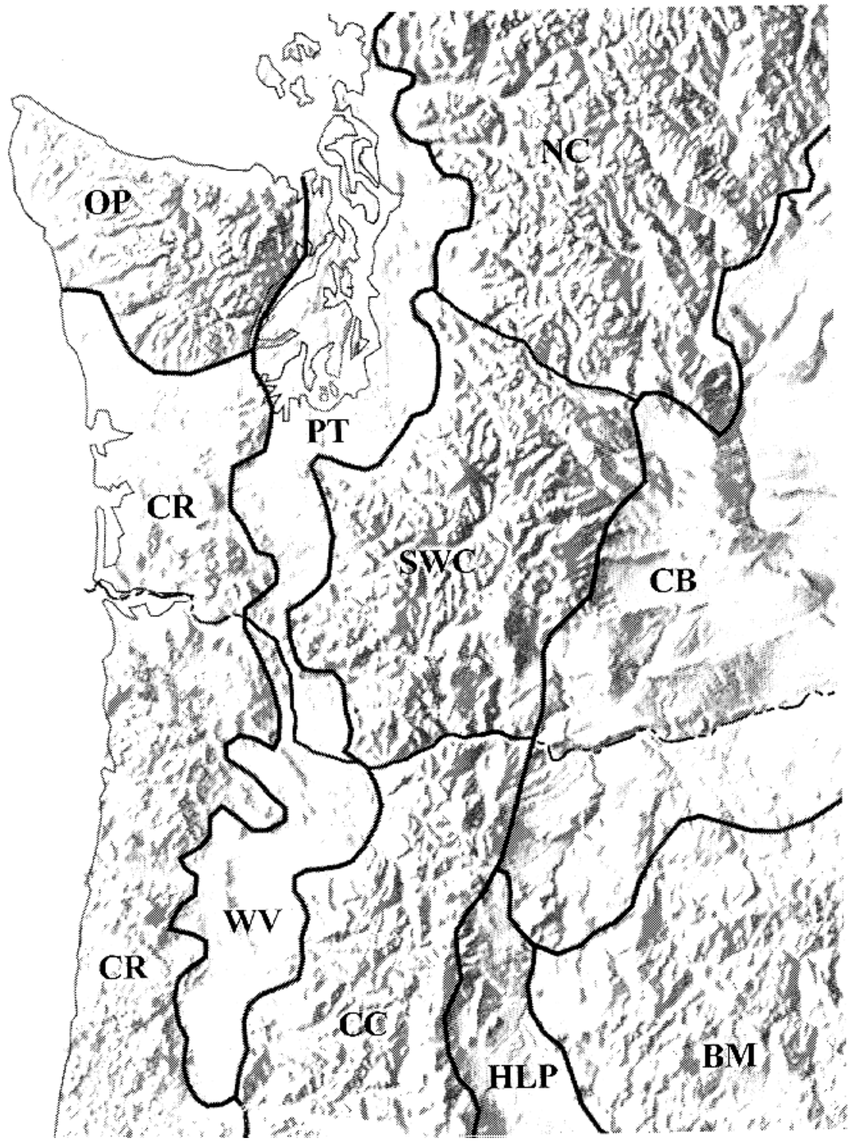

Figure 2.1 Southern Washington Cascades and Surrounding Physiographic Provinces (after Rosenfeld 1993:41; see also Franklin and Dyrness 1973:6. Mount Ranier is about ½ inch above the "C" in SWC)

Key: (approx. north to south)

OP: Olympic Peninsula	PT: Puget Trough	NC: North Cascades
CR: Washington Coast Range	**SWC: Southern Washington Cascades**	CB: Columbia Basin (Plateau)
CR: Oregon Coast Range	WV: Willamette Valley	CC: Central Cascades
	HLP: High Lava Plains	BM: Blue Mountains

Mount Rainier Holocene Geology

The modern appearance of Mount Rainier and the southern Washington Cascades is the culmination of Pliocene-Pleistocene mountain building and substantial Holocene modification. By 75,000 years ago, Mount Rainier had reached a height of about 16,000 ft (Harris 1988:240). Though modified by extensive glaciation, the mountain maintained much of that height until after the close of the Fraser/Wisconsin glacial episode circa 15,000 to 13,500 years ago. Most of the subsequent volcanic events that reduced, rebuilt and modified Mount Rainier's shape occurred during the last 7,500 to 5,000 years—a period that undoubtedly witnessed increasing human presence in the general region and on the mountain itself.

The single most massive destructive event (or series of roughly synchronous events) to affect Mount Rainier were the Paradise-Greenwater-Osceola mud and debris flows (lahars) occurring between 5,000 and 4,500 years ago (Scott et al. 1995:12). These events apparently were stimulated by eruption and collapse of Mount Rainier's summit; releasing tremendous volumes of ice, mud and unconsolidated debris down the east and northeastern facies of the mountain (Harris 1988:243). Most of the material (Greenwater and Osceola mudflows) rushed over Steamboat Prow and down both forks of the White River; covering lowland floodplains from the base of the mountain to the Puget lowlands as far away as Auburn, Washington near Tacoma. The Paradise lahar emanated from the same source, but flowed south then west down the Paradise and Nisqually Rivers beyond Ashford, west of the Park boundary. Limited deposits extended down the Nisqually as far as Yelm near Olympia (Crandell 1971; Pringle 1994:2G-1). These events removed about 2,000 vertical feet from Rainier's summit and erased the archaeological record of early Holocene human activity in its affected river valleys. Figure 2.2 shows the extent of the major Mount Rainier lahars, including the more recent Electron mudflow.

About 2,500 to 2,300 years ago, renewed eruptive activity on Mount Rainier filled the Osceola crater and rebuilt the mountain summit to approximately its present 14,410 ft height. This eruption ejected coarse-grained tephra (Mount Rainier Pumice Layer C) over the cone and much of the northeast and southeast quadrants of the Park. Gravelly Rainier C tephra is the modern surface on some of the Park's most familiar landscapes such as Sunrise Ridge and rolling alpine tundra between Frozen Lake and Berkeley Park. Deposits range from 2.5 to 20 cm (1 to 8 in) thick. We know that human use of the mountain predates this event by virtue of lithic debris eroding from below Rainier C tephra in borrow pit cut banks on the south slope of Sunrise Ridge (site FS 90-01 or 45PI408). It is likely that more rapid drainage qualities of the gravely tephra contributes to prevalence of patchier forest cover on the mountains lee. Mount Rainier C deposits also make site discovery more difficult, while simultaneously providing a protective, time-diagnostic cap over such deposits once found.

Lava flows associated with the Mount Rainier C eruption were limited to areas near the summit. However, these events spawned lahars which crashed into the White and Nisqually River valleys, again inundating and temporarily raising these valley floors within Park boundaries (Harris 1988:246). On these floodplains, the archaeological record again would have been effectively destroyed.

The most recent major lahar was the Electron mudflow about 500 years ago. This large, clay-rich mudflow (similar in composition to the Osceola flow) poured down the Puyallup and Mowich Rivers on Rainier's western slope. Though less massive than the Osceola flow, it inundated the Puyallup valley floor for almost the same distance into the Puget lowlands (see Figure 2.2). Lesser lahars occurred throughout the Holocene, continuing to the present. The above events are stressed to provide general familiarity with them because of their large scale and consequent impact on the archaeological record. The relatively high frequency and destructive power of such events points to a broader problem in interpreting the archeological record (or absence thereof) along Mount Rainier's river valley floodplains.

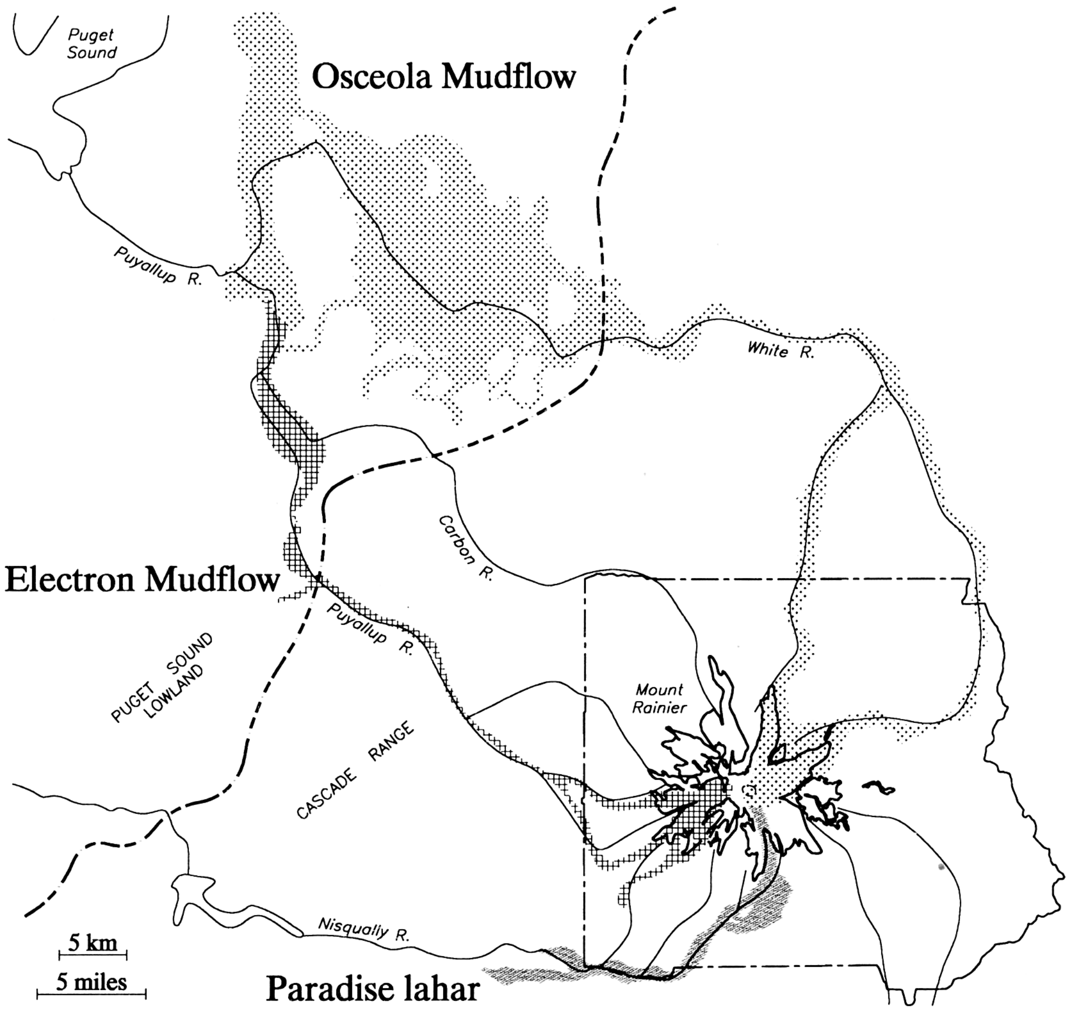

Figure 2.2 Major Mount Rainier Lahars (after Crandell and Mullineaux 1967, and Crandell 1971)

Mount Rainier's Holocene geological activity has not been limited to the destructive and creative events noted above. Of some importance to the archaeological record are Holocene tephra producing eruptions by Mount Rainier, Mt. St. Helens, and Mt. Mazama (now Crater Lake) in Oregon. Holocene eruptions from these sources created a complex patchwork of varying depth volcanic deposits, affecting different parts of the Park at different times during the period that humans could have used the mountain. While many of these events provide useful temporal markers for the Park's archaeological record, none are considered to have been of sufficient magnitude to have significantly altered montane land-use patterns in the southern Washington Cascades.

Our understanding of the mountain's volcanic deposition patterns remains incomplete (Pringle pers. com. 1995), but will improve as ongoing dating and mapping studies progress. Available sources have been consulted to provide an outline of depositional eruptive events known to have affected the Park in the last 10,000 years (Table 2.1). Figure 2.3 shows the approximate distribution of the best understood layers. The basic reference for Table 2.1 and Figure 2.3 is Crandell (1987)—who credits most of his information to studies by D.R. Mullineaux. All radiocarbon ages and partial data sets are from Scott et al. (1995) and Pringle (1994).

Critical points to be made about Mount Rainier's Holocene geology are: 1) the mountain has been extraordinarily active during the time-frame in which humans could reasonably be expected to have used the Park; 2) these events to varying degrees modified the physical structure of the mountain; and 3) these events affected the archaeological record and, to a lesser extent, the character of prehistoric land-use practices. The most dramatic impacts involved destruction of very high elevation landscapes near the summit; and lahar destruction, in filling and subsequent down cutting of major river valleys. Because of extreme elevation, the effect on human use by the former should have been slight.

The impact on river valley land-use practices is more difficult to estimate. Repeated stream flow alteration undoubtedly had a negative effect on native and anadromous fish. Even so, it is likely that fish populations would have returned quickly once affected rivers regained stable streambeds. The primary impact may have been more to resource predictability than to absolute presence/absence *per se*. The latter is controlled by waterfalls and other major upstream impediments which limited anadromous fish to relatively few Park watercourses. Because of downstream obstructions and lahars emanating from above, human use of Mount Rainier's river valleys is likely to have *never* been important; particularly when compared to relatively resource-rich subalpine and alpine habitats. Unfortunately, repeated inundation of the floodplains makes riverine use difficult to examine empirically.

Table 2.1 Sources and Ages of Volcanic Deposits on Mount Rainier

Tephra Layer	**Thickness (in)**		**Fragment**	**Color**	**Source**	**Age**
	West	**East**	**Dia. (in)**			**(^{14}C years ago)**
X	Absent	1	¼ - 2	Light olive gray	Mount Rainier	100 - 150
W (W_n)	0 - 1	1 - 3	Medium sand	White	Mt. St. Helens	470
C	Absent	1 - 8	¼ - 8	Brown	Mount Rainier	2300
P					Mt. St. Helens	2500 - 3000
Y (Y_n)	5 - 20	1 - 5	Coarse sand	Yellow	Mt. St. Helens	3400
B					Mount Rainier	4500
H					Mount Rainier	4700
F (poss. blast)					Mount Rainier	5000
S (poss. blast)					Mount Rainier	5200
D	Absent	0 - 6	¼ - 6	Brown	Mount Rainier	5500 - 6500
L	Absent	0 - 8	¼ - 2	Brown	Mount Rainier	5500 - 6500
N & A					Mount Rainier	5500 - 6500
O	1 - 3	1 - 3	Flourlike to fine sand	Yellowish orange	Mt. Mazama	6800
R	Absent	0 - 5	⅛- 1	Reddish brown	Mount Rainier	>8750

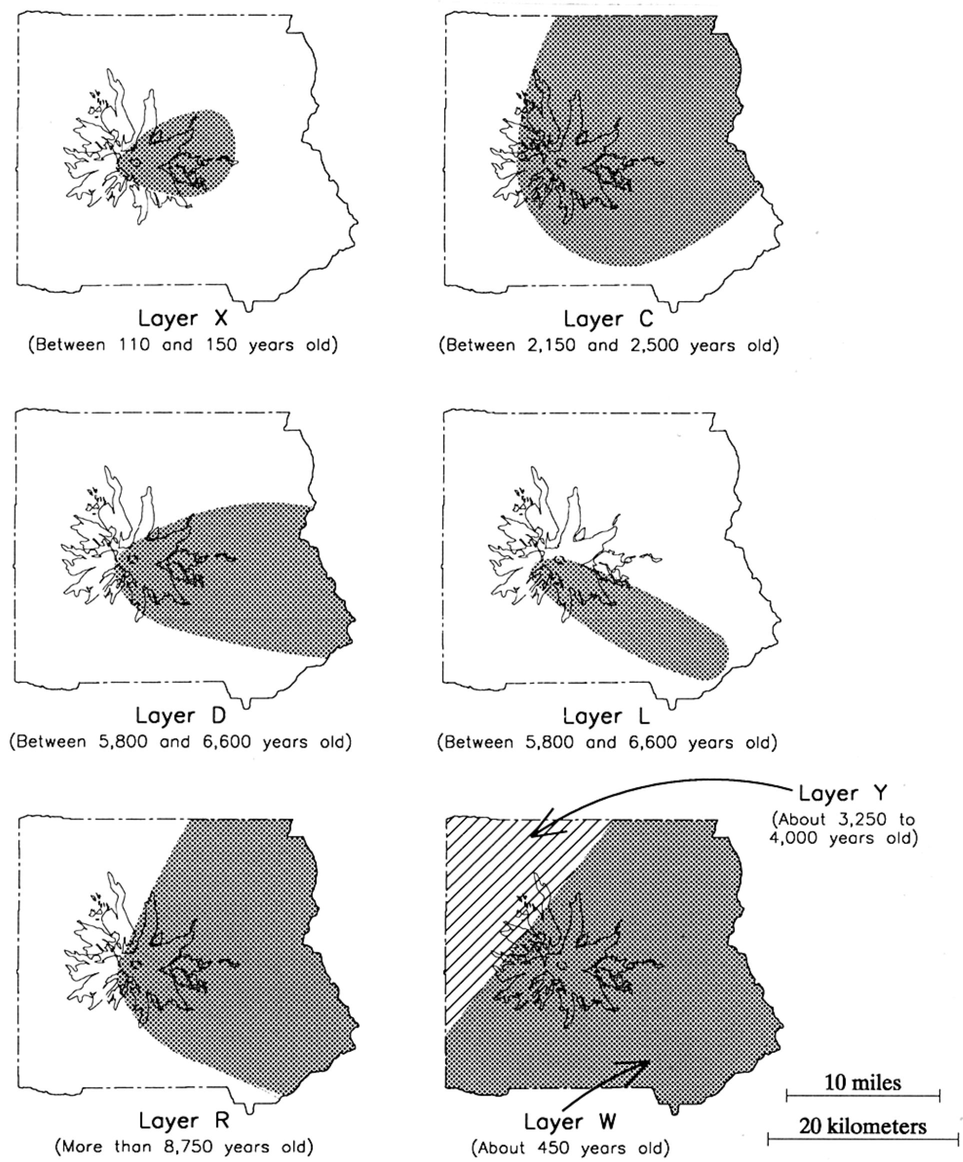

Figure 2.3 Distribution of Selected Volcanic Deposits on Mount Rainier (after Crandell 1987:14)

None of Mount Rainier's Holocene volcanic deposits were deep enough to have disturbed plant and animal associations in a massive way. Floral and faunal perturbations are likely to have been relatively short lived with insufficient impact on land-use patterns to show in the archaeological record. Even so, the tephra deposits make cultural remains substantially more difficult to locate. During the current reconnaissance, Mt. Mazama tephra was observed between 80 and 100 cm deep in several locations in the Park's NE quadrant. On the south flank of Sunrise Ridge, lithic debris were sandwiched between St. Helens Y_n and Rainier C deposits 25 cm below the modern ground surface. While depth of cultural deposits vary with age and position on the mountain, it is clear that efforts must be made to locate prehistoric materials in subsurface context. It is important to recognize that materials documented by surface reconnaissance alone will tend to under-represent actual prehistoric site count, under-represent materials variability and abundance at identified sites, and bias results toward more recent, shallow deposits.

ENVIRONMENTAL ZONES, RESOURCES AND HUMAN LAND-USE PATTERNS

Ecological Maturity, Resource Abundance and the Northwest Maritime Forest

Due to similar latitude and position relative to Pacific westerlies, the Cascades share general climate and environmental patterns. The Coast Range, Puget Trough, Olympics and Cascades are exposed to a relatively mild, seasonally wet maritime climate along the foothills and western slopes. As Pacific air masses flow over the high Cascades and down the eastern slope, adiabatic warming increases moisture holding capacity and induces the drier climatic regimes characteristic of the Columbia Plateau.

In direct response to moist, relatively stable climatic conditions, the greater northwest maritime region tends toward states of high ecological maturity; that is, toward generally dense, stable forest cover. While not alluding to maturity directly, Heusser (1983:241), citing Waring and Franklin (1979), emphasizes this effect for the Pacific Northwest.

> The climatic regimen of winter storms (with protracted periods of moisture and cloudiness, summers with relatively short intervals of soil-water loss, and moderate temperatures over much of the year) is very favorable for tree growth and accounts for the dense coniferous forests of the region. The forests with massive trees of great longevity are unrivaled among temperate forest regions of the world.

In a natural state, dense hemlock and fir forests carpet much the region from the Puget Trough, to the eastern slopes of the southern Washington Cascades. Though specific plant communities vary in response to micro-climate and sediment differences, and especially to forest perturbation (lahars, winds and fires), the general tendency is toward mature, wet forest conditions up to about 5,500 ft above sea level near Mount Rainier. I refer to this mature forest pattern as the *Northwest Maritime Forest* (see Burtchard and Keeler 1991:17-32). At higher elevations, Pacific Maritime Forests give way to subalpine parkland, alpine tundra, and, on the highest peaks, to glacial snowpack and rubble. On the eastern slope, maritime fir forests grade to more xeric interior pine stands and ultimately to the shrub steppe of the Columbia Plateau.

Forest maturity patterns are important because they are linked to the distribution and abundance of edible plant and animal resources in the maritime Northwest. In a mature or late successional state, Northwest Maritime Forests are difficult places to live. Food sources are limited by the tendency of uniform, high maturity forests to lock up most of their energy and nutrient budget in standing biomass (principally cellulose). A relatively small percentage goes to edible foliage or reproductive parts (see Pianka 1974:89-90; Odum 1971:385; and Whittacker 1975:137).[6] Edible biomass is highest not in the forest proper, but in lower maturity subalpine parkland and alpine tundra associations above the forest line, or at other places where forest cover has been reduced temporarily by fire, landslides, lahars or other sources of disturbance. Consequently, in the Cascades and on Mount Rainier, the most productive habitats over the long term are alpine grasslands, patchy subalpine forest, open wet meadow associations, and patchy interior pine forests (not represented in the Park).

[6] These arguments are more fully developed in an earlier study of environmental and site distribution patterns in Mt. Hood National Forest (Burtchard and Keeler 1991; see also Appendix C in this volume).

Disturbance related low maturity areas are productive as well, but tend to be temporary; closing as the maritime forest regenerates. Laced through this general pattern are salmon bearing rivers and tributary streams locally capable of sustaining intensive human use given sufficient need and labor to meet extraction and storage demands.

In short, high maturity tendencies of the Pacific Maritime Forest tend to suppress food resources necessary to sustain prehistoric populations. In order to maximize access to seasonally available game and edible plants, successful groups were obliged to focus their activities toward lower maturity or earlier succession zones regardless of cultural affiliation or idiosyncratic preferences (i.e., toward open to patchy habitats however they were created and maintained). Accordingly, the key to understanding patterned prehistoric use of Mount Rainier, lies in large measure in our ability to understand the distribution of low to higher maturity habitats within the general forest regime. The following sections address this issue.

Mount Rainier Environmental Zones and Human Use

Several taxonomic systems have been devised to characterize forest or plant associations in the Pacific Northwest. The earliest widely applied system characterized forest constituents in terms of south to north latitudinal patterns for the North American continent; keyed to roughly comparable elevation zones on Mount Rainier. In their manuals on Mount Rainier flora and fauna, Brockman (1947) and Taylor and Shaw (1927) used this system to distinguish Humid Transition and Canadian, Hudsonian subalpine forest, and Arctic-Alpine snowfield and tundra zones for the Park. Even though the system oversimplifies local variability, it nonetheless provided useful distinctions between modal plant and animal communities that result from elevationally induced variation in growing season and snowpack.

Perhaps the best known environmental taxonomy for Oregon and Washington was developed by Franklin and Dyrness (1973). Because of its descriptive rigor and applicability to varied settings, this work has become the *de facto* standard for archaeologically-related environmental descriptions in the Northwest. Franklin and Dyrness' system improves on earlier continental zones by emphasizing combined effects of physiography, climate, and sediment structure to map climax plant associations. For the southern Washington Cascades and Mount Rainier, climax forest zones include 1) *Tsuga heterophyla* (western hemlock) forest at lowest elevations; grading to 2) *Abies amabilis* (Pacific silver fir) associations on intermediate slopes; and 3) *Tsuga mertensiana* (mountain hemlock) forests above 1,250 m (4,100 ft). Mountain hemlock associations become increasingly patchy toward timberline until dominated more by subalpine meadow grasses, sedges and composite flowers than by trees. Fully alpine tundra grasslands are situated between timberline and permanent snowfields above circa 8,000 ft. As will be seen, the system used in the present report builds on Franklin and Dyrness' scheme by grouping *Tsuga heterophyla* through lower *Tsuga mertensiana* forests into the single *Northwest Maritime Forest* class that emphasizes their shared tendency toward high maturity.

In *Vegetational History of the Northwestern United States*, Heusser (1983:243) models forest associations from the Puget Trough to the crest of the southern Washington Cascades near Mount Rainier. He emulates Franklin and Dyrness' distinctions but couches them in terms more easily recognized as forest/landscape types. Heusser's model (Figure 2.4) is included below because of its similarity to environmental distinctions used here, and because it simulates a mountain profile, drawing attention to the effects of decreasing temperature on key vegetation constituents. Modifications are indicated in brackets.

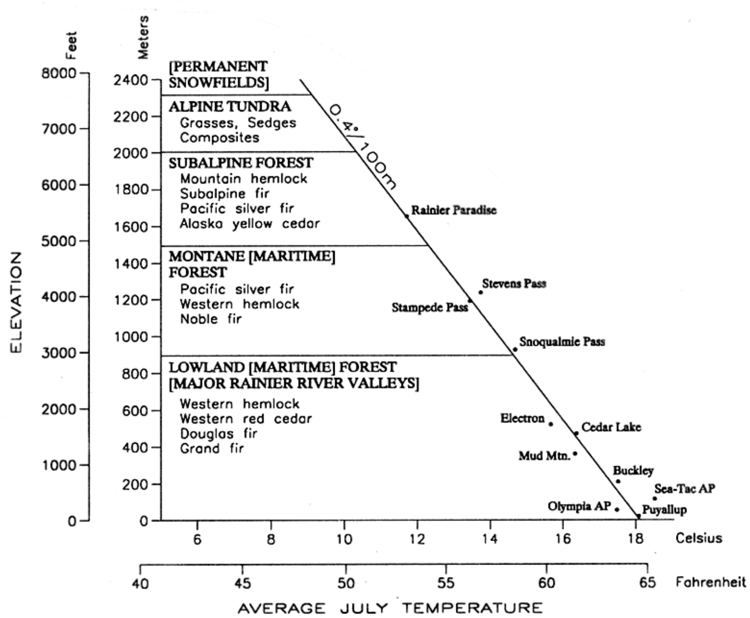

Figure 2.4 Vegetation Zones: Puget Trough - S. Washington Cascades (after Heusser 1983)

The most thorough consideration of forest association patterns for the immediate project area is Franklin et al.'s (1988) *The Forest Communities of Mount Rainier National Park.* The authors identify a mosaic of climax associations keyed to four Park quadrants and associated river systems. Elevation and moisture related variability in floral composition and understory dominants are used to provide a more realistic picture of plant associations in various parts of the Park. Importantly, the authors move beyond the three-part high maturity/climax plant association system to consider maturity reducing impacts of major fires, avalanches and lahars. Figure 2.5 is a simplified mosaic of Mount Rainier National Park habitat types as affected by temperature (i.e., elevation) and precipitation (primarily windward versus leeward position on the mountain). It provides a notion of the complexity that underlies simpler forest constructions; and draws attention to an important food resource —*Vaccinium* — as an understory constituent and seral dominant when *Abies amabilis* forests are disturbed by fire (see the ABAM/VAAL association in Figure 2.5). Interested readers should refer the complete volume (see also Moir 1989) for detailed consideration of Mount Rainier floral associations.

Useful as it is for developing a thorough understanding of Mount Rainier forest ecology, the Franklin et al. (1988) study is unnecessarily complex for present purposes. The most salient issues are those that address relative forest maturity, distribution and abundance of food resources, and factors that alter the forest's maturity/resource balance. It already has been emphasized that in general 1) Northwest Maritime Forests tend toward high maturity; 2) variety and abundance of game and edible plant resources tend to vary inversely with maturity; 3) maturity decreases in a more or less regular, predictable fashion with elevation, maximizing food resource abundance in subalpine and lower alpine habitats; and 4) maturity is reduced in an irregular, less predictable fashion in response to large fires and other forest disturbing phenomena. To accommodate these considerations, the system outlined below isolates five environmental zones that includes three major plant associations keyed to variable maturity and resource distribution patterns; a low elevation river valley subzone; and high elevation glacier/ permanent snowfield category. The maturity reducing effect of fire on forest habitats is discussed as well.

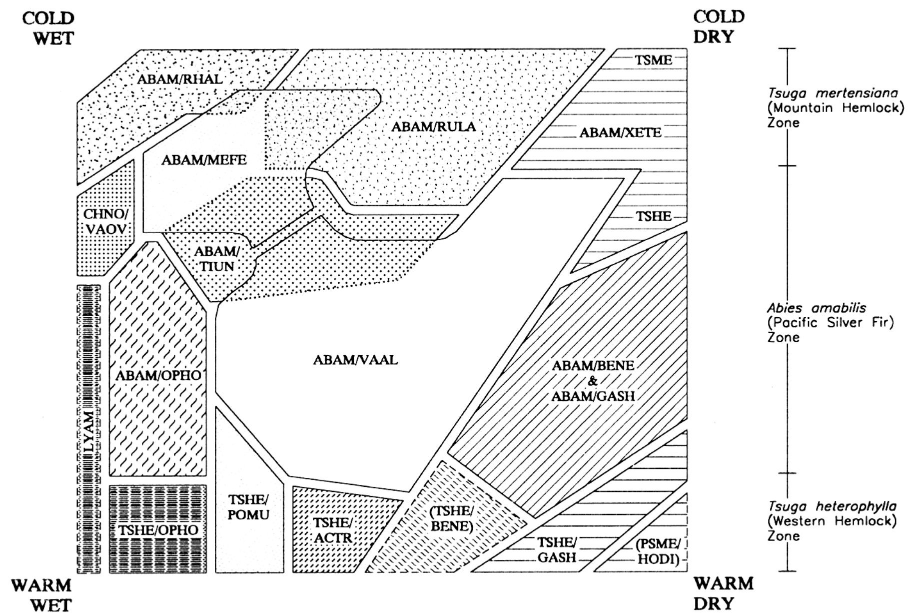

Figure 2.5 Generalized Distribution of Mount Rainier Habitat Types (after Franklin et al. 1988:34)

Key: "*"indicates historically collected species; "!" indicates high economic importance (see Smith 1964 and Gunther 1973)

ABAM: *Abies amabilis* (Pacific silver fir)
ABLA: *Abies lasiocarpa* (subalpine fir)
ABPR: *Abies procera* (noble fir)
ACTR: *Achlys triphylla* (deerfoot vanillaleaf)*
ALRU: *Alnus rubra* (red alder)
ARUV: *Arctostaphylos uva-ursi* (kinnikinnick)*
BENE: *Berberis nervosa* (Oregon grape)*
CEVE: *Ceanothus velutinus* (snowbush ceanothus)
CHNO: *Chamaecyparis nootkatensis* (Alaska Cedar)*
ERMO: *Erythronium montanum* (avalanche fawnlily)*
GASH: *Gaultheria shallon* (salal)*
HODI: *Holodiscus discolor* (creambush oceanspray)
LYAM: *Lysichitum americanum* (skunk cabbage)
MEFE: *Menziesia ferrunginea* (rustyleaf)
OPHO: *Oplopanax horridum* (devilsclub)*
POMU: *Polystichum munitum* (swordfern)
PSME: *Pseudotsuga menziesii* (Douglas fir)
RHAL: *Rhododendron albiflorum* (Cascades azalea)
RULA: *Rubus lasiococcus* (dwarf blackberry)*
RUSP: *Rubus spectabilis* (salmonberry)*
TIUN: *Tiarella unifoliata* (western coolwort)
TSHE: *Tsuga heterophylla* (western hemlock)
TSME: *Tsuga mertensiana* (mountain hemlock)
VAAL: *Vaccinium alaskaense* (Alaska huckleberry)*!
VAOV: *Vaccinium ovalifolium* (oval-leaf huckleberry)*!
VASI: *Valeriana sitchensis* (Sitka valerian)
VISE: *Viola sempervirens* (evergreen violet)
XETE: *Xerophyllum tenax* (common beargrass)*

Table 2.2 correlates the present taxonomy with those outlined above. Franklin et al.'s (1988:64-75) *modal forest ecosystem* structure is used to represent their more elaborate mosaic system. Please note that elevation breaks between all zones are approximate. Boundaries typically are more gradual than shown and vary locally with precipitation, exposure, sediment structure and so on. Alternating gray and white bands indicates zonal concordance to the system used here.

Northwest Maritime Forest

Low to Mid-Elevation Forest

Except for high elevation landscapes, Northwest Maritime Forest associations blanket most of the region from the Puget Trough to the eastern flank of the southern Washington Cascades. Western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*) are consistent low elevation dominants. Though probably a seral constituent, Douglas fir (*Pseudotsuga menziesii*) is presently the most common tree associated with low to moderate elevation forests. Salal (*Gaultheria shallon*) is a

Table 2.2 Mount Rainier Environmental Zonation Systems

Elevation (ft.)	Brockman 1947 Taylor & Shaw 1927	Franklin & Dyrness 1973	Heusser 1983	Franklin et al. 1988 (model system)	This Volume (cf., Burtchard & Keeler 1991) Windward | Leeward
≥ 10,000 – 8,000	Artic -			Permanent Snow Fields	Perpetual Snowfields & Rock Rubble
	Alpine Zone	Alpine	Alpine Tundra	Alpine Meadows	Alpine Tundra
6,000	Hudsonian Zone	Subalpine Meadows Upper *Tsuga mertensiana* Patchy Forest	Subalpine Forest	Parkland Mosaics	Subalpine Parkland
4,000	Canadian Zone	Lower *Tsuga mertensiana* Forest *Abies amabilis* Forest	Montane Forest	*Abies amabilis / Rubus labfococcus* Association *Abies amabilis / Vaccinium alaskaence* Association	Northwest Maritime Forest (Montane) (NMF - Rainier Riverine Lowlands)
2,000 – 0	Humid Transition Zone	*Tsuga heterophyla* Forest	Lowland Forest	*Tsuga heterophyla / Achlys triphylla* Association	(NMF - Lowlands)

frequent understory species (Franklin and Dyrness 1973:89). Prairies with patchy stands of Douglas fir, oak (*Quercus garryana*), and shrubs are common in the Puget Trough south of Puget Sound. Prior to modern development, these lower maturity prairies probably were maintained by low summer precipitation coupled with gravelly glacial outwash soils, and by periodic burning by Indian groups (Franklin and Dyrness 1973:89; cf., Taylor and Shaw 1927:9). The latter case illustrates the capability of humans to maintain and/or increase the productive capacity of their environment by repressing forest succession (i.e., by lowering ecosystem maturity).

Low elevation western hemlock forests grade into mid-elevation associations dominated by Pacific silver fir (*Abies amabilis*) at about 3,000 to 3,500 ft in the southern Washington Cascades. Silver fir associations are the Park's primary forest type up to circa 4,000 to 4,500 ft. This is the heart of Franklin et al.'s (1988) silver fir/Alaska huckleberry (ABAM/VAAL) and other *Abies amabilis* associations shown on Figure 2.5. Though dominated by silver fir, forest constituents vary widely with exposure and age. Other common tree species include western hemlock, noble fir (*abies procera*), Douglas fir, western red cedar (*Thuja plicata*—wet sides), and western white pine (*Pinus monticola*). Aside from *Vaccinium,* locally dominant understory constituents include Oregon grape (*Berberis nervosa*) and salal (*Gaultheria shallon*) on the dry side; and devilsclub (*Oplopanax horridum*) and skunk cabbage (*Lysichitum americanum*) in wetter areas.

Upper Elevation Forest

Above 4,500 ft, mountain hemlock (*Tsuga mertensiana*), subalpine fir (*Abies lasiocarpa*), Alaska yellow cedar (*Chamaecyparis nootkatensis*), and western white pine (*Pinus monticola*) silver fir forests become increasingly prevalent. On wetter northwest, west and southeastern exposures, Pacific silver fir tends to maintain its upper story dominance. Primary understory co-dominants, however, shift from Alaska huckleberry toward dwarf blackberry or dwarf bramble (*Rubus lasiococcus*), rustyleaf or fool's huckleberry (*Menziesia ferruginea*) and rhododendron (*Rhododendron albiflorum*) (Franklin et al. 1988:18). On the drier northeastern, lee side of the mountain, mountain hemlock tends toward upper story climax dominance, with beargrass (*Xerophylum tenax*) dominating low ground cover. Due principally to vegetation repressing effects of snowpack, closed maritime forests tend to reach only to about 5,200 ft on the wetter windward side of Mount Rainier, and to about 5,800 ft on the drier leeward side.

Forest Fauna

Taylor and Shaw (1927:11) list animals common to Mount Rainier's low to mid elevation forests as

> ...Harris woodpecker, Gairdner woodpecker, northern red-breasted sapsucker, western pileated woodpecker, western flycatcher, Steller jay, Louisiana tanager, chestnut-backed chickadee, western golden-crowned kinglet, russet-backed thrush, and western bluebird. Mammals ...are the Trowbridge shrew, brown bat, bobcat, Cooper chipmunk, beaver, and snowshoe rabbit.

Of the larger animals, black-tailed deer are present in the forest were adequate browse is available, particularly at meadow fringes. However, both deer and elk (presumed to be present prehistorically) "during the summer months ...seek the higher levels of the park, where open spaces afford more sunlight and grass. They [deer] are especially fond of burns, where the thick vegetation provides an abundance of browse" (Taylor and Shaw 1927:118). Similar considerations apply to black bear. Marmots, goats and large birds (grouse and especially ptarmigan) tend to frequent higher elevation subalpine to alpine landscapes.

It is interesting and, from a prehistoric hunter's point of view, important to note that the most abundant mid-forest animal species are relatively small birds and mammals. Even though more economically useful larger game is present where browse permits, over the long run, most successful hunters would have followed their prey *through* the forest into more open subalpine and alpine settings at higher elevation.

The Huckleberry Issue

The single most noteworthy exception to the food resource poor qualities of mature mid-elevation montane forests lies in their response to major maturity-reducing disturbances. Franklin et al. (1988:150) note that "Wildfire is, by far, the most important agent of forest catastrophe at Mount Rainier National Park, followed by snow avalanches and debris flows (lahars) (Hemstrom and Franklin 1982). Wildfires have occurred on approximately 90 percent of the existing stands, avalanches on 7 percent, and lahars on 2 percent." In cases of forest catastrophe, huckleberries are a common early successional dominant. According to Franklin et al. (1988) *Vaccinium alaskaense* is usually the most abundant of the Mount Rainier huckleberries.[7] Four other mid-elevation varieties also are common—black or big-leaf (*V. membranaceum*), blue or oval-leaf (*V. ovalifolium*) and red (*V. parvifolium*) huckleberry, and the small red grouseberry (*V. scoparium*). Cascades or dwarf blue huckleberry (*V. deliciosum*) is more common higher in subalpine settings. Western bog blueberry (*V. occidentale*) and evergreen huckleberry (*V. ovatum*) are found in low abundance, at low elevation (see Brockman 147:127-128). Abundance of all species is increased by maturity reducing forest disturbances, particularly fire, but diminishes as forest cover returns.

Because of its edible resource qualities and because deer, bears and birds are attracted to productive huckleberry grounds, *Vaccinium* may have been important to prehistoric foraging strategies. Indeed, during early historic times, huckleberry collection appears to have been the *primary* reason Indian groups came to Mount Rainier (Smith 1964:155). The most important varieties reported by Smith (1964:157-163) were oval-leaf (probably including Alaska) and big-leaf huckleberries in mid-elevation forests; and low growing dwarf huckleberries at higher elevation. Among other things, Smith goes on to discuss huckleberry drying techniques on mats and elevated racks; popular collecting grounds; the practice of setting fires to enhance huckleberry production; and packaging for downslope transport. At several points he notes the use of horse transport and coordination of berry collecting with hunting activities.

In my opinion, it is doubtful that the nutrient or caloric value of huckleberries was sufficient to overcome distance and bulk transport difficulties associated with mass harvest prior to introduction of the horse circa A.D. 1700. There is no doubt, however, that the resource was used extensively by small collecting parties emanating from various tribal groups on all sides of the mountain thereafter (see Smith 1964:149-179). Furthermore, given its history of repeated burns prior to modern fire suppression (Franklin et al. 1988:149-158), Mount Rainier could have supported substantial huckleberry habitat at ostensibly resource poor maritime forest elevations. For now, it must be recognized that burned and excessively drained mid-elevation habitats may have produced floral and faunal resources sufficient to attract significant human use in the past. The extent to which such use extended into the prehistoric past depends on the direct value of these berries as food plus the value of game co-occurring at mid-elevation berry grounds, compared to resources found at higher-elevation habitats. I suggest that despite presence of mid-elevation huckleberry habitat, the greater stability and overall higher productivity of subalpine habitats would consistently have attracted greater human use over longer stretches of time. If so, most of the Park's prehistoric archaeological record should be located in subalpine and alpine habitats with a lower frequency elsewhere.

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[7] Early accounts seldom mention Alaska huckleberry. This probably is because *V. alaskaense* and *V. ovalifolium* are difficult to distinguish by either habitat or habit (Mathews 1988:97). It is likely that early accounts identified both species simply as *ovalifoluim* (blue or oval-leaf huckleberry).

Low Elevation Rivers and Floodplains

In a sense, rivers and associated floodplains are not a distinct environmental zone *per se*, but rather are more characteristic of maritime forest stands near sea level. This is generally true of the Park's lowest major floodplains—particularly the Carbon, Nisqually and Ohanapecosh Rivers in the Park's northwest, southwest and southeast corners. Brockman (1947:3) enthusiastically describes the Park's lower riverine forest in his *Humid Transition Zone* introduction as

> ...awe-inspiring in its quiet solitude; cathedral-like in its sombre, peaceful grandeur. So dense are the trees that their branches interlace overhead to form an evergreen canopy, and even on bright summer days a condition of semi-twilight exists on the forest floor. The great trunks rise from a tangled mass of shade-loving plants which, in places, approach tropical-like luxuriance. Other trees, leveled by age or the elements, sprawl upon the ground—some newly fallen, others festooned with moss, and some in the last stages of decomposition. The trails, carpeted by an accumulation of humus and forest litter, are soft and yielding to the tread.

Lahars and Floods

Inviting as such scenes may be, they are limited in scale by the Park's overall high relief and physiographic instability. The subzone is distinguished here less for its unique floral qualities in the mature state described by Brockman, and more in recognition of Mount Rainier river valleys' frequent exposure to maturity-reducing lahars and high energy runoff, and because of presence and potential resource importance of anadromous fish in some of the river systems.

Lahars represent the most spectacular destructive events to impact Mount Rainier's low elevation riverine environments. Effects of major Mount Rainier mud and debris flows such as the 5,000 year old Osceola and 500 year old Electron mud flows are well known. Lesser flows are destructive on a smaller scale, and are far more common. Because of its relief, heavy rainfall and geological youth, many of Mount Rainier's rivers and streams are subject to periodic disruption, particularly in upper to mid-level drainages (see Crandell and Mullineaux 1967, and Scott et al. 1995). Such events repress forest maturity, temporarily opening affected floodplains to more productive early succession plant and animal associations. Even in the absence of such spectacular events, high energy seasonal runoff on major rivers—such as that shown in Figure 2.6 on the Carbon River—are capable of altering river courses and transporting boulder-sized rock substantial distances, and in so doing, keep the forest fringe at bay.

Anadromous Fish

Because they improve forage by suppressing floodplain forest cover, lahars and high energy floods promote a modest gain in exploitable resource abundance. The most important riverine resources, however, would not have been ungulates but salmon. Because of predictability and high seasonal abundance, salmon has been an important resource for regional populations since the mid-Holocene. The abundance and extent to which anadromous fish penetrated into Mount Rainier National Park, however, remains unclear. Despite repeated floods and debris flows, at least limited salmon populations have been reported historically in major river systems within Park boundaries (Samora pers. com. 1995). Her sources allude to coho salmon (*Oncorhynchus kisutch*) in the White, Carbon, Puyallup and Mowich Rivers; chinook (*Oncorhynchus tshawytscha*) in both White River forks; and steelhead (*Oncorhynchus mykiss*) in the Carbon, White, Puyallup and Nisqually Rivers. Fulton (1968) reports fall chinook in the Cowlitz River just south of Park Boundaries. He also reports steelhead spawning areas in the Ohanapecosh well within the Park (Fulton 1970). Bull trout (*Salvelinus confluentus*) and/or Dolly Varden (*S. malma*) historically also were present in several of the Park's rivers (Samora pers. com. 1995).

Figure 2.6 Carbon River Floodplain. (Facing upstream from Northern Loop Trail crossing, September 4, 1995. Note that high energy flow is infringing on the west-bank forest margin.)

Combining information above with maps showing spawning areas (Fulton 1968, 1970) and major upstream impediments (Williams et al. 1975), it is possible to reconstruct roughly the extent to which spawning salmon physically could have entered Mount Rainier rivers. Figure 2.7 shows river systems and approximate upstream limits of unimpeded salmon migration. Rivers not highlighted have major cascades or falls that effectively preclude upstream migration well below Park boundaries. Please note that this projection should be considered a working model to be improved as more information is made available.

Randall Schalk (pers. com. 1996) has studied Fulton and Williams map data, and offers these observations:

> The White River appears to have no obstacles below a point slightly above the mouth of Deadwood Creek. The highest for present chinook usage appears to be Pinochle Creek and lower Huckleberry Creek north of the Park. Within Park boundaries, there are several White River tributary creeks that have salmon usage listed as *unknown*. Many say *none*. Coho usage is possible in some of the creeks that flow into lower Huckleberry Creek (a few miles north of the Park boundary) and possibly Silver Creek.
>
> No modern salmon usage is shown in the Puyallup River within the Park. LeDout and Niessen Creeks show some coho usage but they are well downstream from the Park. There are three upper basin tributaries that penetrate the park apparently without natural obstructions (source Williams et al. 1975):
>
> South Mowich R. (obstacle shown @ 3 mi into park)
> North Fork Puyallup (obstacle shown at @ mi into Park)
> South Fork Puyallup (blockage shown at @ mi into Park)

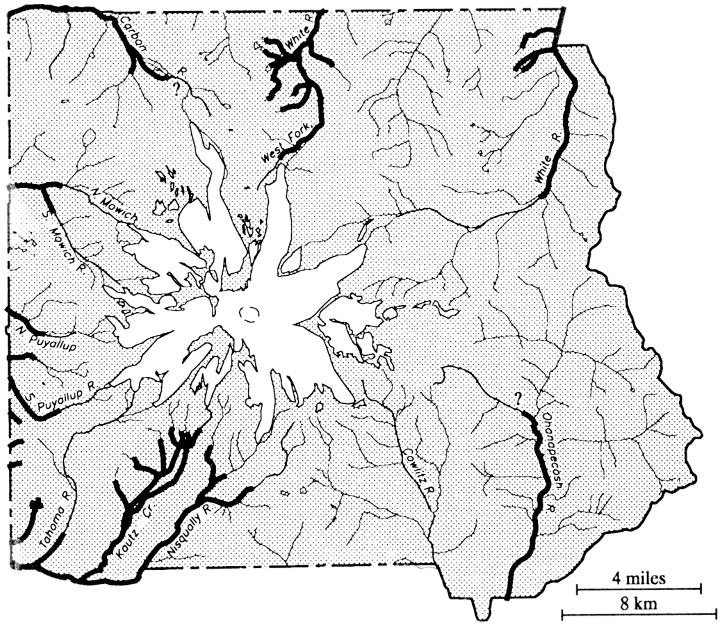


Figure 2.7 Potential Salmon-Bearing River Systems in Mount Rainier National Park

> I have no data on steelhead usage of the Puyallup and Mowich Rivers although steelhead probably could get wherever chinook and coho go. Spring chinook probably migrated at least as far up as the cohos and probably beyond.
>
> The main stream of the Nisqually presently is blocked above LaGrande by an impassable dam. How far salmon got up this drainage historically is less clear. No natural obstacles are shown on the river until just below Paradise. Goat and Tenas Creeks have no obstacles shown. Tahoma Creek has none on the lower two miles. No major obstacles are shown on Kautz Creek., though glacial silt is likely to have hindered spawning (source Williams et al. 1975).
>
> Fulton's (1970) steelhead map for the upper Cowlitz shows steelhead presently use the lower portion of the Ohanapecosh River. Coho are shown as using the lower parts of Butter Creek and Lake Creek—two tributaries of the Cowlitz that enter below the Ohanapecosh. Fall chinook are shown in the Cowlitz still further below (Fulton 1968). I [Schalk] suspect that spring chinook probably would spawn at least as far upstream as coho and steelhead although Fulton doesn't provide detail at this fine scale.

It is important to recognize that, because of extensive habitat alteration, present fishery data are not good indicators of prehistoric presence or abundance. We have emphasized the position of upstream barriers to attempt to show maximum possible migration routes. Unfortunately, we cannot reconstruct specific upstream migration patterns or seasonality with precision. Even so, it unlikely that salmon were ever a major resource in the Park. Periodic floods and debris flows temporarily, but repeatedly, must have diminished anadromous fish habitat. Perhaps more important is the high energy, silt-laden character of the near mountain river systems. According to Schalk (pers. com. 1996):

> The heavy loads of glacial silts further diminish the value of these kinds of streams as spawning habitat. Some salmon may have penetrated the Park in very limited numbers but salmon fishing this far upstream I believe would have always been poor at best. If people were harvesting any salmon at all within the park I suspect it was infrequent and incidental to other activities.

Floodplain Archaeology and Land-Use

Aside from maintaining modest low maturity stream side ungulate habitat, the primary impacts of river dynamics and lahars may have been most pronounced on the archaeological record itself. Destructive impact of larger lahars is obvious. Though less destructive, smaller mud and debris flows, and annual hydrological activity also have erased the stream side archaeological record from time to time. Accordingly, it is unlikely that low elevation floodplains preserve a substantial record of the more distant prehistoric past, at least for larger, more geologically active drainages.

Even so, there is reason to believe that river floors were not a major element of Mount Rainier's prehistoric resource base. The river valley landscapes experience resource limitations common to maritime forests generally. Indeed, because Mount Rainier's river valleys are too low for productive huckleberry habitat (at least for commonly collected varieties), too narrow for extensive ungulate habitat and too silty and lahar prone for productive anadromous fisheries, their usefulness to prehistoric populations may have been more for access to Mount Rainier itself, rather than for resources offered directly.

Subalpine Parkland

Up from the floodplains and above the maritime forest, dense forest cover gives way to clumped tree groups scattered among meadow communities. Sometimes referred to as the forest/tundra ecotone (Franklin and Dyrness 1973:248), these subalpine parklands typically appear as patchy associations of conifers interspersed with grassy meadowlands sandwiched between closed forest below and open tundra above. Because of high resource potential, and because they compromises distance between tundra and forest ecozones, I suggest that Mount Rainier's subalpine parklands are the *most important places* for focused seasonal human use during the prehistoric past—clearly not the *only* places, but the most intensively and repeatedly used over the long-term.

The subalpine zone's enhanced productivity lies in the maturity suppressing effect of heavy snowpack and short growing season. Under such circumstances, rapidly growing and reproducing species such as grasses, sedges, composite flowers, low shrubs, and plants with underground bulbs have an advantage over slower growing, longer-lived trees. Rapid growth plants also provide the best forage for ungulates as well as smaller mammals and birds. Locally dense dwarf huckleberries are good bear and bird habitat and can be exploited directly by humans. Subalpine parklands offer an effective compromise between closed forest and open space—meadows provide a good source of ungulate forage and edible flora, and tree patches provide protective shelter from predators and weather.

Talyor and Shaw (1927:12-13) also emphasize the subalpine zone's unique floral and faunal abundance.

> ...the Hudsonian Zone (above the narrow forested area), with its happy combination of open grassy park and subalpine flower garden on the one hand and pinnacle and glacier on the other, is without doubt the most attractive zone on the mountain. The shade of the deep Canadian forest is gone. Groups of handsome spirelike alpine firs and mountain hemlocks are set about the meadow borders or interspersed over the green expanses, always affording plenty of light

> and moisture to the grass and flowers. *There is an abundance of food for birds and mammals, which are more conspicuous and probably more numerous in this zone than in any other in the park.* The Hudsonian is the most desirable and the only favorable zone for camping away from the hotels, because *only here* (except at Longmire) *can forage* for horses *be found* [emphases added].

Closed Pacific maritime forests give way to patchy subalpine associations above about 5,200 ft on the wetter northwest, west and southern sides of the mountain; and above 5,800 ft on the drier northeastern side. Tree groups become increasingly patchy and stunted with elevation, ultimately giving way to scrubline vegetation and full alpine tundra at about 6,200 and 6,800 ft on windward and leeward sides respectively. Figure 2.8 shows subalpine associations at circa 5,400 ft in Mist Park in Mount Rainier's northwest quadrant. The view is taken from Mt. Pleasant Rockshelter site FS 72-02 (45PI433). Two additional prehistoric sites and two isolate finds have been documented in the near vicinity.

Patchy forest associations are dominated by Pacific silver fir on wetter sides of the mountain. Mountain hemlock tends to predominate on the dry side (see Figure 2.5). Typically, subalpine stands incorporate a higher frequency of mountain hemlock, subalpine fir (*Abies lasiocarpa*), and white bark pine (*Pinus albicaulis*) than present at lower elevation. Alaska yellow-cedar is locally present in low density. Near timberline, subalpine fir is one of the last tree species to give way to alpine tundra.

Figure 2.8 Mist Park Subalpine Meadows from Mt. Pleasant Rockshelter. East-northeast facing photo shows Sluiskin Mountain (jagged peaks at upper left-center), and Old Desolate Mountain, in the background.

Subalpine Meadows

While tree patches are important for shelter, our primary interest in subalpine and tundra habitats lies in the productivity of their meadow communities. As with forests, composition of subalpine meadows varies with sediment structure, drainage, elevation, and solar exposure. Citing Henderson (1973), Franklin and Dyrness (1973:252) identify five major meadow groups on Mount Rainier: 1) *Phyllodoce empetriformis-Vaccinium deliciosum* (red heather-dwarf huckleberry); 2) *Valeriana sitchensis* (lush herbaceous); 3) *Carex nigrians* (dwarf sedge); 4) rawmark and low herbaceous; and 5) *Festuca viridula* (grass or dry grass) (cf., Whitney 1983:42-43). Community associations within these groups is highly variable, though here we focus only on dominant constituents.

Heather-dwarf huckleberry associations (Group 1 above) are most prevalent on gentle slopes with moderately well-drained soils. A good example are the south trending ridge near Mt. Ararat and parts of "Indian Henry's Hunting Ground"in the Park's southwest quadrant. Both heather and huckleberry are low-growing shrubs capable of forming nearly complete low ground cover mats. Franklin and Dyrness (1973:256) suggest that more purely dwarf huckleberry stands (such as those near Mt. Ararat) tend to be pioneer communities on burned habitats, and are succeeded either directly by forest (at lower elevation) or by more complex heather-huckleberry associations.

Ethnohistoric reports on the importance of dwarf huckleberry (*V. deliciosum*) are contradictory. Smith's (1964:160-161) sources refer to it variously as 1) of little economic importance because it grows too low to the ground and ripens too late in the year; and 2) gathered in quantity because the berry is large and low to the ground. It is plausible that the apparent contradiction is due to use as a buffering resource in years when lower elevation, taller *V. alaskaense, ovalifolium and membranaceum* varieties were not productive. In any case, dwarf huckleberry's subalpine co-occurrence with hunted game is likely to have ensured use minimally as a supplemental, if not staple, food item.

The lush herbaceous meadows (Group 2) are the richest and most diverse of the subalpine meadow communities (see Franklin and Dyrness 1973:256-262). These meadows develop on steep to moderate gradient, well watered, avalanche-prone slopes. They are common to the southern and western slopes of Mount Rainier. Specific floral composition varies. Community dominants listed by Henderson (1973) in Franklin and Dyrness include varieties of valerian (especially *Velariana sitchensis*), false hellebore (*Veratrum viride*), lupine (*Lupinus latifolius*), bistort (*Polygonum bistortoides*), sedge (*Carex spectablilis*), and monkeyflower (*Mimulus lewisi*). Actual composition, of course, is substantially more diverse. More important than specific floral composition is the capacity of these low maturity associations to provide forage for a variety of exploitable mammals such as elk, deer and marmots. If continuously maintained by frequent landslides, such communities may have been of substantial importance to prehistoric hunter-gatherers.

Black sedge (*Carex nigricans*) communities (Group 3) typically are found on relatively flat to rolling sites with short growing season due to late persisting snowpack and cold, wet soils (Franklin and Dyrness 1973:261). Floral diversity is relatively low and growth limited by the circumstances noted above. Local co-dominants include marshmarigold (*Caltha biflora*) and pedicularis (*Pedicularis groenlandica*).

Franklin and Dyrness' rawmark and low herbaceous category (Group 4) consists of poorly developed, pioneer associations in a variety of locations with well drained bouldery/gravely to sandy sediments (Franklin and Dyrness 1973:262-263). Slope is variable, ranging from alpine scree to low gradient regisols. Total plant cover varies from a low of about 20 percent to nearly complete. Dominant associations include saxifrage (*Saxifraga tolmiei*), luetkea (*Luetkea pectinata*), buckwheat-pussypaws (*Eriononum pyrolaefolium-Spraguea umbellata*), everlasting (*Antennaria lanata*), and aster-everlasting (*Aster alpigenus-A. lanata*).

Grassy parklands (Group 5) are particularly well developed on the drier northeastern side of the mountain. Two dominant community types intergrade on a moisture gradient (Henderson 1973 in Franklin and Dyrness 1973:263): fescue-lupine (*Festuca viridula-Lupinus latifolius*) in moist locations and fescue (*F. Viridula-Aster ledophyllus*) in drier places. Fescue-lupine associations are most commonly associated with level to low gradient parklands such as Sunrise Ridge and Grand Park. Fescue-aster associations are found on even drier steep, south facing slopes with coarse textures soils.

Subalpine Fauna

Subalpine communities were important prehistorically both because they produced directly consumable plants (e.g., huckleberries and alpine lily), and because they supported relatively high bird and mammal populations as well. A sample of common species can be gleaned from Taylor and Shaw (1927:13), Whitney (1983:42-43) and Schamberger (n.d.:21-23) summary accounts. The birds reported by these sources include golden eagle, saw-whet owl, calliope hummingbird, Clark nutcracker, Cassin purple finch, western sparrow, warblers, mountain chickadee, Townsend solitaire, hermit thrush, mountain bluebird, northern three-toed woodpecker, Hammond and olive-sidedflycatcher, golden-crowned kinglet, gray jay, red-breasted nuthatch and evening grossbeak. Mammals include red fox, Washington weasel, Canada lynx, mountain lemming mouse, Rainier meadow mouse, large-footed mouse, red-back, Oregon and heather voles, Rainier pocket gopher, hoary marmot, yellow pine and Townsend chipmunk, mantled ground squirrel, snowshoe hare cony (pika), pine marten, coyote, black bear, mountain lion, elk and black-tailed deer. Though more common to alpine tundra, mountain goats occasionally graze in upper elevation subalpine associations and move through them to upper forest zones to find winter shelter. Ptarmigan, common in tundra associations, also are found in subalpine places.

At first glance, faunal variation may not appear markedly different from the forest proper. However, overall diversity is greater and, importantly, seasonal abundance of larger and fatter (i.e., energy rich) animals is substantially higher. Animals such as black-tailed deer, elk, black bear, and marmots find better forage in the meadow/forest ecotone than in the closed forest (except for burn areas). Assuming game animals are not over hunted, the subalpine combination of high return faunal and floral species should have been attractive to human exploitation throughout the prehistoric past.

Subalpine Parkland, Land-Use and Archaeology

The primary point to be taken in the discussion above is that subalpine communities *substantially increase the abundance and diversity* of low maturity flora over that of lower elevation maritime forests. Enhanced forage, in turn, favors increased faunal abundance. Assuming humans tend to structure their annual round to seek out productive habitats, we should expect subalpine parklands to have been the primary focus of human hunting and gathering activity throughout the prehistoric past. While burns and landslides also tend to be resource rich, only subalpine and alpine zones do so in a manner that is stable over a long period of time. If subsistence resource availability was the principal variable attracting prehistoric people to Mount Rainier, it is reasonable to expect Mount Rainier's archaeological record to reflect a bias toward low maturity subalpine to alpine landscapes.

It should be noted in closing that subalpine communities exist in a state of dynamic tension between lower forest boundaries and the upper tree or shrubline (krummholtz) boundary with alpine tundra (see Franklin and Dyrness 1973:276-284). In the subalpine ecotone, density of tree stands decreases with elevation as dictated by local effects of wind, fire, avalanches and snowpack; and by the overarching effect of decreasing temperature. In general, trees invade subalpine meadows during prolonged periods of stable warm weather, and retreat in the face of cold or unstable conditions. That is, parkland meadows tend to shrink and move upslope during periods of climatic warming (providing fire frequency does not increase); and expand and move downslope during cool, excessively dry and/or unstable circumstances. If subalpine communities are as important to prehistoric hunters and gathers as suggested here, it is important to develop a thorough understanding of Holocene climatic variables in regard to their implications for the resource productivity of these zones.

Alpine Tundra

Upper elevation tree clumps and scrubline mats of Englemann spruce (*Picea englemannii*) and subalpine fir give way to open alpine communities at about 6,200 to 6,800 ft on Mount Rainier. Alpine tundra extends upward to the firnline boundary with permanent snowfields at circa 7,600 ft. Because of Mount Rainier's great height and geological youth, much of the circa 7,600 ft upper boundary with permanent snowfields is characterized by rock and essentially vegetation free glacial rubble.

Figure 2.9 shows alpine tundra habitat and a pair of mountain goats (*Oreamnos americanus*) on Burroughs Mountain in the northeastern side of Mount Rainier. Fryingpan Glacier in the background and lower reaches of Emmons Glacier at photo right show increasingly barren glacial scree slopes and glacial scour at the alpine interface with standing snowfields.

Figure 2.9 Mountain Goats on Burroughs Mountain Alpine Tundra. (South facing photo shows Fryingpan Glacier and White River headwater snow fields in the background.)

Alpine Tundra Flora

The greatest expression of alpine communities on Mount Rainier is on the drier northeastern slope at places like Goat Island Mountain, Burroughs Mountain, and terrain near Frozen Lake and Mt. Fremont. The growing season is short with substantial diurnal temperature variation. Terrain is open with tundra grasses and forbes growing at moderate density over variously exposed volcanic lapili and shallow lithosols. Specific plant associations vary with local conditions. At least at lower elevations, subalpine meadows extend with minimal constituent variation into the open tundra. Dominant plant associations on the northern slope were studied by Hamann (1972) and reported by Franklin and Dyrness (1973:287) as follows:

Black crowberry/prairie lupine (*Empetrum nigrum/Lupinus lepidus*); north-facing fellfields.
Kinnikinnik/coast goldenrod (*Arctostaphylos uva-ursi/Solidago spathulata*); south-facing fellfields.
Blunt-leafed sandwort/prairie lupine (*Arenaria obtusiloba/L. lepidus*); pioneer on gentle slopes.
White heather/alpine aster (*Phyllodoce glanduliflora/Aster alpigenus*); moistest alpine environments.
Coiled pedicularis/showy sedge (*Pedicularis contorta/Carex spectabilis*); forms well-developed turf.
Golden fleabane/prairie lupine (*Erigeron aureus/L. lepidus*); forms well-developed turf.
Spreading phlox/mountain sandwort (*Phlox diffusa/Arenaria capillaris*); seral to pedicularis/sedge.

Alpine Fauna, Land-Use and Archaeology

Floral and faunal diversity decreases above the scrubline. Successful animal species are those suited to grazing on the low ground flora, cope with unstable weather without tree shelter, and make use of high elevation snowfields and cleavers for predator escape. Mountain goats, pika, white-tailed ptarmigan, marmots and other smaller rodents are common alpine tundra feeders during its brief July through September summer. Ravens, larks, finches and piptis (see Taylor and Shaw 1927:15; Whitney 1983:43-44; Schamberger n.d.:22-23) also use subalpine habitats. While extirpated from the Park by the late 1800s or earlier, elk are also likely to have been warm season grazers in the lower alpine-subalpine boundary. Because of the brevity of alpine summers, by early to mid October, game becomes virtually unavailable. Pika and marmots move to underground dens and elk migrate to lower-elevation forage. Goats move downslope a short distance to upper forest wintering areas such as Tum Tum Peak on Mount Rainier's southwest slope (Schamberger n.d.:75).

It is likely that goats, elk and perhaps marmots provided sufficiently productive food and wool sources to attract human predation in the alpine tundra zone. In the historic period, goat wool was highly prized for its beauty and warmth (see Eells 1985). Indeed, though other animals undoubtedly are present, to date the only unambiguously identified faunal remains in archaeological context are goat teeth from Fryingpan Rockshelter (FS 63-01 [45PI43]) (Gustafson:1983:27-28). Marmots may have been important for their fat. The benefit of elk, of course, lies in large body size and correspondingly high meat return per animal killed.

Because of unstable weather and availability of fewer specific resources, it is probable that alpine foraging tended to be carried out by small task-specific hunting groups with short duration camping, ambush, butchering or lithic procurement stops. If so, we should expect the alpine/upper subalpine archaeological record to reflect such constraints in the form of more functionally limited tool kits and lower artifact density (except at lithic quarries and butchering sites such as FS 86-01 [45PI407] at Frozen Lake). These qualities contrast with the subalpine to subalpine forest boundary where resource variety is greater and weather is milder. Lower-elevation conditions favor longer-term use, probably by a higher frequency of mixed sex gathering and hunting parties. We expect subalpine/upper forest margin sites should exhibit the full rage of sites common to alpine habitats *plus* a number of higher artifact count, multi-task assemblages consistent with more sustained and varied activities, and probably with more repetitive use. It is plausible, too, that select lower elevation places functioned as base camps from which more limited task gathering and hunting parties operated. Indeed, that argument will be made for three of Mount Rainier's lower subalpine/upper forest sites—FS 95-10 (45PI429) in the Park's southwest quadrant, and FS 71-01 (45PI438) and FS 90-01 in the northeast quadrant.

Perpetual Snowfields and Glaciers

Perpetual snowfields with standing glaciers and associated barren rubble fields range from firnline at 7,600 ft to Mount Rainier's 14,410 ft summit. Individual glacial tongues and young recessional moraines extend downslope in major glacial valleys to circa 5,500 ft. The largest of these—Carbon, Winthrop, Emmons, Ingraham, Nisqually, Tahoma and Mowich Glaciers—extend to below 5,000 ft.

Above the firnline, vegetation is suppressed by snow and ice mass. Floral species are limited essentially to mosses and lichens with very few grasses and flowering plants on rocky cleavers and other seasonally ice-free areas (Brockman 1947:6). Fauna are limited as well. A few marmots, pika, mice and shrews have been observed as high as 8,000 to 10,000 ft. Mice and even bear tracks have been reported at the summit (Schamberger n.d.:22). Clearly, such events are rare, and high mountain edible biomass is negligible. Perhaps the single exception to the pattern the presence of mountain goats which take advantage of glaciers and high rock fields for travel, observation, and escape. For the most part, however, Mount Rainier's glacial zone is largely devoid of economically useful plant and animal life.

Given logistical difficulty, relatively high risk and low return, we assume that prehistoric human use of high elevation Mount Rainier was limited to goat hunting, possible ceremonial use of the alpine/glacier interface, and very infrequent use of higher elevation snow and boulder fields. The highest elevation prehistoric archaeological finds presently documented on Mount Rainier are two isolated projectile points found at 7,500 ft on Success Cleaver (IF 01-70 in the southwest quadrant). Their presence is consistent with use of the locality as a hunting stop at the upper alpine/lower permanent snowfield boundary. We expect similar finds, perhaps associated with low stacked rock features or talus pits to be documented as cultural resource studies continue.

The following set of color maps (Figures 2.10, 11, 12 and 13) show Mount Rainier environmental zones and formally documented archaeological sites in four Park quadrants. Zonal boundaries are derived from environment data logged into the Park's geographic information system (GIS). Basic data on forest, subalpine and alpine boundaries were plotted from aerial photographs. They are intended to model climax vegetation associations, excluding effects of short-term fire alteration. Perpetual snowfield boundaries include standing glaciers, permanent snowpack and a 100 ft buffer to accommodate glacial scree slope rubble. High energy floodplains are those that have experienced major documented floods and/or lahars. These maps provide the best precision presently available for displaying environmental zones and for graphically illustrating association with documented prehistoric sites. The clear association of prehistoric sites with subalpine and alpine settings is consistent with ecological land-use arguments offered above, in ethnohistoric accounts collected by Smith (1964), and discussed in the following sections.

HOLOCENE EVOLUTION OF MOUNT RAINIER'S ENVIRONMENT

The central premise underlying environmental and land-use patterns discussed above holds that critical plant and animal resources are not evenly distributed but rather tend to cluster seasonally in 1) upper-elevation subalpine to alpine habitats, and 2) early fire succession habitats in mid-elevation forests. Assuming that these plant and animal resources are the primary attractors drawing lowland populations to the mountain, it is reasonable to expect human use to have always favored these places over other less productive forest zones. Because of their spatial stability (relative to burn areas) and because they optimize access to the widest range of exploitable resources, subalpine to alpine habitats are expected to have been particularly heavily used during the prehistoric past.

Vegetation boundaries are not perfectly constant over periods. There is little doubt that Holocene climatic changes altered high elevation forest patterns, affected resource productivity, and may have altered human land-use strategies on Mount Rainier. At a general level, there is ample reason to believe most of the northern hemisphere experienced general climatic warming following final retreat of Fraser/Wisconsin glacial epoch about 9,500 years ago. The trend persisted until about 4,500 to 4,000 years ago, then reversed, with generally cooler conditions to the present.

Even though this pattern substantially simplifies actual Holocene climatic oscillations there is reason to expect climatically induced variation in forest and resource structure during the period of time that humans have inhabited the Mount Rainier region. Without active human intervention, periods of sustained environmental warming could be expected to be accompanied by forest advance in upper elevation environments, effectively reducing the area of economically productive subalpine habitat. Alternatively, delayed snowpack melt associated with sustained colder periods would have repressed montane forest cover, ostensibly lowering forest maturity in upper elevation settings, thereby improving ungulate forage and huckleberry habitat.[8]

This section assembles available data to model the late Pleistocene and Holocene climate sequence for the Mount Rainier region. Sources include plant macrofossil and pollen data and interpretive summaries from Mount Rainier, the Cascades and the surrounding region (especially Dunwiddie 1986, Heusser 1977; Whitlock 1992; and Sea and Whitlock 1995); and synchronous North Cascade and Mount Rainier glacial advance-retreat patterns (Crandell and Miller 1974; Porter 1976). Climatic implications of these data are summarized in Table 2.3. The curve is adapted from Heusser's (1977) inferences for the Pacific Slope of Washington as modified by pollen and geological data. The modified Heusser curve is a useful means of modeling climatic change because it displays greater variability and provides a better notion of climatic process than static time-block sequences (see Sea and Witlock 1995:378 for a good summary of the latter). Even though the curve simplifies a more complex natural reality by smoothing shorter-term oscillations, it can be refined as additional data become available and offers a more precise mechanism for comparing human system responses, if any.

The climate curve in Table 2.3 estimates long-term changes in summer temperature based on relative frequency of western hemlock (*Tsuga heterophylla*) to Douglas fir (*Pseudotsuga menziesii*) in 300 pollen spectra from the Hoh River Valley on the western Olympic Peninsula and Salmon Springs near Puyallup in the Puget Trough (Heusser 1977), as modified by macrofossil and glacial data noted above. Changes are expressed in degrees Celsius relative to present average July temperature at sea level (zero on the scale). The vertical guides are set arbitrarily at 1° C above and below the modern July mean. This zone approximates historically experienced (i.e., *modern*) climatic circumstances. Portions of the curve falling to the left (i.e., colder) of the -1° C line are classified by reference to their most commonly applied regional glacial or interglacial nomenclature. Sections falling within the ±1° guidelines are classed as *modern interludes*. The single significant part of the curve falling to the right of the +1° line (i.e., warmer) is the mid-Holocene xerothermic period labeled here the *Hypsithermal Interval*.

[8] In lowland environments such as the Puget Trough, the pattern is reversed. Sustained warm intervals are associated with a higher fraction of more mesic species in more open stands (i.e., forest maturity declines). Cooler, effectively wetter conditions are associated with more nearly closed maritime forests.

Figure 2.10
Mount Rainier National Park
Northwest Quadrant

ENVIRONMENTAL ZONES

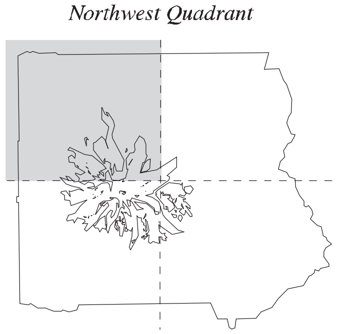
- Perpetual Snowfields and Glacial Rubble
- Alpine Tundra
- Subalpine Parkland
- Northwest Maritime Forest
  - High Energy Floodplains

- Documented Archaeological Sites and Isolates

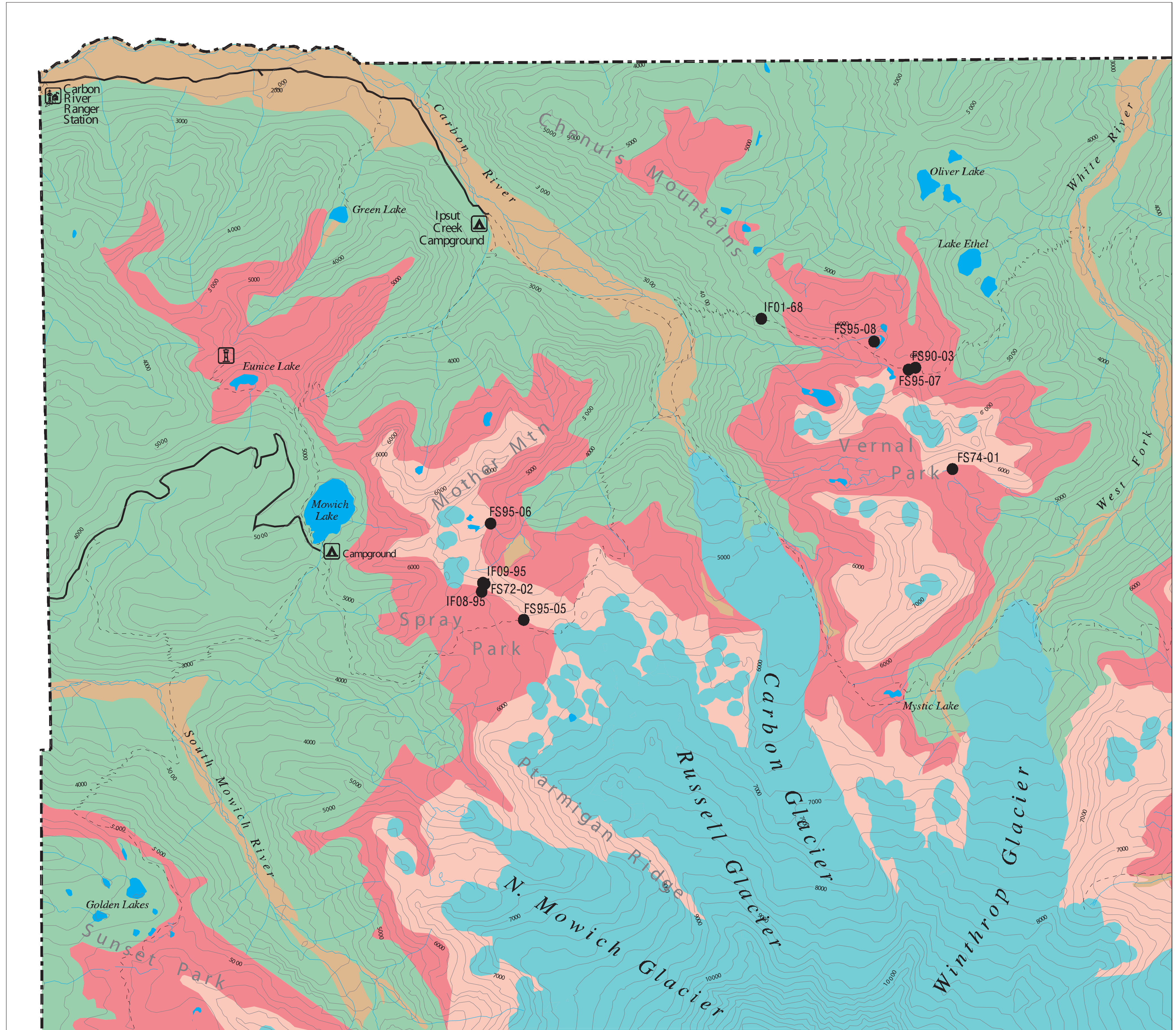
- Roads
- Trails
- Streams
- Lakes
- Contours

0 1 2 3
KILOMETERS
CONTOUR INTERVAL 250 FEET

Northwest Quadrant



Mount Rainier National Park
Geographic Information Systems



Projection UTM
NAD 1927, Zone 10, Units Meters

Figure 2.11
Mount Rainier National Park
Northeast Quadrant

ENVIRONMENTAL ZONES

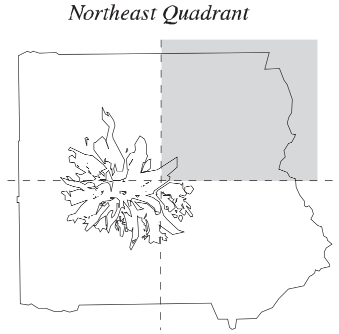
- Perpetual Snowfields and Glacial Rubble
- Alpine Tundra
- Subalpine Parkland
- Northwest Maritime Forest
  - High Energy Floodplains

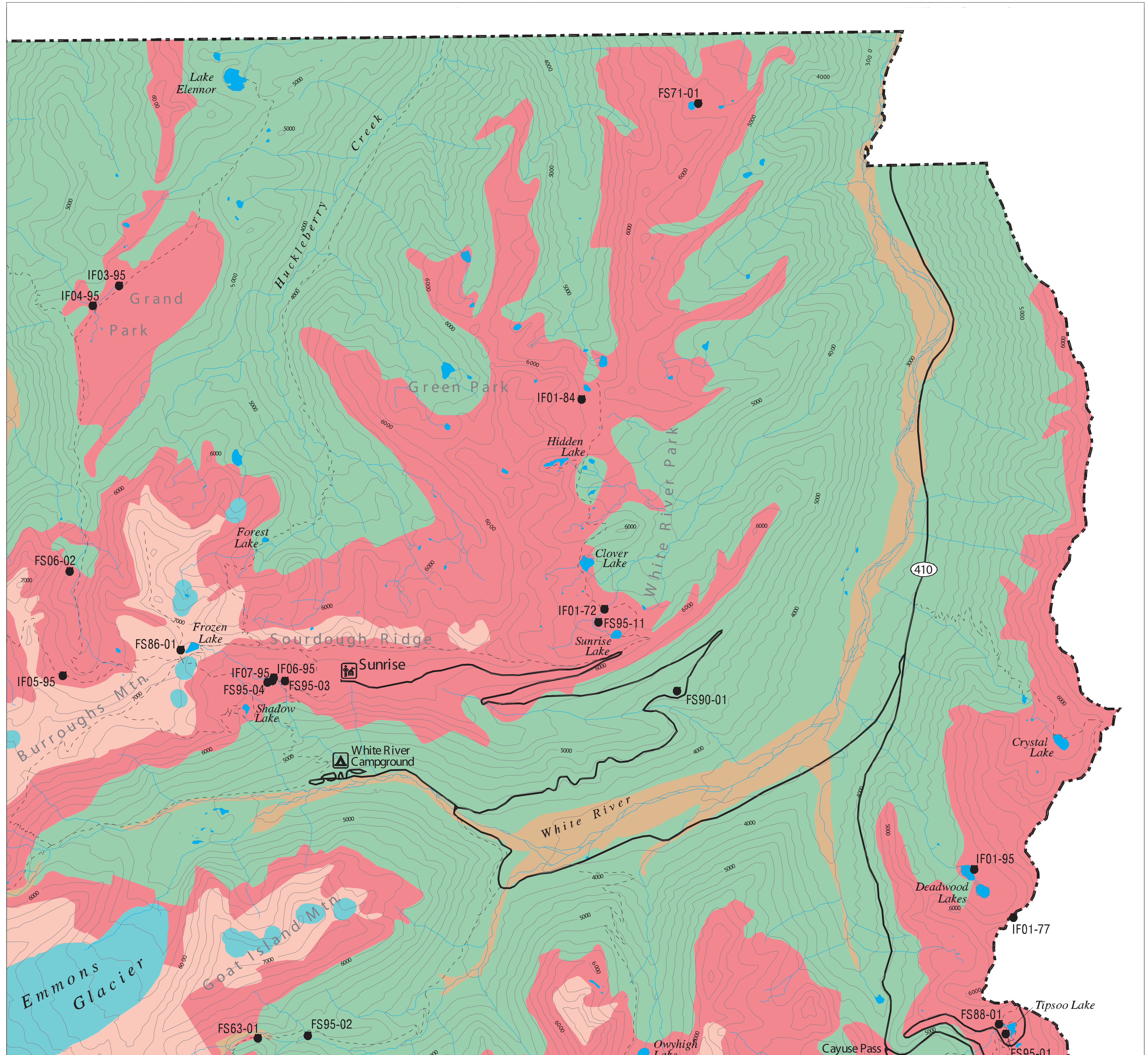
- Documented Archaeological Sites and Isolates

- Roads
- Trails
- Streams
- Lakes
- Contours

0 1 2 3
KILOMETERS
CONTOUR INTERVAL 250 FEET

Northeast Quadrant





Mount Rainier National Park Geographic Information Systems

Projection UTM
NAD 1927, Zone 10, Units Meters

Figure 2.12
Mount Rainier National Park
Southwest Quadrant

ENVIRONMENTAL ZONES

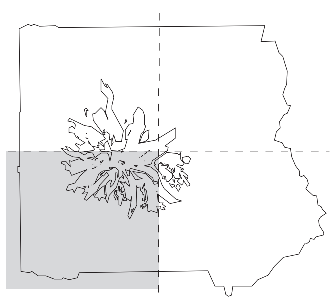
- Perpetual Snowfields and Glacial Rubble
- Alpine Tundra
- Subalpine Parkland
- Northwest Maritime Forest
  - High Energy Floodplains

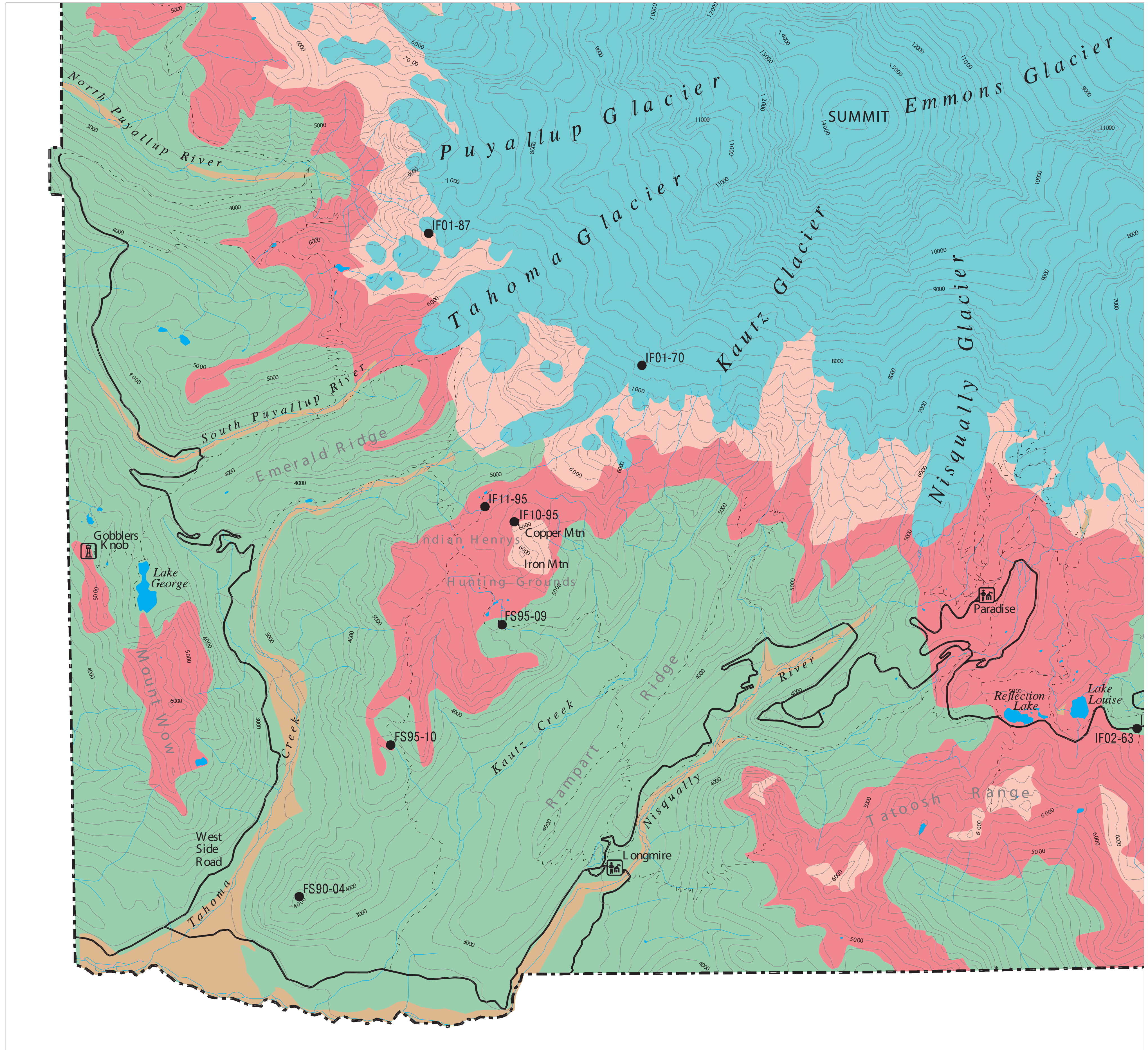
- Documented Archaeological Sites and Isolates

- Roads
- Trails
- Streams
- Lakes
- Contours

0 1 2 3
KILOMETERS
CONTOUR INTERVAL 250 FEET

Southwest Quadrant





Mount Rainier National Park
Geographic Information Systems

Projection UTM
NAD 1927, Zone 10, Units Meters

Figure 2.13
Mount Rainier National Park
Southeast Quadrant

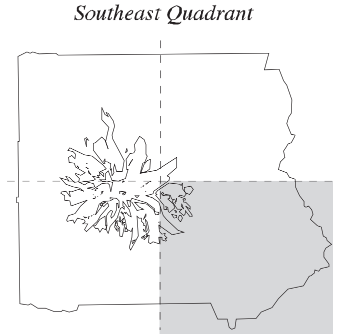
ENVIRONMENTAL ZONES

- Perpetual Snowfields and Glacial Rubble
- Alpine Tundra
- Subalpine Parkland
- Northwest Maritime Forest
  - High Energy Floodplains

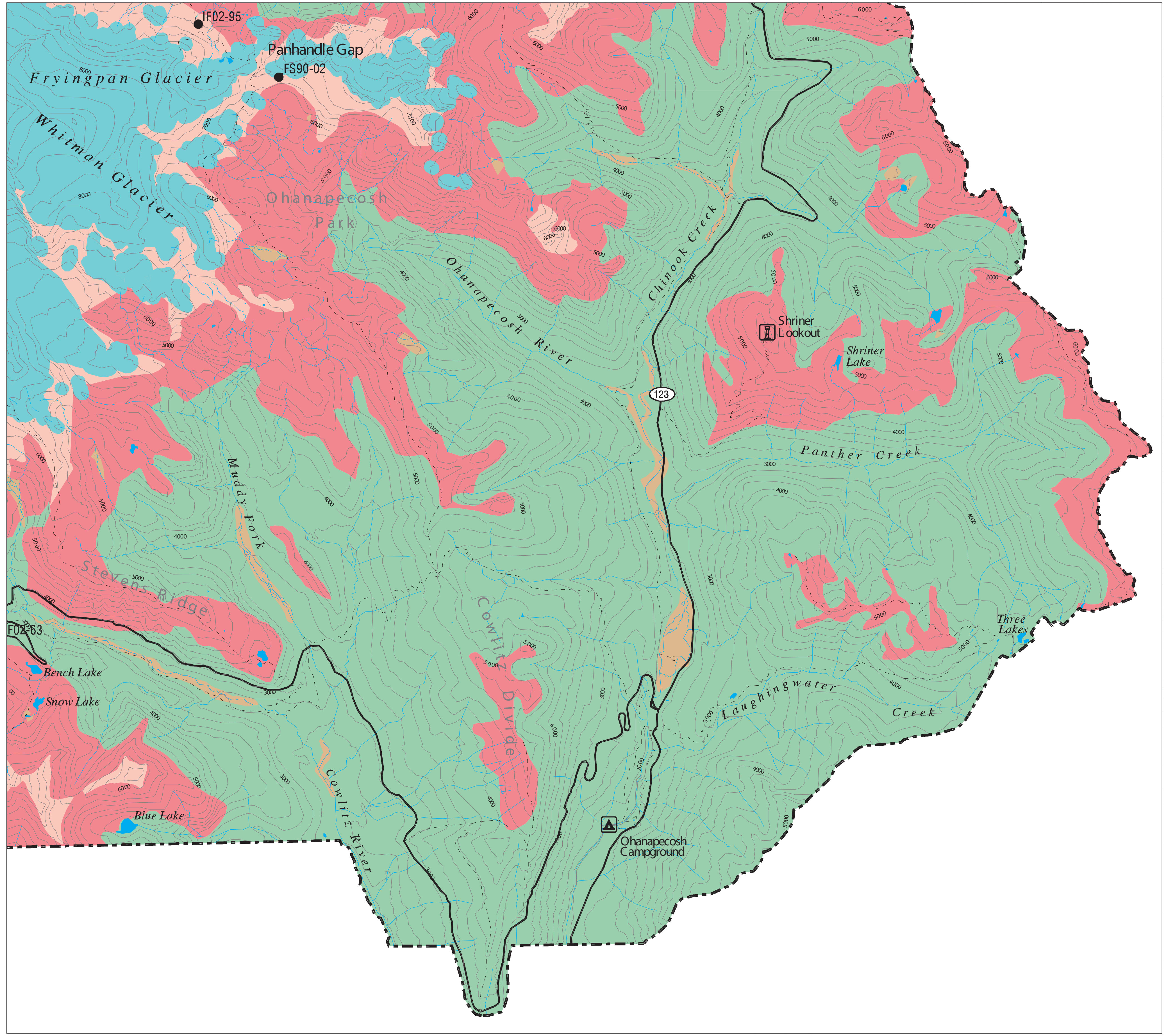
- Documented Archaeological Sites and Isolates
- Roads
- Trails
- Streams
- Lakes
- Contours

0 1 2 3
KILOMETERS
CONTOUR INTERVAL 250 FEET

Southeast Quadrant

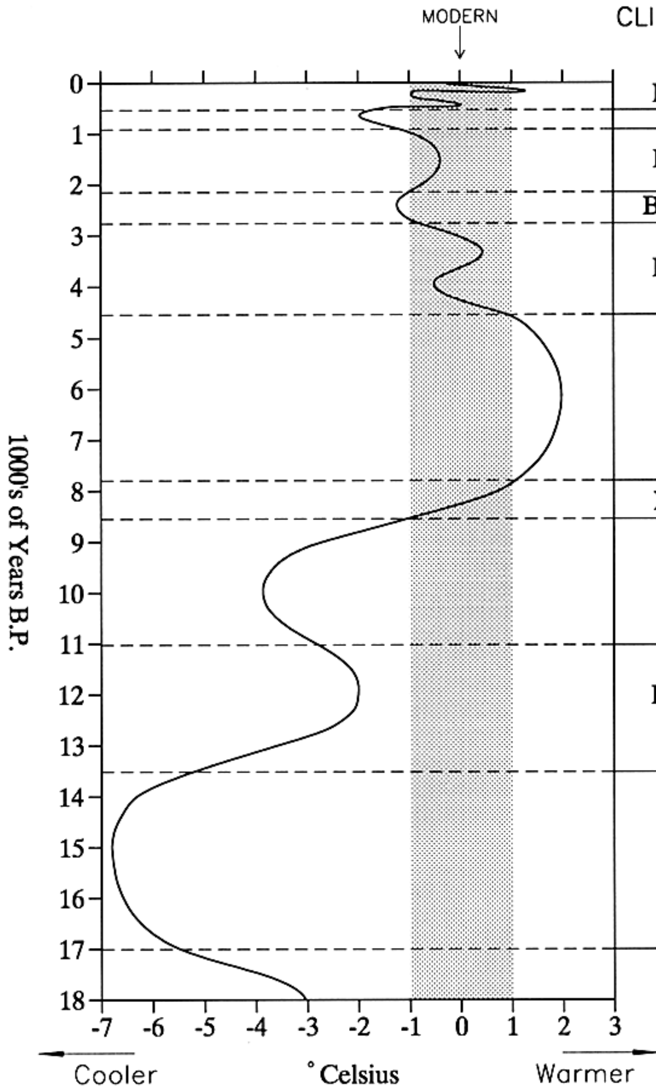


Mount Rainier National Park
Geographic Information Systems



Projection UTM
NAD 1927,Zone 10,Units Meters

Table 2.3 Mount Rainier Region Late Pleistocene - Holocene Climatic Sequence



CLIMATE SEQUENCE	REGIONAL & MT. RAINIER CHARACTERISTICS
Modern Interlude 4	Includes "Little Ice Age" ca. 400–100 B.P., A.D. 1930s warming and 1940s cold rebound. *
Garda Stade	Mt. Rainier glacial advance – snowline to ca. 6200ft. *
Modern Interlude 3	*
Burroughs Mtn. Drift	Mt. Rainier glacial advance – snowline to ca. 6400ft. *
Modern Interlude 2	Without fire modification. Forests encroach during warmer periods. Subalpine and tundra habitats expand at cooler/wetter intervals
Hypsithermal Interval	Increased diurnal temperatures. More open Puget lowland forests. If not fire-managed, forest encroaches on subalpine and alpine habitats on Mt. Rainier.
Modern Interlude 1	Approximately modern forest pattern established on lowlands and on Mt. Rainier
Sumas Stade (McNeely Drift) Fraser Glaciation	Open forest to tundra habitat in Puget lowlands. Mt. Rainier snowline ca. 5250–5900ft (Crandell & Miller 1974 and Porter 1964).
Everson Interglacial Fraser Glaciation	Tundra to open lodgepole forest in Puget lowlands. Mt. Rainier remains largely glaciated.
Vashon Stade Fraser Glaciation	Puget glacial lobe covers lowlands. Mt. Rainier largely ice mantled. Probable tundra habitat on east side lower elevations in Cascades fringe. Mesic forest south of the Puget lobe and along the Puget Coast.

* Dates based on Crandell & Miller 1974:49

It now appears that Mount Rainier landscapes became sufficiently glacier-free, with adequate time for floral and faunal dispersal processes to have established economically useful plant and animal habitats by about 8,500 years ago. Prior to that time, glacial ice mass would have effectively precluded human use of Mount Rainier proper; although the Puget lowlands, eastern foothills and larger intermontane valleys could have sustained exploitable species as early as the Everson interglacial circa 13,500 years ago (the Pacific coast and southern lowlands earlier still). Assuming, for the moment, that humans did not intervene to alter natural successional processes, basic climate/environmental patterns on Mount Rainier and in the Pacific Northwest approximated the basic pattern shown in Table 2.3. The periods summarized below represent units of time during which the curve extended above or below 1^{o} C of the modern July average. Please keep in mind that these periods are difficult to identify with precision and contain substantial climatic variability not represented in the curve's smoothed contours.

Late Fraser Glaciation: Vashon Stade; circa 17,000 to 13,500 B.P.

The Cordilleran ice sheet reached its maximum development in the Pacific Northwest between about 15,000 to 13,500 years ago (Whitlock 1992:9; Porter 1976:73; cf., Waitt and Thorson 1983). According to these sources, glacial ice covered the central and northern Puget Trough and the Straits of Juan de Fuca. East of the Cascades, Cordilleran ice lobes reached their most southerly extension. Alpine glaciers, however, appear to have been less extensive than earlier Fraser advances. Even so, Mount Rainier for all practical purposes was either ice shrouded or barren. Ice free areas on the mountain and in its immediate vicinity would have appeared essentially as rock or rock-grass islands impoverished of floral and faunal species in the midst of predominantly ice-mantled landscapes.

South of the glacial ice, vegetation took on a more mesic character compared with the preceding several thousand years. Probably responding to increased winter moisture that fed the Vashon stade, low elevation vegetation on the Washington coast, in the southern Puget Trough, and in lowland southwestern Washington shifted from predominantly parkland/tundra to parkland/open forest associations (Whitlock 1992:13-14). East of the Cascades and south of the glacial ice mass, periglacial steppe persisted to an elevation of about 1,500 m (4,900 ft).

Clearly, Mount Rainier, central and northern Puget Trough, Olympic Mountains, and North Cascades could not support human use during Vashon times. Even though plant and animal communities south of the glacial ice could potentially have supported human settlement, it is unlikely that anyone was there to avail themselves of them. At this time, most North American human populations remained locked in the ice-free periglacial Berginian refugium that extended from eastern Siberia to northwestern Alaska. It is unlikely that groups were able to move south of the continental ice in significant numbers (if at all) prior to its rapid wasting at the close of the Fraser/Wisconsin epoch (Burtchard 1987:209-213; Mathews 1982; Young 1982).

Terminal Fraser: Everson Interglacial & Sumas Stade; circa 13,500 to 8,500 B.P.

Floral and faunal patterns changed dramatically with the wasting of cordilleran and continental ice at the end of the Fraser glacial epoch. Despite interruption by at least one major renewed advance about 11,000 to 9,500 years ago (the Sumas Stade, or McNeely drift on Mount Rainier), plant and animal communities dispersed into previously ice mantled areas, changing the character of the Cascades, Puget Trough and Olympic Peninsula dramatically. By virtue of its tolerance for nutrient poor, glacially scoured sediments, *Pinus contorta* (lodgepole) became the dominant tree species in central and northern Puget Trough early in the period (Whitlock 1992:15). Whitlock notes that through time "*P. contorta* was joined by *Pica sitchensis* [Sitka spruce], *Pseudotsuga* [Douglas fir], and *Tsuga heterophylla* [western hemlock] to form a more closed forest." Presumably these more nearly closed forest conditions appeared near the end of the period coincident with rapid wasting of the Sumas stade.

As Cascade alpine glaciers retreated, alpine tundra and patchy forest habitat established on lower mountains and intermontane valleys. Similar communities probably were established to a limited extent on Mount Rainier as well. During the McNeely drift, permanent snowline on Mount Rainier is estimated at about 5,900 ft with glacial tongues extending well into the major river valleys (Crandall and Miller 1974:43). At this elevation, many of the Park's larger mid-elevation ridge, cirque basin, and tarn parklands would have been under, or immediately adjacent to, perpetual snowpack. Vegetated habitat would have been limited primarily to low to mid-elevation slopes—probably in dispersed semi-isolated stands around the mountain base. While it is likely that some open forest/tundra species colonized the mountain during the Everson interglacial and persisted through the McNeely Drift (e.g., mountain goats, pika and marmots), their number was probably too low and exploitation cost too high to have been of serious economic interest to the few early Holocene human groups in the region. The probability of human forays into the immediate Mount Rainier area increases sharply, however, with rapid glacial retreat and establishment of more nearly modern plant and animal associations after about 9,000 to 8,500 years ago.

Modern Interlude 1; circa 8,500 to 7,800 B.P.

The demise of the Fraser glacial epoch, and ultimately the onset of the mid-Holocene hypsithermal interval probably was due largely to an increase in summer solar radiation brought about by more pronounced earth axial tilt in conjunction with a near sun orbit (perihelion) during the summer (Kutsback and Guetter 1986; Whitlock 1992:15-16). According to Sea and Whitlock (1995:379), "The direct effects of greater-than-present summer radiation in the Pacific Northwest included higher temperatures and decreased effective moisture. Increased summer radiation also resulted in a strengthening of the east Pacific subtropical high pressure system." In concert, these events induced dramatic environmental changes in the Pacific Northwest and over much of the world.

During this relatively brief interval, environmental conditions on Mount Rainier are likely to have approximated those of the present day—though perhaps with hotter summers. In essence, this is a formative period during which Mount Rainier took on most of its modern vegetative character; even though, geologically, the mountain was rather different than present. The mid-Holocene destruction and rebuilding of Mount Rainier's summit had yet to occur, and many of the newly ice-free landscapes are likely to have been highly unstable. Even though the permanent snowline retreated to approximately its present elevation, the effects of rapid glacial retreat should have lingered. It is likely that water-heavy ice masses stimulated frequent avalanches on upper elevation slopes and generated repeated high energy lahars in glacial river valleys. Newly exposed, poorly consolidated high gradient terrain should have been subject to repeated mass wasting rock avalanche movement.

These geological characteristics probably did not have a marked effect on forest succession above the lahar-prone river valleys and below glacial margins. It is likely that, for the first time, most of Mount Rainier's low to mid-elevation slopes took on a forest mantle roughly comparable to that of the present day, though probably with greater species variability and higher fraction of seral representatives. It is reasonable to expect basic faunal patterns described earlier in this chapter to have become established as suitable habitat became available.

The development of economically useful plant and animal associations and the presence of human populations sets the stage for initial use of Mount Rainier National Park. Even so, because of very low regional population density and probable availability of game in less logistically challenging places elsewhere, it is likely that use of the mountain was limited. Indeed, people may have done little more than observe the massive peak at a distance well beyond present Park boundaries.

Hypsithermal Interval; circa 7,800 to 4,500 B.P.

Because the northern hemisphere had entered into a period of rapid climatic change, the first Modern Interlude was essentially a transient state into a prolonged xerothermic period that dominated the region for over 3,000 years. Evidence for the existence of an early to mid-Holocene drought in the Pacific Northwest is compelling, though timing and local effects remain incompletely understood. Heusser (1977) notes its impact on the Puget Trough and coastal Olympic peninsula by charting an increased fraction of Douglas fir over western hemlock—a change that he believes reflects an increase in about 2° C in mean summer temperatures compared to the present climate.[9] Citing a number of sources, Whitlock (1992:17) reinforces the point, noting further that prairies and open forest conditions expanded throughout most of the Puget Trough. Fire frequency increased, in places reducing forest maturity in a manner that created a "mosaic of forest in various stages of succession." At Battle Ground Lake on the lower western flank of the southern Washington Cascades, Whitlock's pollen data suggest a 40-50% reduction in annual precipitation between 9,500 and 4,500 B.P. Similar to Heusser, she suggests that these data imply an annual temperature 1° to 3 ° C higher than present.

East of the Cascades, the forest/steppe margin moved higher and further north than present. The Columbia Plateau remained essentially treeless. Higher than present percentages of chenopodium and amaranthus at Carp Lake in southwest Washington indicate warm/dry rather than cold/dry condition were dominant during the period (Whitlock 1992:17; Barnowsky [Whitlock] 1985).

On Mount Rainier, Dunwiddie (1986) examined pollen and macrofossil data from three sites situated between 4,250 to 4,920 ft elevation on the mountain's southern flank atop the 6,000 year old Paradise Lahar. As expected for a very young landscape, Dunwiddie notes a high fraction of early seral species at the base of the profiles (especially noble fir [*Abies procera*], subalpine fir [*A. Lasiocarpa*] and lodgepole [*Pinus contorta*]). However, seral species continue to dominate all levels below Mt. St. Helens series Y_n tephra (circa 4,000 to 3,250 B.P.), suggesting persistence of a warmer/drier than present climate before that date (Dunwiddie 1986:63). Assuming his interpretation is correct, these Mount Rainier data are approximately consistent with the general mid-Holocene xerothermic period as indicated by floral changes elsewhere in the Pacific Northwest.[10]

Glacial drift data from Mount Rainier also indicated a prolonged mid-Holocene period of alpine glacial withdrawal. No major glacial advance can be documented between the final retreat of the Fraser (McNeely Drift) circa 9,500 years ago and the relatively limited advance marked by the Burroughs Mountain Drift about 2,900 years ago (Crandell and Miller 1974). This does not mean that

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[9] This represents a circa 9° C mean summer temperature increase from the height of the Fraser's Vashon Stade.

[10] Because Dunwiddie's samples were taken from Paradise lahar sediments, his inferences do not extend to the early Holocene. Also note that the link between continued presence of seral species and climate is not clear cut at this elevation. Succession also could be repressed by increased summer storm frequency or by human induced fires. Evidence for increased fire frequency is ambiguously represented in the profiles. Fire and climate should both be considered contributing variables to maintenance of seral species in the pre series Y tephra samples.

there were not lesser glacial advances and retreats during the period, but that such advances were small and traces obliterated by later, larger advances.

Geological events on Mount Rainier would also have affected environmental patterns temporarily, particularly to the mountain's southern and northeastern slopes. About 6,000 years ago, the Paradise and other lesser lahars reduced the summit and modified landforms on the south face of the mountain. Later, the 5,700 year old Osceola collapse and mudflow lowered the summit approximately 2,000 ft, moving a massive sediment load down the north and east faces of the mountain into the White River drainages and out into the Puget Trough. Undoubtedly, the physical character of the mountain was transformed dramatically. Even so, it is likely that impacts to vegetation patterns were largely temporary. The impact to the *archaeological record* notwithstanding, effect on land-use itself was probably neither substantial nor long lasting. The primary effect would most likely have been limited to short-term repression of forest cover serving to enhance somewhat the resource productivity and economic utility of affected landforms.

Clearly, regional effects of the Hypsithermal Interval are complex. Since human populations were now established in the region, Hypsithermal climatic changes hold implications for adjustments to regional settlement patterns and for use of Mount Rainier itself. For our purposes, the following general Hypsithermal patterns appear to apply to subregions in the vicinity of Mount Rainier:

East of the Cascades:
1) Increased aridity and degradation of ungulate forage in the Columbia Plateau.
2) Northward and upward shift in forest/steppe margins in the Okanagan and Cascade Mountains respectively.

West of the Cascades (Puget Trough):
1) Increased patchiness and open forest mosaics with increased fraction of mildly drought tolerant species such as oak (*Quercus*) and Douglas fir (*Psuedotsuga*).
2) Improved ungulate habitat due to opening of the forest canopy and concomitant expansion of grasses and brushy plant cover.

Southern Washington Cascades (including Mount Rainier):
1) On lower slopes and intermontane valleys, forest cover becomes patchier as drier conditions make forests more susceptible to fire—particularly in leeward settings; ungulate and collectable plant habitat improves.
2) Effect on upper to middle elevation slopes variable with exposure; species composition may have shifted to increased representation of drought tolerant species such as *Psuedotsuga*; in the absence of massive fire events, closed canopy forest should have dominated in wetter windward settings with increased patchiness in leeward settings and geologically disturbed landforms; effect on ungulate habitat unclear—here considered inconsequential.
3) Forest expansion on high elevation landscapes; forests invade and become more uniform in subalpine and lower alpine zones due to suppressed snowpack and lengthened growing season; upper elevation ungulate habitat is restricted; selective contexts for increased human induced burning to enhance habitat.

As the mid-Holocene drought deepened, it is likely that climatic events combined to reduce forage essential to support ungulate populations and their human predators east of the mountains, while simultaneously increasing them in the Puget Trough and lower elevation Cascade valleys and foothills. Accordingly, the Hypsithermal Interval may have witnessed a punctuated increase in use of landscapes and productive environmental zones in the vicinity of Mount Rainier. It is likely the use of the mountain itself increased during the period, perhaps involving fire modification of upper elevation landscapes.

Modern Interlude 2; circa 4,500 to 2,800 B.P.

Heusser's (1977) data suggest rapid amelioration of mid-Holocene warming starting about 5,000 years ago. By about 4,500 years ago, climatic conditions appear to have cooled to within 1° C of the present summer average (see Table 2.3). Given that climatic conditions were not perfectly stable or as regular as indicated on Table 2.3, the general return to cooler and moister circumstances should nonetheless have induced environmental regimes on Mount Rainier approximating those of the present day. Dunwiddie's (1986) data from Paradise lahar are consistent with a such a change. He suggests that cooler/moister conditions are indicated by increased fractions of mountain hemlock (*T. mertensiana*) and Alaska yellow cedar (*Chamaecyparis nootkatensis*) above Mt. St. Helens series Y_n tephra. Because the mountain building Mount Rainier series C eruptions had not yet occurred, Rainier retained its lower, open to the east (but presumably now well vegetated) profile created by the Osceola collapse over a thousand years earlier.

Less xeric climatic conditions following the Hypsithermal Interval should have reversed regional environmental patterns. In the Puget Trough, forest cover returned more completely closed canopy. Forest maturity also increased on lower elevation Cascade valleys and slopes. Higher, forests retreated, reopening subalpine and alpine habitats on Mount Rainier. East of the mountains, forests again moved downslope, and Columbia Plateau rangeland improved.

It is plausible that loss of lowland ungulate habitat in the Puget Trough and lower western slope would have increased resource stress on growing regional populations now well established in the region. Such conditions would have established a selective context favoring intentional burning to maintain forests at a more productive, lower maturity state. On Mount Rainier, seasonal use should have focused on subalpine to alpine habitats and at the margins of naturally and culturally induced burns as discussed in the previous section.

Burroughs Mountain Glacial Advance; circa 2,800 to 2,100 B.P.

The Burroughs Mountain advance is the first stade of the Winthrop Creek glaciation on Mount Rainier (see Crandell and Miller 1974:44-50). It is indicated in the Park by a few remnant moraines, most of which have been crosscut by the later, larger Garda stade. At the peak of the Burroughs advance about 2,600 to 2,400 years ago, permanent snowpack is estimated to have shifted downslope to about 6,400 to 6,200 ft—400 to 600 ft lower than the mid-1960s snowline. In essence, permanent snowpack would have covered what is now the Park's alpine tundra as shown on Figures 2.10 through 2.13. Subalpine associations are likely to have shifted downslope to what are presently Mount Rainier's upper forested slopes.

The Burroughs glacial advance is roughly contemporaneous with the most recent mountain building episode on Mount Rainier (i.e., the Mount Rainier series C eruptions that rebuilt the summit to its present elevation. Series C events not only built the modern summit, but deposited sand to gravel sized tephra over much of the central and northeastern part of the Park (see Figure 2.3). It is possible that the combination of lowered snowline and heightened eruptive activity reduced the value of affected mid to upper elevation landscapes. More likely, however, increased snowpack, shortened growing season and periodic volcanic disruption simply pushed tundra and subalpine associations downslope, and perhaps extended them to the northeast.[11] It is unlikely that these events had marked effect on the productivity of economically useful plants and animals. Since major river valleys are not primary resource areas in any case, expansion of glaciers and glacial outwash events into them should not have significantly influenced human use.

Modern Interlude 3; circa 2,100 to 900 B.P.

Huesser's (1977) lowlands data and Crandell and Miller's (1974) glacial study indicate a circa 1,200 year interval between the two Winthrop Creek glacial advances. Huesser's climatic inferences suggest that temperatures rose overall during the interglacial period, but remained slightly cooler than present (see Table 2.3). During this interlude, regional floral and faunal patterns should once again have returned to near modern conditions as described for the second Modern Interlude above. On Paradise lahar, Dunwiddie's (1986) pollen profiles show an increase in western hemlock (*T. heterophylla*) about 2,000 years ago at Jay Bath, and Alaska yellow cedar (*C. nootkatensis*) at Reflection Pond about 1,500 years ago. Both suggest continuing cool and moist conditions, perhaps associated with natural succession processes begun with the amelioration of the Hypsithermal Interval.

Garda Stade Glacial Advance; circa 900 to 500 B.P.

The second major advance of the Winthrop Creek glaciation extended beyond and obliterated most of the moraines of the earlier Burroughs Mountain drift. The Garda stade on Mount Rainier reached its peak about 700 years ago, lowering permanent snowpack to about 6,200 ft—circa 800 ft lower than the mid-1960s (Crandell and Miller 1974:45). There is little floral data from Mount Rainier directly attributable to this period. Dunwiddie (1986:65-66) speculates that predominance mountain hemlock (*T. mertensiana*), normally represented at higher elevation, and loss of seral species at Jay Bath may be attributed to this glacial advance.[12]

In the absence of more refined floral data, we are limited to inferences based on combined effects of cooling and the lowered snowline. At 6,200 ft, permanent snowpack would cover some of the Park's larger expanses of upper elevation low gradient terrain (e.g., Sunrise Ridge and Spray Park). Even though tundra and subalpine associations would have shifted downslope, the substitution of sideslope habitat for the broader "pasture" of these rolling uplands, implies a loss of ungulate forage overall. However, other areas of flat to rolling terrain—Grand Park, Mist Park, Indian Henry's Hunting Ground—lie below the snowline as inferred and probably retained tundra, if not upper subalpine, qualities. For present purposes, I apply the same assumptions as those for the lesser Burroughs Mountain stade—that is, that net losses of upper elevation subalpine/tundra habitat probably were balanced by habitat increases at lower elevation. From a human standpoint, it is likely that use of the mountain continued, but use intensity may have decreased overall or shifted from higher landforms like Sunrise Ridge, upper Berkeley Park and Spray Park to lower elevation, low gradient landscapes such as Mist Park, Indian Henry's Hunting Ground, or presently forested lower elevation ground. It is important to note, however, that these assumptions are speculative in the absence of paleoecological and

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[11] Absence of pollen and macrofossil studies directed to eastern and northern sections of the Park make environmental effects difficult to track with precision.

[12] Dunwiddie labels all Garda stade advances as the "Little Ice Age". The term is more appropriately applied to late Garda world-wide cooling episodes (and lesser glacial advances) beginning about A.D. 1450 with cold weather peaks in the mid to late 1600s, early 1800s and mid to late 1800s (Crowley and North 1991:95-96).

archaeological data from a wider selection of Park locations. Such work holds intriguing promise for improving our understanding of paleoclimate, habitat and human interactions and are highly encouraged.

Modern Interlude 4; circa 500 B.P. to Present

The current interlude is marked by renewed climatic warming to within 1^{o} C of the present July average at sea level. The period is associated with a variety of short-term, punctuated climate shifts world-wide (the apparent contrast with earlier periods simply reflecting more complete climatic data for the historic period). The maximum extension of glacial ice associated with the Garda stade retreated sharply at the outset, though renewed minor advances occurring between 500 and 100 years ago (i.e., the *Little Ice Age*) technically may be considered part of the general Garda event (Crandell and Miller 1974:49-50, also see footnote 12). For the most part, the period from A.D. 1450 to the latter half of the 1800s was cooler than present, but warmer than the Garda stade peak noted above. Twentieth century oscillations also include the sharp, but brief, xerothermic event of the 1930s and a cold rebound in the 1940s.

It is reasonable to assume that climatically sensitive environmental zonation patterns described earlier applied, in general terms, throughout this most recent interlude. Also we assume that resource opportunities described in that section were available to human populations during this time frame and during each of the earlier Holocene modern interludes. The manner and intensity with which they were exploited, however, varied not only with resource availability and abundance, but with population density and social variables affecting human groups in the broader region surrounding Mount Rainier. Consideration of broad-scale, long-term changes in regional land-use patterns and their implications for the archaeology of Mount Rainier National Park is the subject of the following final section of the chapter.

ENVIRONMENT, HUMAN USE AND MOUNT RAINIER'S ARCHAEOLOGICAL RECORD

The intent of this chapter has been to draw attention not so much to Mount Rainier's environmental characteristics *per se*, but rather to emphasize their critical role in 1) conditioning the manner in which Park landscapes were used during the prehistoric past; and 2) transforming, obscuring, or obliterating the archaeological record of that use. The former issue largely concerns *why, when, where* and to a certain extent *how* the Park was used, and *what* effect such use can be expected to have had on the archeological record. The latter issue affects our ability to understand those land-use patterns through the physical remains left behind.

The second issue—post-depositional impacts to the archaeological record—is the more straightforward of the two. At Mount Rainier, the physical character of prehistoric remains have been altered or obscured most significantly through both destructive and depositional volcanic events and, perhaps, from major lahars. Lesser, more spatially localized disturbances result from such sediment disturbing events as tree fall, rodent burrowing, landslides and frost heaving. The primary concern here has been directed toward major impacts to the archaeological record resulting from Holocene volcanism—particularly Mount Rainier's summit collapse circa 4,700 years ago, and the summit rebuilding Mount Rainier series C eruptions of circa 2,400 years ago. The former event would have destroyed much of the early archeological record in the Park's northeast quadrant. The rebuilding eruptions served to hide what remained of the early to mid-Holocene record across much of the same quadrant as shown in Figure 2.3.

Important as physical alteration of the landscape may be to transforming the archaeological record, our primary interest here lies with the first of the two issues—the relationship between environmental patterns and prehistoric use of Mount Rainier. Accordingly, various sections of the chapter have sought to describe environmental parameters, and to draw attention to the causal relationship between geology, ecology and patterned human use of the mountain and its surrounding terrain. Below, issues developed in the text are summarized in terms of constraints Mount Rainier's environment posed to prehistoric human use.

Implicit to the discussion has been the notion that seasonal availability of economically important resources constitutes the primary reason that prehistoric humans used Mount Rainier.[13] I have argued that, because the most useful of these resources (e.g., goats, elk, deer, marmots, bears, game birds and huckleberries) are not evenly or randomly distributed, successful populations were those that fit their hunting and gathering strategies to the distribution patterns of the resources sought. In essence, this perspective views humans as intelligent predators focusing on a finite suite plant and animal species. If we hope to understand systematic human predation patterns then it is necessary for us to understand the behavior and patterned distribution of its most important prey. Once such links are established, corresponding patterns in the archaeological record can be predicted. Validity of the predictions become a test for the model and its economic premise.

Operating from these assumptions, and provided we can reasonably reconstruct environmental and resource history of a place, it is possible to derive basic expectations as to how people are likely to have organized their behavior in regard to that place. We have taken some time to establish the environmental resource history of Mount Rainier in order to build expectations that can be taken to the archaeological record for evaluation and rejection or refinement. Several basic sets of environmentally derived land-use and archaeological expectations close the chapter following the *why, when, where* and *how* metaphors introduced above.

Why Did Hunter-Gatherers Use Mount Rainier?

Perhaps the most basic question regarding prehistoric use of Mount Rainier is why a seemingly remote, difficult-to-access place with severe winters would have been used by prehistoric people all. It was not long ago that high montane environments were assumed by many to be poorly suited to human use during prehistoric times; at least in other than the most cursory manner or as barriers to be crossed on the way to somewhere else. Ethnographic evidence to the contrary (Smith 1964), presumed unimportance of high elevation landscapes was implicit in the river valley emphasis of the Park's first formal archaeological survey (Daugherty 1963) and lingered into the mid-1970s as witnessed by statements alluding to the Park's limited potential for archaeological remains (Bohannon 1974, 1975).

To understand why mountains were important to prehistoric hunter-gatherers, we must recognize that such places were *not* particularly remote to early Holocene foragers whose mobility options were not restricted by ties to lowland villages. Most archaeologists now accept basic tenets of Binford's (1980) forager/collector model as modified and elaborated in the Pacific Northwest.[14]

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[13] This is not meant to imply that *all* prehistoric use of Mount Rainier was economically driven; but rather, that *most* prehistoric use, *most* of the time was geared toward extraction of critical subsistence and maintenance resources. Accordingly, general patterns in the character of the archaeological record are explained most effectively by reference to these seasonally available economic attractors to the montane environment.

[14] The forager to collector continuum, and the mid-Holocene shift from predominantly mobile foraging to semisedentary collector land-use systems is discussed further in Chapter 5.

Working from that perspective, the annual round of early Holocene, small foraging groups would have been determined largely by the seasonal availability and productivity of locally obtainable subsistence and maintenance resources. Population density and competition for available food was low. The relatively few foraging groups in the region were free to move to new hunting and gathering places in a reasonably unencumbered fashion in accordance with changes in the availability of the most important resources. Storage needs were minimal and residential moves and could be made by the entire social unit.

For early Holocene foragers, subalpine and alpine habitats were used simply because they were among the best available places to acquire useful plants and animals during the summer and early autumn. Mountains remained useful so long as resource competition was low, and people were mobile enough to move into them during the productive summer season and move away to new locations when winter returned.

During the mid to late Holocene, the economic draw of montane habitats is less clear. Assuming increasing regional population density and elevated resource competition, unfettered use of upland habitats by small, autonomous groups would at some point have had to become unreliable. With or without environmental changes, a time had to come when there simply were too many people competing for too few resources in too little space. Such conditions provide economic stimulus for a shift to more intensive use of lowland resources—especially salmon; relying on mass harvest and storage (rather than group relocation) to bridge seasonal short-falls. Group sizes become larger and movement restricted by labor and storage requirements of the new economy. In essence, mobile foragers become semisedentary collectors with late summer harvest responsibilities focused on lowland rivers rather than subalpine meadows.

Schalk (1988) presents the clearest arguments for decreased mid to late Holocene use of upland environments in his study on the *Evolution and Diversification of Native Land Use Systems on the Olympic Peninsula.* As suggested above, he argues that salmon acquisition, processing and storage conflicts with summer use of the mountains, decreasing the resource value of the uplands and increasing logistical difficulty in their exploitation. Rather, it made better sense to allow elk and deer to fatten safely in subalpine summer habitats, to be hunted in the winter after they migrated back to lower elevation grazing areas.

The strength of these arguments not withstanding, presence of archaeological materials atop Mount Rainier-C tephra suggests that use of Mount Rainier's subalpine habitats continued into the late Holocene.[15] Three logical possibilities accommodate these data: 1) lowland-based communities continued to dispatch groups to the mountains to collect high-value commodities despite logistic difficulty and high labor costs relative to return; 2) the mid-Holocene shift to collector economies was not perfect, leaving marginal forager groups free to continue summer use of montane habitats despite reduced reliability; and/or 3) collector systems extended territorial boundaries into upland habitats and dispatched groups for limited collection tasks while guarding against summer poachers. In all cases, some use of the upland habitats continues, but in a manner consistent with increasingly complex logistic and political mechanisms required to fit elevated population density to a finite resource base.

In sum, there is ample resource-based reason to expect use of Mount Rainier to have begun early in the prehistoric period and to have continued, perhaps in a per capita reduced and redirected

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[15] Radiocarbon dated southern Washington Cascade sites discussed Chapter 3 also demonstrate human presence in the mountains during the late Holocene.

fashion, throughout the Holocene. The extant archaeological record amply demonstrates prehistoric use of Mount Rainier and the Cascades generally. If the arguments presented here have utility, we can expect continued archaeological research to demonstrate an extended temporal period for such use, and if the data are adequate, changing land-use strategies in the middle Holocene.

When Did Hunter-Gatherers Use the Mountain?

Temporal issues regrding use of Mount Rainier include seasonality, onset of earliest human activity and potential variation in use intensity through time. The first two of these issues are imbedded in the discussion above. Clearly, seasonal use of subalpine and higher landscapes on Mount Rainier is constrained primarily to summer and early autumn by severe winter weather and heavy snow cover. Generally, snowpack has melted and brows have greened sufficiently to support upward ungulate movement in June. The warmest, most predictable weather occurs in August and early September. Subalpine habitats can remain open into October. Accordingly, we would expect human use to have been biased toward these seasons during the prehistoric past much as it is in the present.

Human use of Mount Rainier and the Cascades probably began in the early Holocene coincident with retreat of Fraser glacial ice, dispersal of adequate exploitable plant and animal habitat, and presence of mobile human hunter-gatherers in the vicinity. Available paleoenvironmental data suggest that post-glacial open forest and tundra habitat was established in the Puget Lowlands and Columbia Plateau east of the Cascades as early as 13,500 years ago. With final wasting of the Sumas stade, similar habitat should have been established on Mount Rainier in sufficient area to support ungulate populations about 8,500 years ago. Human presence has also been established in the greater Pacific Northwest by this time. Accordingly, it is possible that earliest human use of the Park dates to approximately this period. The probability for significant human use of Mount Rainier rises sharply after circa 5,000 to 4,500 years ago as Hypsithermal climatic effects weakened and forest retreated to form the modern subalpine pattern.

Variation in human land-use intensity attributable to Holocene environmental causes is more difficult to predict. Events that can be expected to have affected exploitable plant and animal productivity include Holocene glacial episodes, volcanism, and forest encroachment during the Hypsithermal Interval. It is likely that the impact of both glacial and volcanic events was limited to short-term or localized habitat disruption with only marginal impact on human use. It is unlikely that either of these sources would have been sufficient to have caused a land-use hiatus of sufficient magnitude to be visible in the archaeological record. Rather, use patterns are expected to have shifted temporarily to remnant productive zones away from the source of disruption. Holocene glacial advances are expected to have lowered subalpine habitat several hundred feet in elevation. Given sufficient temporal and spatial control, the archaeological record may show a comparable downward shift during prolonged glacial advances at about 2,400 and again at about 600 years ago.

Where Did Montane Hunting and Gathering Activities Take Place?

Much of the discussion in this chapter has been dedicated to developing ecological concepts that would allow us to predict which mountain landscapes, or more properly environmental zones, are expected to be associated with most frequent prehistoric human use. Building on arguments linking edible resource productivity to repressed forest maturity, I have argued that human use, and hence the archaeological record, should demonstrate a consistent bias toward upper forest, subalpine and alpine tundra environmental zones. These are the places in which the most critical floral and faunal species — especially mountain goats, elk, deer, marmots, bear, ptarmigan and huckleberries—tend to occur in greatest density. If these resources are the primary attractors to prehistoric human use of the mountain, then the archaeological record should display a corresponding distribution pattern. While fire and other sources of forest perturbation may open roughly comparable habitat at lower elevation, these areas tend to reforest quickly and, hence, are less likely to experience continued use. Accordingly, over the long-term, I expect most use to have concentrated at or near the more permanently immature subalpine to alpine habitats. Available archaeological site distribution data presented in Chapter 3 and visible in Figures 2.10 through 2.13 are consistent with these expectations.

The expected location of sites at the upper forest margin warrants special comment. Sites here could be explained either 1) by reference to retreating tree line during Holocene glacial episodes; and/or 2) because such locations minimized distance to subalpine hunting grounds in a relatively storm-protected setting. I suggest that forest margin sites may have served as base camps from which subalpine and alpine hunting and gathering forays were staged (cf., Baxter 1986). These upper mid-elevation residential camps may have been particularly desirable for mid to late Holocene collectors, logistically tethered to lowland villages; though their protected location may well have made them desirable places to early Holocene foragers as well. If these concepts have merit, we should find a higher fraction of larger, multi-functional residential site concentrations among the forest fringe sites when compared with those in the subalpine and alpine zones. At least three presently documented sites—FS 95-10 below Mt. Ararat, FS 90-01 on the southern flank of Sunrise Ridge, and FS 71-01 near Buck Lake—appear to meet these criteria.

Some economically important resources, of course, are found outside subalpine and alpine habitats. Lithic sources, for example, reflect exposure rather than habitat considerations. Local tool stone is important because it reduces the need to carry elaborate, and heavy, tool kits to the mountain. Several suitable exposures of micro and cryptocrystalline silicate stone (cherts and jaspers) are located on Mount Rainier. One, in a forested setting on Tum Tum mountain in the Park's southeast quadrant, is a documented lithic procurement site (FS 90-04). Another presently unverified outcrop is reported near Mt. Fremont (Dalle-Molle 1988). While not quarry sites *per se,* what appear to be locally procured flakes are documented at sites near Mother Mountain (FS 95-06) and Windy Gap (FS 90-03 and FS 95-07). Additional lithic sources undoubtedly exist on the mountain as well. If found in reasonable association with use areas or trails to such areas, we can expect a good chance of finding evidence of quarrying and primary lithic reduction activities at these places. The link to resource zones emphasized here cannot be discounted altogether, but is necessarily secondary to the location of the sources themselves.

It is likely that some prehistoric/early historic effort was given to collecting cedar bark in valleys and on Mount Rainier's wetter slopes. Fibrous cedar bark was used historically for making, among other things, expedient containers for huckleberry collection and transport (see Mack 1996). Western red cedar (*Thuja plicata*) is limited to low elevation wet forests, but Alaska yellow cedar (*Chamaecyparis nootkatensis*) grows higher on the nearer potential berry sources. A copse of peeled cedars has been reported in the Park adjacent to Shaw Creek (Carl Fabiani pers. com. 1995). Two additional peeled cedars have been reported on Mount Rainier's southern boundary (Liddle, pers. com. 1996). It is likely that more sites will be found as surveys continue. The location and age of culturally modified tree sites, of course will be limited by habitat (especially that of Alaska yellow cedar) and the survival age of the trees (several hundred years).

Pedestrian and equestrian trails provided ingress and egress from Mount Rainier's resource zones. Sections of a trail most plausibly linking Sunrise Ridge to the Yakama Nation east of the Park have been reported in the vicinity of site FS 90-01 (Jack Morrison and Carl Fabiani pers. com. 1995, and Roger Drake pers. com 1996). There is no doubt that a network of trails extended into and across Mount Rainier during the prehistoric past. Unfortunately, trails tend to be poorly represented as archaeological sites because, where not documented historically, they tend to be invisible to archaeological scrutiny. Even so, historical documentation and early maps (e.g., USGS 1915) may be consulted for additional insight into trail location in the more recent past.

Ceremonial sites may or may not be associated with subalpine and alpine habitats. Ceremonial use frequently is ascribed to stacked rock and talus pit features common to the Cascades (see Winthrop et al. 1995). Elsewhere, I have suggested that many, perhaps most, of these features functioned as hunting blinds whose locations were keyed to the spatial association of rocky scree slopes with broad visual exposures (Burtchard and Keeler 1991:86) and hence are explainable by reference to the general resource driven model employed here. The validity of these arguments notwithstanding, ritual use of Mount Rainier cannot be discounted altogether. As yet no stacked rock or other arguably ritual features have been identified in the Park. However, the probability that such sites will ultimately will be documented is high. At that time, renewed effort should be made to establish function and investigate spatial patterns.

How Did Regional Settlement Systems and Montane Environments Affect Site Distribution Patterns?

Hunting and gathering patterns on Mount Rainier are constrained by the particular suite of resources available, their tendency to aggregate in upper elevation habitats, and their strictly seasonal availability. I have suggested that montane resources are integrated differently into the seasonal round of early Holocene foragers compared with mid to late Holocene collectors tethered to villages in major lowland river valleys. For foragers, we expect small, mixed age and sex residential groups to move as a unit to the near vicinity of the resources sought during the season in which they could be exploited most effectively. Foragers are expected to relocate when economic return degrades through local over-exploitation or seasonal change. Collector based economies support higher population densities operating out of permanent to semi-permanent villages. Resource collection trips are made to and from the village with composition of the collecting group dictated by the character of the task.

In either case, once on Mount Rainier, ungulate and other *faunal* resources probably were acquired in a roughly similar manner. Because of exposed habitat, unpredictable weather and occasionally rugged terrain, upland game are most effectively hunted by small task-specific parties capable of rapid place to place movement with short-term stays at any given point. Since such characteristics are not common to mixed residential groups, it is possible that both foragers and collectors on Mount Rainier employed a two-part settlement pattern with hunting parties operating out of and returning to somewhat larger residential base camps—the latter perhaps situated at the forest fringe.

Whether collected and dried for return to lowland villages or foraged for immediate consumption, huckleberries were probably the single most important *floral* resource on Mount Rainier. Acquisition requirements for huckleberries are quite different than those for game animals. Traditionally, huckleberries are collected by predominantly women and children and returned to a central location for consumption and processing. For early Holocene foragers, the optimal strategy overall would be to locate a base camp in a setting intermediate to berrying and hunting grounds that allowed access to both. Assuming huckleberries were valuable enough to warrant mass harvest, transport and storage, mixed sex hunting and gathering groups probably continued to use Mount Rainier through the mid to late Holocene. A dual residential gathering and task-specific hunting strategy appears to be the most optimal means to access both resource classes simultaneously.

Despite very different ways in which montane resources were integrated into broader subsistence systems through time, the manner in which they were most effectively exploited on Mount Rainier may have resulted is similar archaeological signatures. That is, for both early Holocene foragers and later Holocene collectors, the best way to hunt and gather mountain resources was to establish moderate-term residential base camps at the forest/subalpine ecotone in support of task-specific procurement locations in subalpine, alpine and perhaps low glacial settings. Although limited, present site distribution patterns on Mount Rainier are consistent with these expectations. As shown on the fold out maps and discussed in subsequent chapters, prehistoric sites are strongly oriented toward subalpine to alpine contexts. Most of these most sites appear to be low density, probably task-specific, lithic scatters. Larger, ostensibly more functionally diverse sites, are set at somewhat lower forest/subalpine ecotonal settings.

Chapter 3

ARCHAEOLOGICAL HISTORY OF MOUNT RAINIER AND THE SOUTHERN WASHINGTON CASCADES

The preceding chapter described Mount Rainier's environmental characteristics emphasizing expected connections between environmental variables and patterned human use of the mountain and its surrounding terrain during the prehistoric past. If those expectations approximate a true picture of past events, then the archaeological record of Mount Rainier National Park should reflect certain aspects of the relationship as laid out in the concluding section of that discussion.

Here we move to a consideration of the history and character of the archaeological record in Mount Rainier National Park and in the surrounding southern Washington Cascade region. The first section describes the early history of archaeology in the Park from the first known report of a prehistoric artifact in the 1920s through the final project completed prior to initiation of the present reconnaissance. The second section, authored by Rick McClure, provides an overview of what is currently known of the broader archaeological record in the vicinity of the Park.

THE EARLY HISTORY OF ARCHAEOLOGY IN MOUNT RAINIER NATIONAL PARK

The first known report of prehistoric archaeological remains is found in former Park naturalist and guide Floyd Schmoe's book *A Year in Paradise* (Schmoe 1967). Returning from a climb in the early 1920s, Schmoe found an obsidian projectile point tip in an alpine goat wallow southeast of Lane Peak in the Tatoosh Range. While he credits the presence of this artifact to a fanciful hunt for the last Mount Rainier mountain sheep (Schmoe 1967:132), he was nonetheless aware of the implications of the high elevation setting that his find occupied. Other early reports of lithic remains from Van Trump Park south of Mount Rainier (Schmoe 1926:80 in Smith 1964:207-208) and Spray Park to the northwest (Richards 1930:7 in Smith 1964:208), also are situated in alpine settings, suggesting that hunting for goat or other alpine fauna was widely dispersed across the Park during the prehistoric past. At least one of these early finds—a chalcedony biface tip—is preserved in Mount Rainier collections in Longmire (catalog number 59, see Appendices A and B). While credited to Schmoe, the find more plausibly is Richards' Spray Park "white quartz" find.

Over the years, various other Park employees also have reported a wide variety of prehistoric and historic remains. Like the biface noted above, an unknown fraction of prehistoric artifacts, some with location data, some without, have made their way into the Park's collection (Appendices A and B). While dominated by dart and arrow-sized projectile points and lithic debris, this casual collection also includes several heavy ground stone tools suggesting that a variety of tasks, some involving short to moderate-term seasonal residence, also were being pursued within Park boundaries.

The first formal archaeological resource study of Mount Rainier National Park was as a combined ethnographic study and archaeological inventory conducted in 1963 by Allan Smith and Richard Daugherty affiliated with Washington State University (WSU) in Pullman. Smith's thorough ethnographic and literature review (Smith 1964) was intended to provide background to an archaeological record he hoped would emerge through field inventory. Based on interviews with local Yakama, Taidnapam, Nisqually and Muckleshoot informants, supplemented by ethnohistoric accounts and Park Service records, Smith postulated early historic territorial boundaries and suggested that Park land-use strategies focused on late summer huckleberry collecting and supplemented by hunting primarily in 4,500 to 6,000 ft Hudsonian (subalpine) life-zone settings (Smith 1964:esp.253-256). While Smith did not anticipate discovery of a large number of archaeological sites, he believed that his data would help build the Park's archaeological record by focusing attention on the subalpine to alpine berrying and hunting settings so clearly emphasized in his informant and literature sources.

Richard Daugherty directed the archaeological study in the late summer of 1963. Unmindful of Smith's subalpine focused results, and apparently unaware of ecological reasons to expect a subalpine land-use focus, Daugherty's reconnaissance emphasized major river drainages with only limited inspections of higher elevation landscapes (see Daugherty 1963:8). Given the valley floor bias, it is not surprising that the project's brief report noted discovery of only two prehistoric localities. These were Fryingpan Rockshelter (FS 63-01 or 45PI43) at the forest/subalpine ecotone on Fryingpan Creek;[16] and IF 02-63, an isolated ovate dart point exposed in a parking lot cut-bank near subalpine Bench Lake on the south face of Mount Rainier. No mention was made of additional archaeological properties in Mount Rainier National Park.

In 1964, David Rice and Charles Nelson excavated a test unit into the floor of Fryingpan Rockshelter found the previous year (Rice 1965). From a 1.25 x 1.85 m unit at the eastern edge of the shelter, they recovered 13 formed tool fragments, 100 pieces of chipped stone debitage and 100 bone and tooth fragments in two levels. A pumice pipe bowl had been collected the previous year. Rice argued that the relationship between cultural and natural stratigraphy in the cave were consistent with use between 1,000 and 300 years ago. Based on stylistic attributes of two projectile points, he inferred use by populations originating from the Columbia Plateau east of the Cascades. Rice suggested that the bone fragments were deer.

The bone remains, however, may not have been deer at all. Fauna from Fryingpan Rockshelter were reanalyzed in the early 1980s in a general study designed to address the presence of prehistoric elk populations in Mount Rainier National Park (Gustafson 1983). Gustafson (1983:27-28) was not able to identify any of the fragmentary bone, but was able to identify tooth remains as either goat (*Oreamnos americanus*) or bighorn sheep (*Ovis canadensis*). It is reasonable to assume that some or all of the bone was goat (sheep have not been observed at Mount Rainier) rather than deer as previously suspected. These results, while limited, are particularly intriguing given the site's ecotonal forest/subalpine location and proximity to alpine tundra goat habitat in Mount Rainier's Panhandle Gap area.

Figure 3.1 and accompanying Table 3.1 summarize the distribution of prehistoric sites in Mount Rainier National Park as established by reports dating from Park inception in 1899 through 1970. In part, the low count reflects the absence of intensive efforts to locate such remains (other than the 1963 Daugherty survey), and the general tendency for casual observers or collectors not to report their finds. To some extent, it also reflects the self-fulfilling belief that the mountain was simply too large, too daunting, too remote, with too few resources to be used other than cursorily by prehistoric populations. Despite Schmoe's (1967:140-141), Smith's (1964) and others accounts of early historic use of subalpine meadows, the primary *archaeological* focus remained firmly fixed on the lowlands;

[16] While not credited in Daugherty's report, the survey team apparently was shown the site by Terry Patton, then a Ranger Naturalist at Mount Rainier National Park, underscoring the value of actively seeking Park employee cultural resource observations and opinions.

particularly on salmon-bearing rivers and streams. The mountains tended to be viewed more as a backdrop or travel barrier, rather than as a productive environment to be integrated into an effective seasonal round by populations residing in their vicinity.

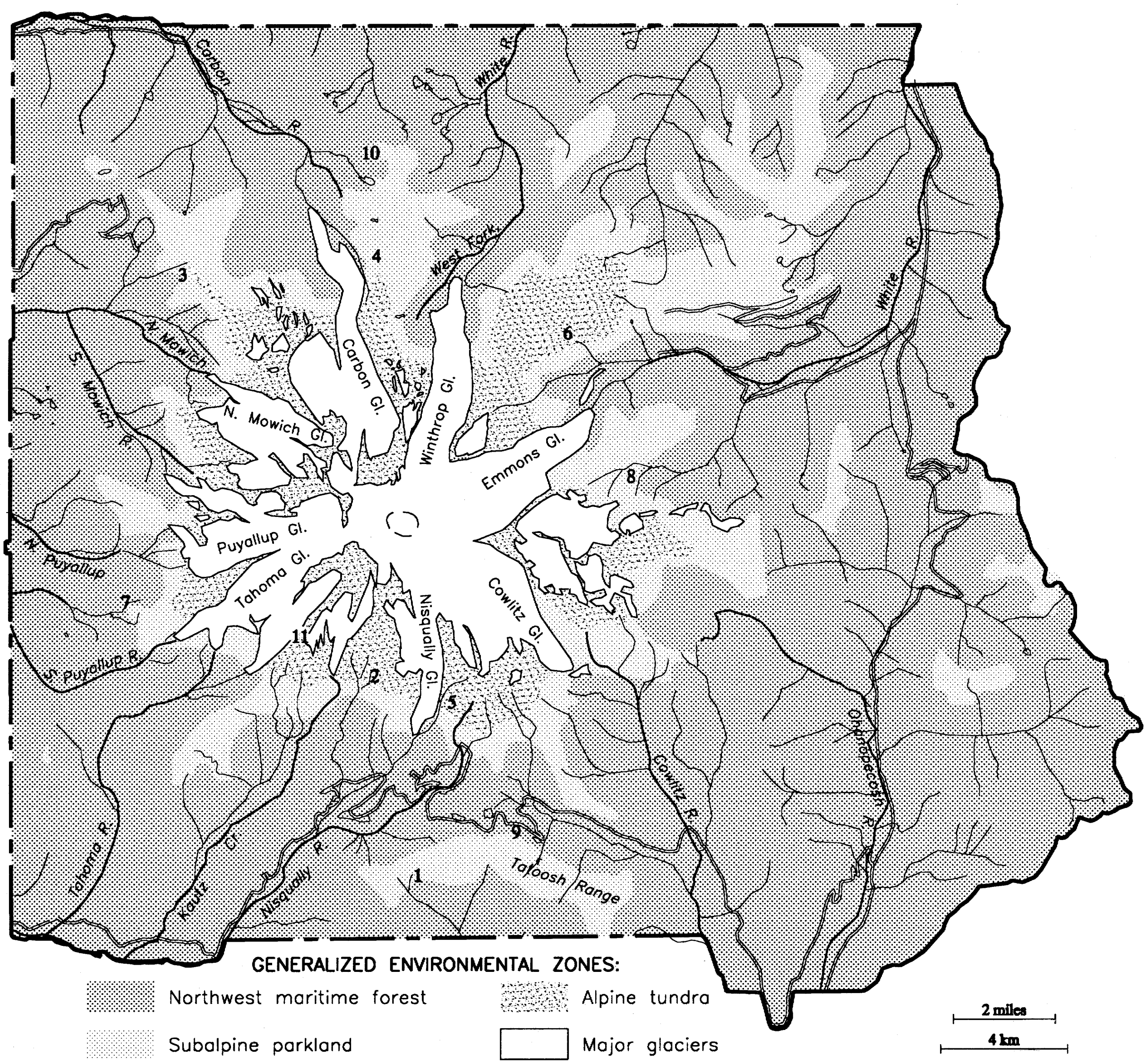

Figure 3.1 Mount Rainier Prehistoric Localities Reported through 1970

Table 3.1 Reported Prehistoric Sites and Isolates, 1899-1970 (also, see Appendix A)

No.	Date	Reported Find	Source	Comment
1	1920s	Obsidian projectile point	Schmoe 1967:128	Lane Peak, location approximate
2	1920s	Unspecified lithic remains	Schmoe 1926:80 in Smith 1964:207-208	Van Trump Park, location unknown
3	1930	Chalcedony biface tip	Richards 1930:7 in Smith 1964:208	Spray Park, location unknown
4	Unknown	Biface preform	Museum collection	Moraine Park, location unknown
5	Unknown	Arrow point	Museum collection	Glacier (Nisqually?) Vista Trail, location unknown
6	Unknown	Dart point	Museum collection	Burroughs Mtn., location unknown
7	Unknown	Arrow point	Museum collection	Klapatche Park, location unknown
8	1963	Rockshelter Site	Daugherty 1963	FS 63-01, 45PI43 on Fryingpan Creek
9	1963	Ovate dart point	Daugherty 1963	IF 01-63, near Bench Lake
10	1968	Arrow point & flake	Museum records	IF 01-68, Bee Flat bench near Yellowstone Cliffs
11	1970	Arrow point & biface tip	Museum records	IF 01-70, on Success Cleaver

Note: two additional artifacts—a chert biface and an ax head (catalog numbers 57 and 58, respectively)—are curated without reference. Given the low catalog numbers, these artifacts probably were found in the 1920s or 1930s. Artifacts 4 through 7 probably were found somewhat later.

Between 1964 and 1986, new archaeological information from within the Park came primarily from site and artifact reports by Park employees, and from internal site-specific clearance inventories. In the 1970s and early 1980s, site-specific surveys were conducted in association with the proposed Ashford sewage system, Paradise sewage system, White River entrance station, and utilities installation at Ohanapecosh (see Bohannon 1974, 1975; Teague 1981). These surveys failed to document clearly cultural remains in the areas in question, though Teague alludes to a "...possible flake scraper ...found as an isolated occurrence" and several 20th century hearths at the Paradise treatment plant. These remains were not considered significant and related project clearances were issued. Interestingly, professional reports reflect the then current assumptions, reinforced by Daugherty's negative results, that "aboriginal remains [in the Park] are few and far between," (Bohannon 1974:1) and that prehistoric use tended to focus on riverine resources with only brief forays into the uplands (Bohannon 1975:1). Informally reported finds, however, were beginning to indicate a very different pattern.

By the 1980s, reports accumulating from Park employees and other interested individuals suggested that prehistoric remains, if not abundant, were at least widely distributed across subalpine landscapes. John and Lois Dalle-Molle, for example, were most active in reporting archaeological observations. A 1978 memo (Dalle-Molle and Dalle-Molle 1978) to the Superintendent lists and provides map data on 12 locations, most of which have since been documented formally as sites and isolated finds.[17] Figure 3.2 shows the developing site distribution pattern as it would have appeared in 1980 had existing records been consolidated; Table 3.2 lists reported sites and isolates from 1971-1980.

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[17] Documented localities first reported by John Dalle-Molle include the Buck Lake lithic scatter (FS 71-01), Frozen Lake Site (FS 86-01), Berkeley Park Rockshelter (FS 86-02), Vernal Park Rockshelter (FS 74-01), Mt. Pleasant Rockshelter (FS 72-02), and the Deadwood Lakes Pass isolate (IF 01-77). He, Carl Fabiani, and Frank Bell also variously reported lithic remains at Windy Gap and at Bee Flat on the Northern Loop trail to Windy Gap from Ipsut Creek. Thanks to their general directions, recorded sites and isolates in these areas now include FS 90-03, FS 95-07 and FS 95-08 near Windy Gap, and IF 01-68 at Bee Flat. Information on all of these localities is included in Sections 2 and 3 of this report, and summarized in tabular form in Appendix B.

Formal archaeological studies resumed in 1986. In late August of that year, Eric Bergland, Jane Evans, and Park Service regional archaeologist James Thomson completed a brief inventory originally intended to reexamine Fryingpan Rockshelter (Bergland 1986:1). Early in the project it became apparent that prehistoric sites were more numerous than assumed. Through discussion with Park employees and examination of collections, Bergland (1986:3) consolidated information on 14 potential prehistoric site locations. In recognition of the Park's varied archaeological record, the group chose to document two of the most promising of the reported localities, rather than focussing exclusively on Fryingpan Rockshelter. These sites were the Frozen Lake lithic scatter (FS 86-01 or 45PI407), situated in an alpine tundra setting west of the Sunrise visitor's center; and Berkeley Rockshelter (FS 86-02 or 45PI303), a double talus boulder shelter with both prehistoric and historic period remains in upper Lodi Creek canyon (see Burtchard and Hamilton 1998). Berkeley Rockshelter was tested further the following year.

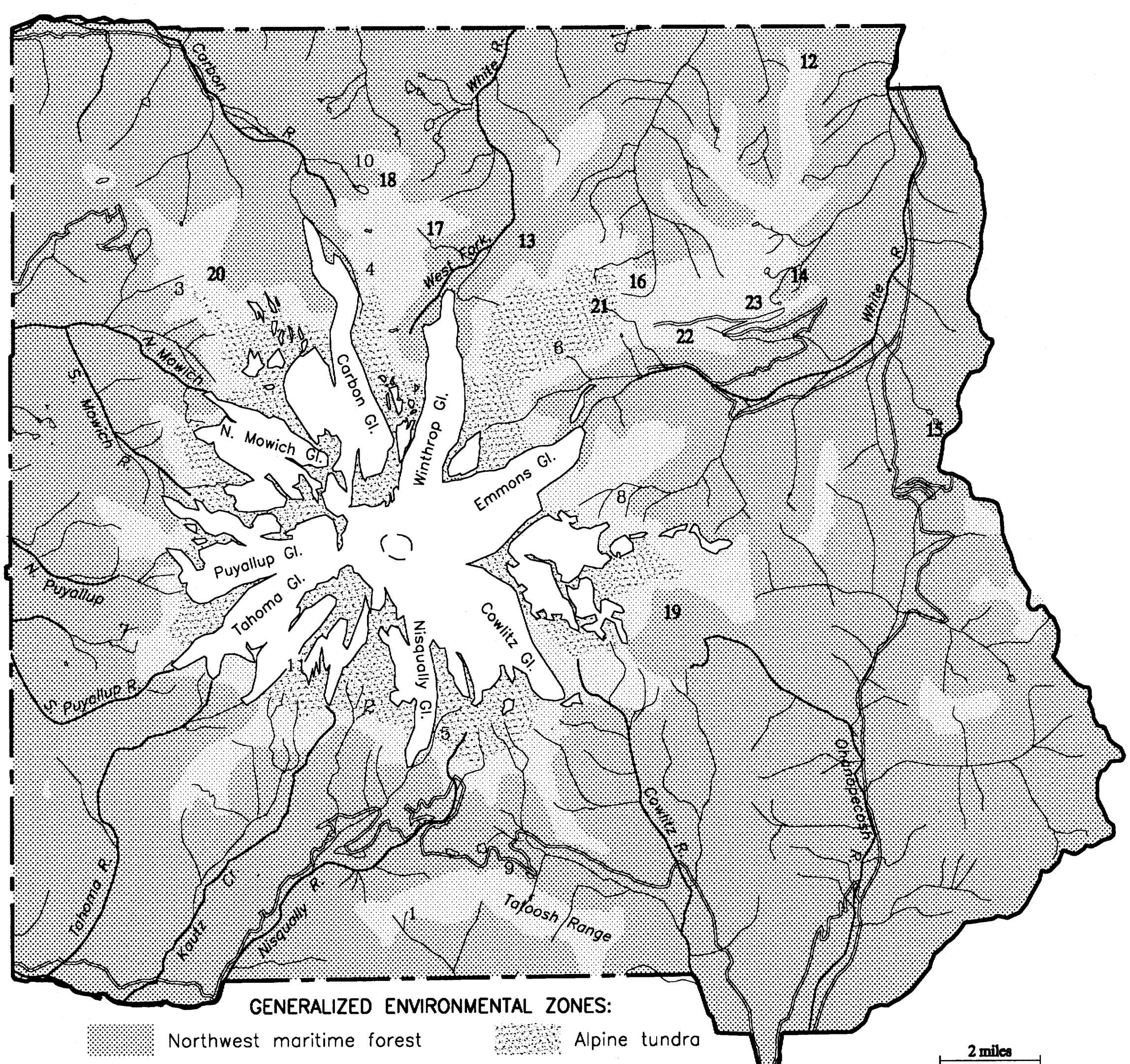

Figure 3.2 Mount Rainier Prehistoric Localities Reported through 1980

Table 3.2 Reported Sites and Isolates, 1971-1980 (also, see Appendix A)

No.	Date	Reported Find	Source	Comment
12	1971	Lithic scatter	Dalle-Molle & Dalle-Molle 1978	FS 71-01, 45PI438; Buck Lake, documented 1995
13	1971	Rockshelter	"	FS 86-02, 45PI303; Berkeley Park, documented 1986
14	1972	Biface tip and flake	Museum records	IF 01-72; Sunrise Creek
15	1978	Unspecified lithic artifact	D-M & D-M 1978	IF 01-77; Deadwood Lakes Pass
16	1978	Probable arrow point	"	Huckleberry Park, 1995 verification unsuccessful
17	1978	Rockshelter	"	FS 74-01, 45PI437; Vernal Park, documented 1995
18	1978	Lithic Scatter	D-M & D-M 1978 C & D Fabiani 1995	Non-specific Windy Gap area (Dalle-Molle); Flakes in trail west of southern tarn lake (Fabiani)
19	1978	Rockshelter	D-M & D M 1978	Unverified site on Boulder Creek
20	1978	Rockshelter	"	FS 72-02, 45PI433; Mt. Pleasant, documented 1995
21	1978	Lithic Scatter	"	FS 86-01, 45PI407; Frozen Lake, documented 1986
22	1978	Isolated flake	"	Nonspecific locations on Sunrise Ridge. (Four Yakama Park sites/isolates, documented 1995)
23	1978	Flake	"	Dege Peak, 1990 verification unsuccessful

Eric Bergland completed a limited test excavation and surface collection at Berkeley Rockshelter in August 1987 (Bergland 1988). He collected surface remains and excavated a 1 x 1 m unit in the larger lower shelter and a 0.5 x 0.5 m unit in the upper shelter. Surface historic and subsurface prehistoric remains were found in each shelter. Prehistoric debris included predominantly late-stage lithic debitage, arrow points and a low density assortment of bifaces, used flakes, cores and miscellaneous lithic remains. The subsurface samples also contained highly fragmented bone and charcoal; all *overlying* what appears to be Mount Rainier C tephra (circa 2,300 B.P.). Three stratified radiocarbon dates from the lower shelter were consistent with late Holocene use.[18] Unfortunately, the predominantly burned bone was too fragmented for identification beyond "large mammal." Recognizing the tentative nature of inferences based on such a small sample, Bergland nonetheless suggested that Berkeley Rockshelter functioned as a seasonal hunting camp, with at least three occupational events dating between approximately 1,000 to 300 years ago. As did Rice 23 years before, Bergland (1988:22) used stylistic attributes to infer cultural affiliations with the Cascades foothills and the Columbia River to the south and east. Historic period remains are attributed to early 1900s Park Service, sheepherding, prospecting and/or hunting camps.

In 1988, Park employees Chris Jensen and Steve Freitas reported a lithic scatter west of Tipsoo Lakes near Chinook pass on the eastern Park boundary. It was recorded formally by Rick McClure as FS 88-01 (45PI406) later that year. The following year, surveys for two proposed construction projects were conducted in the northeastern park quadrant—one for parking lot paving at Tipsoo Lakes, the second for

[18] The stratigraphically lowest radiocarbon sample taken from a charcoal lens in culturally sterile sediments overlying probable Mount Rainier C tephra returned a radiocarbon age of 1970 ±80 years: 20 B.C. [Beta 44528] (Sample MORA #4633 submitted by R. McClure after Bergland's study). A discrete sample from the lowest clearly cultural stratum 39 cm below the surface returned an age of 1070 ±90 years: A.D. 880 [WSU 3666]. A composite sample from 0 to 10 cm below the surface was dated to 290±120 years: A.D. 1660 [WSU 3665]. All samples were removed from test Unit A in the lower shelter.

expansion of Highway 410 adjacent to the White River north of the Sunrise turnoff. The Tipsoo Lakes results (Forrest 1989) confirmed McClure's observations and added reference to a small distinct lithic concentration south of the largest lake. This second Tipsoo location remained undocumented until found again by Gregg Sullivan and recorded as FS 95-01 (45PI426) during the current reconnaissance.

The first phase of what was to become the present project was begun in 1990. Rick McClure, then an archaeologist with the Randle District of the Gifford Pinchot National Forest, was contracted through interagency agreement to provide a general archaeological overview and research design for Mount Rainier National Park. Award of the project recognized the Park's need to develop a systematic framework to interpret and manage its growing archaeological record. McClure interviewed Park employees, and with the assistance of Janet Liddle and Cari Kreshak, conducted site inspection surveys that resulted in formal documentation of four new prehistoric sites—a dense lithic scatter on the flanks of Sunrise Ridge (FS 90-01, 45PI408); two subalpine to alpine limited use lithic scatters near Sarvant Glaciers (FS 90-02, 45PI409) and at Windy Gap (FS 90-03, 45PI410); and a chert quarry on Tum Tum Peak (FS 90-04, 45PI411). McClure (1990) also completed an introductory overview to the archaeology of Mount Rainier and adjacent areas. Table and Figure 3.3 provide a summary description and show the distribution of both reported and formally documented prehistoric sites and isolates through 1990.

Table 3.3 Reported Sites and Isolates, 1981-1990 (see also Appendix A**)**

No.	Date	Reported Find	Source	Comment
24	1984	Arrow point	Museum records	IF 01-84; near Upper Palisades Lake
25	1986	Lithic scatter	Bergland 1986:3	Unverified, at Indian Bar, precise location unknown
26	1986	Lithic scatter	Bergland 1986:3	Unverified, on Lake James trail, location unknown
27	1987	Dart point	Museum records	IF 01-87; near Tokaloo Rock
28	1988	Jasper lithic quarry	Dalle-Molle 1988	Unverified site; near Mt. Fremont
29	1988	Lithic scatter	McClure 1990 & Forrest 1989	FS 88-01, 45PI406; Tipsoo Lakes
30	1989	Lithic scatter	Forrest 1989:3	FS 95-01, 45PI426; documented 1995 at Tipsoo Lakes
31	1990	Lithic scatter	McClure 1990	FS 90-01, 45PI408; below Sunrise Ridge
32	1990	Lithic scatter	McClure 1990	FS 90-02, 45PI409; Sarvant Glaciers
33	1990	Lithic scatter	McClure 1990	FS 90-03, 45PI410; Windy Gap
34	1990	Chert lithic quarry	McClure 1990	FS 90-04, 45PI411; Tum Tum Peak

Note: Two ground stone mauls (catalog numbers 8319 and 8320) are stored without location information at Park headquarters. The catalog numbers suggest discovery during this time period. Lithic remains from the Paradise waste treatment plant (Teague 1981) and near White River springs (MORA 89-01 or Site #1 in Forrest 1989) are not included because of improbable prehistoric affiliation. Unverified masonry on Cataract Creek is not included because of probable historic period use (see Bergland 1986:3).

Despite its productive beginning, the 1990 project was not completed as envisioned. Site forms for the four newly documented sites were prepared and registered with the Washington Office of Archaeology and Historic Preservation (OAHP), and an archaeological background draft was written (McClure 1990). The final overview and research design document, however, was not finished.

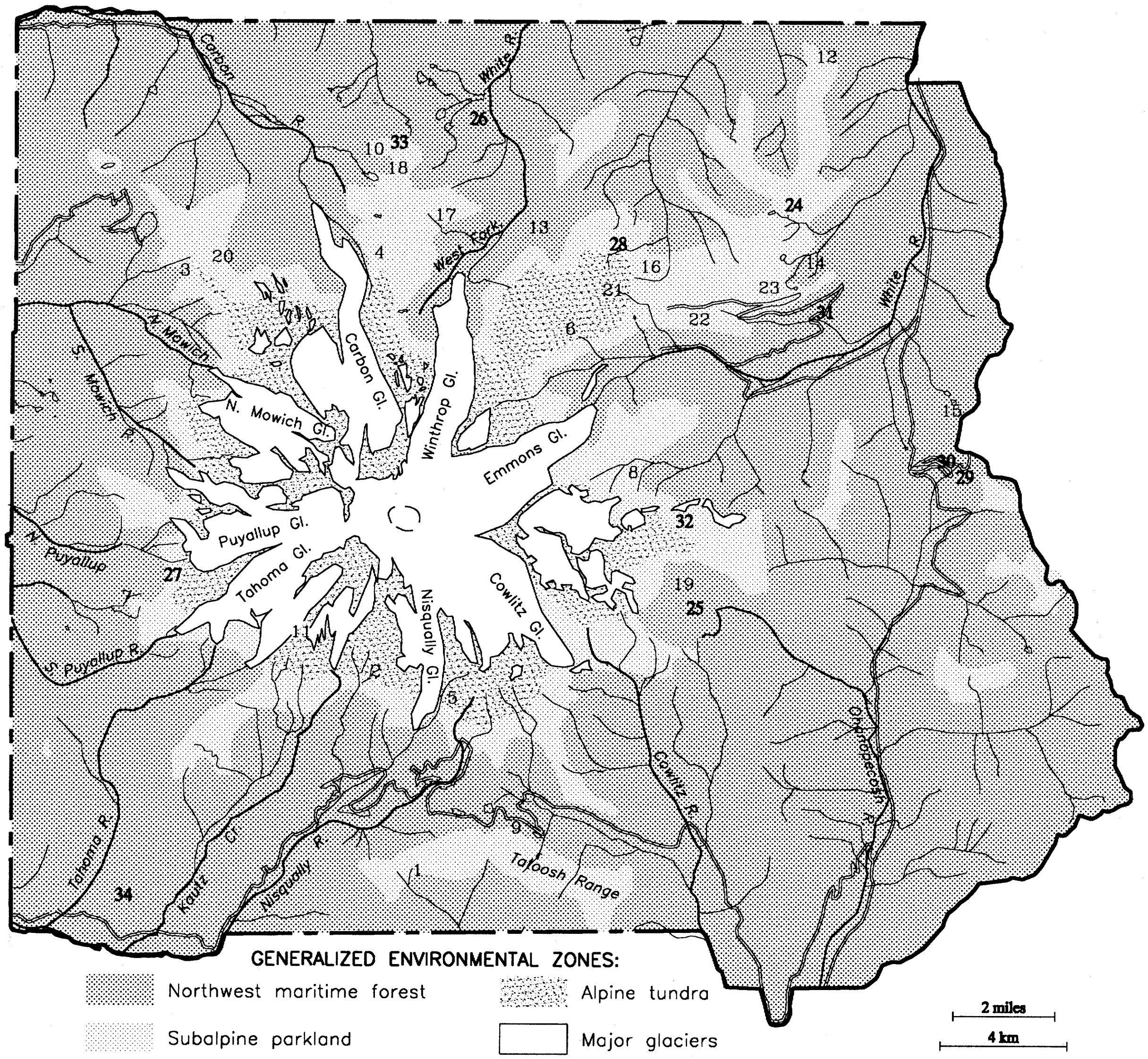

Figure 3.3 Mount Rainier Prehistoric Localities Reported through 1990

The present project grew directly from the desire to build on the foundation begun in 1990; and to complete the overview/research design in a manner that would assist continuing management obligations and improve our understanding Mount Rainier's place in larger regional and temporal contexts. Archaeological procedures and results of the present Mount Rainier effort are discussed in detail in Chapter 4. In the following section, we consider the character of the southern Washington Cascades archaeological record in the in the vicinity of the Park.

PREHISTORIC ARCHAEOLOGY IN THE SOUTHERN WASHINGTON CASCADES
by Richard H. McClure, Jr.

Over the past decade, archaeological research in the Washington and Oregon Cascades has increased dramatically. A substantial amount of that research has taken place within the Southern Cascades Physiographic Province. The scope of this summary includes those watersheds that lie adjacent to Mount Rainier National Park. These watersheds were the home territory of Native peoples who travelled to the slopes of Mount Rainier during the historic period. Assuming that prehistoric people followed a similar land-use pattern, archaeological research from these drainages provides a context for understanding archaeological resources within Park boundaries.

Models recently developed to explain prehistoric settlement and subsistence in the Cascades foothills (Blukis Onat 1988; Mierendorf 1986) indicate that the mountain highlands were used extensively by people living in settlements well within the foothills, at least during the late prehistoric period. People living further downstream had access to different resources, such as those from saltwater estuaries, thus entailing a somewhat different economy and concomitant material culture. These differences provide some justification for restricting the discussion to what is essentially the central portion of the southern Washington Cascades region.

The following summary is organized geographically. It includes 1) White River drainage basin north of the Park, 2) Naches and Tieton drainages east of the Park, and 3) upper Cowlitz River watershed south and west of the Park. A fourth section is a consideration of regional site chronology. Archaeological data from drainages west of the Park, including the upper Puyallup and Nisqually watersheds, is very limited. Although numerous archaeological surveys have been conducted in this area, few prehistoric sites have been found. Two sites on the Nisqually/Cowlitz watershed divide (45LE277 and 45LE288) are discussed in the section describing research in the upper Cowlitz basin. Sites and places discussed in this account are shown on map Figure 3.4.

Upper White River Basin

The earliest professional investigations centered on a series of prehistoric sites on the Enumclaw Plateau, in the White River drainage north of Mount Rainier National Park. Site survey, documentation, and test excavations were conducted by Green River Community College archaeology classes under the direction of Dr. Gerald Hedlund beginning in 1968 and continuing into the late 1970s (Hedlund 1973, 1976, 1983). Of the 19 sites documented in this foothills area, two sites on private farmland were selected for excavation. They include the Imhoff site (45PI44), excavated between 1968 and 1971, and the Jokumsen site (45KI5), excavated in 1972 and 1973.

Approximately 457 m^2 of the Imhoff site were sampled, producing an artifact assemblage of 768 items. Hedlund and his students also collected surface artifacts at the nearby Schodde site (45PI45). Microcrystalline silica and silicified wood are the dominant lithic raw material types represented in the two collections. Hedlund initially (1978) believed these materials were largely from exotic sources, but later (1986) recognized their abundance in local stream gravels. Traditional/functional tool classes from the two sites include a variety of unifacial tools such as scrapers, blades, burins, and gravers, with "flake side-scrapers" being the most numerous. Utilized flakes, cores, and core tools, knives, and projectile points were also collected. The majority of the projectile points (47.5%) are small triangular types that Hedlund (1973:49) noted "indicate a similarity to those of the Cayuse phase," referring to the Plateau typology developed by Nelson (1969). The second most common type is of leaf-shaped form (34.5%).

Perhaps the most significant discovery at the Imhoff site was a number of features including an earth oven, five fire hearths, and a series of post holes. Radiocarbon dates of 440±70 B.P. and 690±85 B.P. were obtained from the features (Hedlund 1973:80). The post holes provided evidence of a structure. Hedlund concluded that the sites represent late prehistoric exploitation of the local prairie environment, and proposed that the prairies were anthropogenic, maintained by periodic burning to enhance the productivity of floral and faunal food resources.

At the nearby Jokumsen site (45KI5), Hedlund and his students encountered more evidence of structures, including a possible semi-subterranean pit house 10 x 6 m (Hedlund 1983). In another portion of the site, "Post alignments were found... that may have been used as a framework for a structure like a mat lodge or drying racks" (Hedlund 1976:87). Approximately 220 m^2 were excavated, in some cases to over 2 m depth. Deposits containing the possible structural remains rested on a thick clay-rich Osceola mudflow deposit. Cultural material was also found below the mudflow, associated with radiocarbon dates of 4,980±60 B.P. from the surface of the pre-mudflow soil, and 5,750±110 and 5,730±90 B.P. lower in the profile. Hedlund suggests that the site may have been occupied at the time of the Osceola event.

Over 13,000 stone artifacts were recovered from the Jokumsen site (Hedlund 1976:85). Raw materials represented in the collection include such microcrystalline silica varieties as jasper, chalcedony, chert, and opal. Igneous materials such as andesite and basalt are also represented in large numbers, and dominate the pre-mudflow lithic assemblage. The artifacts from the early component include gravers, burins, end scrapers, triangular projectile points, a single drill and a single leaf-shaped projectile point. Possible bolas and sling stones are also reported in the early assemblage.

The composition of the later assemblage from the site is somewhat similar to that described for the Imhoff and Schodde sites, but also includes some microblades and microblade cores. Hedlund (1976:85) lists 222 leaf-shaped projectile points, 220 triangular-shaped forms and 53 lanceolate points in the post-mudflow deposits. A radiocarbon date of 1,125±70 B.P. is associated with this later component, which may actually represent several different periods of occupation. It appears that the later component of the Jokumsen site represents a winter village settlement (Hedlund 1983:118). The Imhoff and Schodde sites may also have functioned as such.

Of the other sites identified by Hedlund on the Enumclaw Plateau, several apparently functioned as temporary camps. At least one, Site 45KI13 on Newaukum Creek, may have served as a special-purpose fishing camp.

After investigations at the Jokumsen site, Hedlund and his students turned their attention to higher elevation sites located to the east of the Enumclaw Plateau, and within the Greenwater and upper Green River watersheds. Between 1974 and 1977, several lithic scatters were discovered on private and National Forest lands on or near the Cascade crest. Investigations were limited to field documentation of surface artifact material. The Twin Camp site (45KI35), located in a Forest Service campground, is the largest of the sites. It has been severely damaged by road construction, campground development and relic collecting. Hedlund (1978:18-19) observed two distinct activity areas of concentrated artifacts, including debitage and cores, utilized flakes, side scrapers, end scrapers, flake or blade knives, gravers, burins, and a few projectile points. Hunting, butchering, skinning and hide working, woodworking and bone working activities are inferred. Even so, Hedlund suggests that the site also functioned as a late summer berry-gathering camp, apparently because of its proximity to this resource.

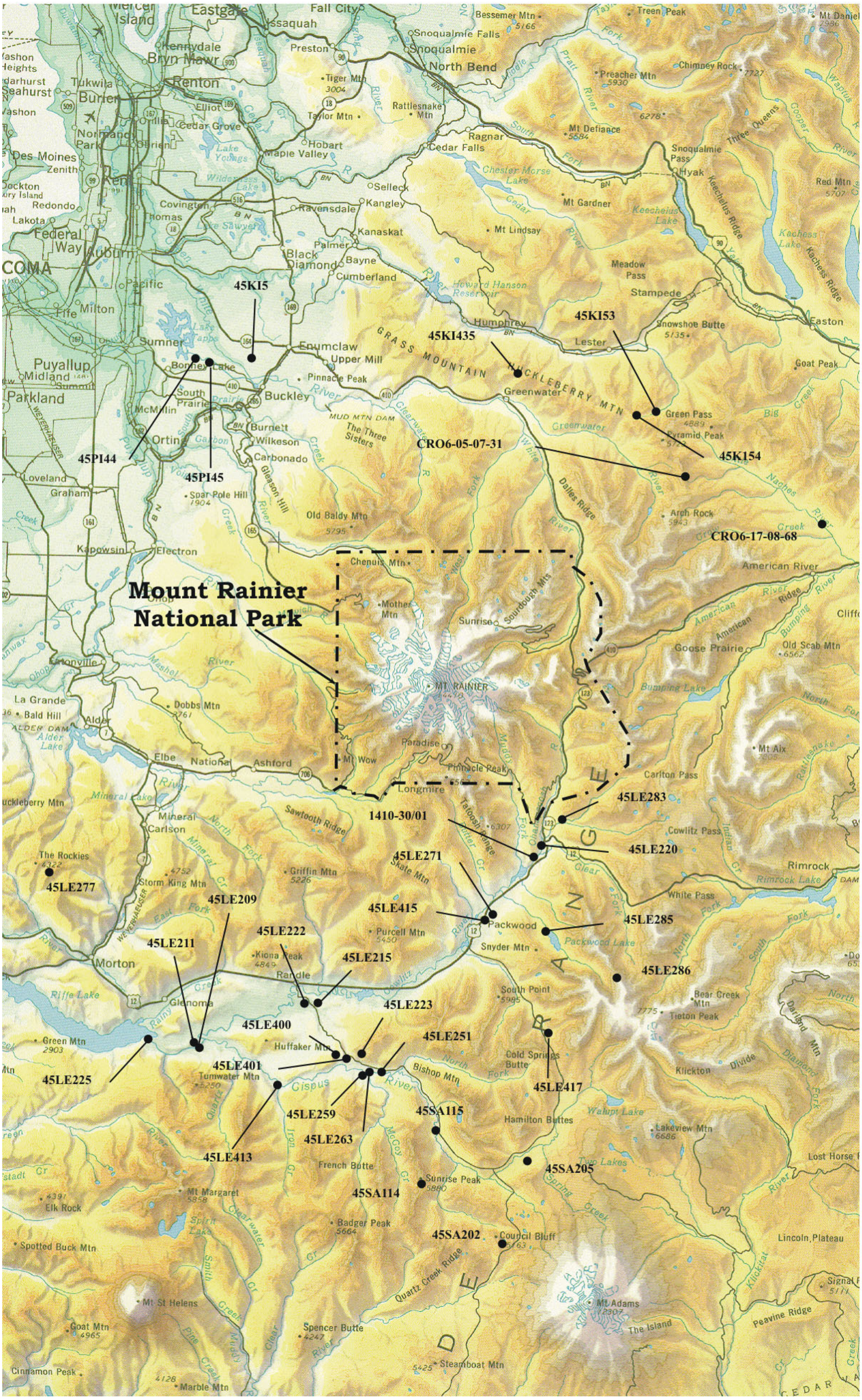

Figure 3.4 Investigated Archaeological Sites in the Vicinity of Mt. Rainier National Park

Hedlund et al. (1978) summarize investigations of four highland lithic scatters, including the Twin Camp site, in an overview of the archaeology and prehistory of the Green River watershed, written under contract to the Mt. Baker-Snoqualmie National Forest. In discussing the function of these sites, they argue that the sites "indicate a far more complex pattern of existence than casual use for berry-picking for a brief period in the late summer," instead, he said, "these sites reflect multiple types of economic use of the high Cascade region" (Hedlund et al. 1978:25). Among the first to champion the cause of Cascades archaeology, Hedlund charged that professional archaeologists had showed something akin to ethnocentric bias in perceiving the highlands as "marginal" areas of little interest. His conclusions included recommendations for more extensive surveys as well as the select testing and excavation of sites in differing ecological settings.

The first test excavations at a highland site in this area were conducted in 1979 by Glenn Hartmann (1980a). Two sites on Huckleberry Mountain, 45KI53 and 45K154, were involved in this investigation, completed prior to a proposed National Forest road construction project. Field work included systematic surface collection and the excavation of two 1 x 1 m test units at 45KI53 and eight at 45KI54. The former had been largely destroyed by previous land disturbing activities, while undisturbed cultural deposits were found at the latter. The predominance of thinning flakes at both sites suggested to Hartmann (1979) that tool maintenance rather than manufacture was a principal lithic activity.

Forest Service personnel have documented several additional lithic scatters and isolated artifacts on or near the Cascade crest north of Mount Rainier National Park. Most are located on or near the Pacific Crest Trail in saddles, on ridge crests, in association with meadows, and on the shorelines of lakes in the upper montane forests west of the crest (Hollenbeck 1987:63-66). At least two sites are located on presumed cross-Cascades travel routes used historically by Native peoples. Most of these sites were noted by paraprofessional Cultural Resource Technicians and have not been formally documented.

Data recovery excavations have been conducted at two of the highland sites on the Mt. Baker-Snoqualmie National Forest. In 1986 and 1987 field investigations occurred at Naches Lithic Scatter (USFS #CRO5-07-31), situated at an elevation of 1,400 m (4,600 ft) on the Naches Pass Trail. Initial site testing by Hedlund (1986) established site eligibility to the National Register of Historic Places. Hedlund described artifact material recovered in the testing phase, and provided a preliminary assessment of probable lithic raw material sources represented in the assemblage. He also used tephrochronology in assessing the age of the site, suggesting that multiple intermittent occupations occurred, spanning at least the past 3,400 years, but perhaps as early as 6,500 to 4,500 years ago (Hedlund 1986:22).

Subsequent excavations at the Naches Lithic Scatter by BOAS, Inc. (Blukis Onat 1988) served as mitigative data recovery in advance of a proposed timber harvest. This study produced a radiocarbon date of 2,220±60 B.P. from a burned earth feature (Blukis Onat 1988:94). Tentative identifications of Mount St. Helens W_e and W_n set tephra and Mazama ash add little to the understanding of site chronology as they appear to be stratigraphically inverted, suggesting severe bioturbation. Lithic analysis took an unusual approach which quantified technological, functional, and distributional variables for the collection of 1,552 items. Very few formed tools or formed tool fragments were found, and a majority (61%) of the collection consists of flake fragments. Microblades were also recovered. The analysts, Hal Kennedy and Harry Oda, suggest that much of the flake breakage at this site was intentional, designed to create working edges of various shape. Edge wear was distinguished from unintentional damage, allowing the researchers to classify 25% of the lithic assemblage as flake tools. These "snapped flake tools" may have served "in the process of manufacture of other tools or materials of a more perishable nature," according to Blukis Onat (1988:101).

More recently, data recovery excavations were conducted at site 45KI435, located on Divide Ridge, a landform separating the Green and White River drainages 32 km north of Mount Rainier. The site is at an elevation of 1,365 m (4,500 ft), and is one of eight sites associated with the historic Divide Trail (Miss and Nelson 1995:51). The 1995 excavations were under the direction of Christian Miss and Margaret Nelson of Northwest Archaeological Associates, Inc., and were carried out in response to a proposed Forest Service land exchange. The excavations sampled 15.4 m^3 of site matrix, and produced a collection of 7,650 lithic and 184 historic or modern artifacts (Miss and Nelson 1995:19).

Multiple occupation periods were evident at the site, with initial use dating between 6,850 and 4,320 B.P. (Miss and Nelson 1995:22). Radiocarbon dates of 3,830±70 B.P., 2,510±60 B.P., 1,690±80 B.P., and 880±70 B.P. provide a chronology of later use. The artifact assemblage from Site 45KI435 includes a high density of lithic debitage representing late stage bifacial tool manufacture. The diversity of tool types recovered is low, consisting of projectile points, unifacial tools (endscrapers and a graver), and bifaces. Most of the materials are varieties of cryptocrystalline silica, but a small amount of obsidian and petrified wood was also recovered. Geochemical analysis has demonstrated that most of the obsidian is from the Obsidian Cliffs parent source, originating in the central Cascades of Oregon.

Trenches interpreted as huckleberry processing features were identified at the site and dated to the period ca. 1,560 to 2,565 B.P. on the basis of radiocarbon samples (Miss and Nelson 1995:41-42). While such features are well documented along the crest of the Cascades in the Gifford Pinchot National Forest (Mack 1992), the trenches at 45KI435 represent the only archaeological examples north of Mt. Adams, and the earliest yet dated. Botanical samples were collected from the trenches and analyzed, but unfortunately lacked evidence of huckleberries leaving functional interpretation ambiguous.

In considering a context for prehistoric use of the Mule Spring site, Miss and Nelson (1995:46-49) identify a pattern of upland use encompassing the southern Washington Cascades. On the basis of resource distribution and ethnohistoric data, they argue that upland use was primarily oriented toward huckleberries and mountain goats. Contrary to Schalk's (1988) ideas cited in Chapter 2, they predict that archaeological evidence throughout this region will show increased and more specialized use of sites above 914 m (3,000 ft) after 5,000 B.P. Miss and Nelson see increased use of the mountains as a probable response to growing human populations and resulting resource use intensification. Ethnographic accounts, settlement patterns, and local topography are used in support of the argument that much of the prehistoric use of the Mount Rainier area was by groups from the Naches and upper Yakama River basins. They further speculate that the people who used the area became "middlemen", specialists in trans-Cascadian trade of mountain resources such as berries, and mountain goat wool, meat, and hides.

Upper Naches and Tieton River Basin

Early archaeological reconnaissance on the flanks of the Cascades east of the Park reflects personal research interests of David G. Rice, then an archaeology student at Washington State University. Rice's involvement with the University's survey of Mount Rainier National Park prompted initial reconnaissance efforts in 1963, oriented toward the understanding of cross-Cascades travel routes, particularly between the upper Cowlitz River and Tieton River drainages (Rice 1964a). Rice recognized that our knowledge of western Plateau prehistory would remain incomplete until efforts were made to understand the archaeology of adjacent mountain areas. Over the next few years, he contacted local people, examined collections, and recorded several sites. One of these, Wild Rose Rockshelter (45YK39), was the focus of test excavations within a few days after Rice completed fieldwork at Mount Rainier's Fryingpan Rockshelter.

The excavations at Wild Rose Rockshelter were limited to two test pits. Rice (1964b:16) does not give the size of Test Pit 2, noting that it was abandoned at 65 cm below surface due to extensive looting disturbance. Test Pit 1, however, was of sufficient size (2.25 by 1 m) and depth (2.4 m) to find undisturbed cultural deposits. Careful attention was given to site stratigraphy, and Rice (1964b:9) was able to assign most recovered material to individual depositional units. In addition to a lithic assemblage of 351 items, the excavators recovered 1,476 pieces of burned and unburned bone. Several bone tool fragments and pieces of worked bone were also recovered, and a number of hearth features encountered. Formed tools include five distinct styles of projectile points, side scrapers, end scrapers, utilized flakes, knives, pebble tools, a bone awl, an awl fragment, and a bone point fragment.

At the rockshelter Rice (1964b:20) recognized an assemblage change from predominate use of small triangular "Columbia Valley" corner-notched projectile points to greater use of small triangular side-notched points. Comparing the projectile points to a chronology developed for a site on the Yakama River, he suggested that the entire occupation sequence at Wild Rose Rockshelter was no older than about 650 B.P. Assemblage composition suggested processing of game animals, including hide cleaning and working activities. Rice (1964b:20) labels the site a "hunting station," and further suggests that the artifacts reflect gender-based division of labor with men engaged in hunting related tasks while women participated in domestic chores such as food preparation and clothing manufacture.

A thorough study of the faunal remains was not made at the time of Rice's study. He stated, however, that "Great quantities of split and burned deer bone" were prevalent, and further suggested the presence of elk and mountain sheep among the remains. Gustafson (1983:29) later re-analyzed the faunal collection, discovering that the majority of identifiable bone is mountain sheep, with lesser quantities of deer and mountain goat. None were identified as elk. The faunal analysis also provided an indication of site seasonality. Rice (1964b:8) assumed that the rockshelter was occupied during the winter after the fall fishing season. The age of death indicated for subadult deer in the collection implies instead that people used the site in the late summer or fall (Gustafson 1983:29-32).

Rice's reconnaissance efforts continued in the area through 1966. Five rockshelters were recorded in the canyon walls above the Tieton River and two lithic scatters recorded in the draw-down zone of Rimrock Lake, on the valley floor (Hollenbeck and Carter 1986; Rice 1969:2). Rice also encountered sites in the Naches River drainage. A predominance of small corner-notched projectile points, a "diagnostic feature of the Cayuse phase on the Plateau" (1969:15), was observed in the collections from Cascades sites examined by Rice. To him, this was an indication that mountain areas were more intensively used in the past 2,000 years as the ethnographic pattern of seasonal exploitation of various resources developed.

Most subsequent investigation in this area has been a result of National Forest cultural resource inventories, beginning in 1975 and primarily related to proposed land disturbing projects such as timber sales. As of 1986, 52 prehistoric sites were reported on the Naches Ranger District, Wenatchee National Forest, encompassing the upper reaches of the Naches and Tieton River drainages (Hollenbeck and Carter 1986:97). Most had been found by paraprofessional Cultural Resource Technicians. The following decade was characterized by more intensive site documentation efforts. Surveys included over 2,000 acres within the William O. Douglas Wilderness and Norse Peak Wilderness adjacent to Mount Rainier National Park. The surveys, conducted by District Archaeologists Matthew Zweifel and Connie Reid (Zweifel 1988a, 1988b), documented a number of lithic scatters between 960 and 1,850 m elevation. By 1996, the number of prehistoric sites on the Naches District had grown to 320. Recently, about 40 additional prehistoric sites were documented in Naches and Cle Elum Districts in association with a proposed land exchange (Burtchard and Miss 1998). The authors suggest that the high site count is consistent with more intensive prehistoric use of drier, more open eastern Cascaded habitats compared with wetter, more nearly closed canopy west Cascade forests.

Since Rice's investigations at Wild Rose Rockshelter, test excavations have been conducted at only three sites in the upper Naches and Tieton basins.[19] In 1978, Glenn Hartmann, representing Central Washington University, investigated the Kaner Ridge site (45KT364) under contract to the Wenatchee National Forest. The excavation sample is small, but it was sufficient to determine that the site was probably a single component seasonal camp dating to the "Cayuse Phase" of the Plateau cultural chronology (Hartmann 1980b). Lithic manufacturing, local hunting, and meat processing activities were inferred from the types of artifacts recovered.

While the Kaner Ridge site occupies a highland ridge saddle, the Indian Flat site (USFS #06-17-63), also tested by Hartmann (1979), is situated on a stream terrace near the Bumping River. Four 1 m by 2 m test units were excavated. Cultural deposits proved very shallow and the artifact inventory is small, making conclusive statements about site age and function somewhat difficult. Hartmann (1979) does, however, suggest that the site served as a small base camp, apparently basing this assessment on proximity to the river.

Fifteen years elapsed before any further excavations were conducted in the Naches and Tieton basins. In 1995 Christian Miss, representing Northwest Archaeological Associates, Inc., directed investigations at the Crow Creek site (USFS #06-17-08-68), located on the Little Naches River 40 km northeast of Mount Rainier (NWAA 1996). Site investigations were done under contract to the Wenatchee National Forest in conjunction with proposed campground developments. Four 1 x 1 m units and a large number of shovel probes were excavated, producing a sample volume of 14.97 m^3. Recovered prehistoric artifacts (n=369) consist almost entirely of lithic debitage, but a few formed tools are also included in the sample. Lithic raw materials are primarily chert, jasper and opalized quartz. Geochemical analysis demonstrated that obsidian in the sample is from the Obsidian Cliffs, Oregon parent source. Multiple episodes of use as a seasonal camp are indicated by the use of different landforms at the site. A radiocarbon date of 870±60 B.P. provides an age estimate for one of the later occupations (NWAA 1996).

A significant development in the archaeology of the area appeared with the completion in 1980 of a cultural resource overview of the Naches River basin by Morris Uebelacker, then a graduate student at the University of Oregon (Uebelacker 1980). This study, prepared under contract to the Wenatchee National Forest, was the first attempt to synthesize existing knowledge of past land-use in the basin. The study's orientation toward landforms and ecology is unique for the region. In the overview, Uebelacker provides a preliminary assessment of archaeological site distribution with respect to landscape features (1980:157-164). This was eventually developed, in the form of a doctoral dissertation (Uebelacker 1986), as a model that he hoped would serve as a research design for future investigations. Uebelacker was also concerned with the adaptive strategies reflected in the archaeological record. Data derived from research in the Plateau were applied to the Naches basin and a developmental model used to create archaeological expectations. Prior to the present project, Uebelacker's research was the most comprehensive study of prehistoric land-use patterns developed for the Cascade Mountains near Mount Rainier. It is of particular importance because it includes the eastern margin of the Park.

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[19] Fifty eight prehistoric sites divided into six site-types were tested in 1997 in Wenatchee National Forest's Naches and Cle Elum Districts after the present summary was written. Procedures and results are included in Burtchard and Miss (1998).

A more recent synthesis of archaeological site data from the Naches and adjacent Cle Elum Ranger Districts, Wenatchee National Forest, by Matthew Zweifel and Connie Reid was published in 1991. Zweifel and Reid (1991) outline the evidence for long-term use of the Cascade uplands, use that was more intense than was previously realized. They suggest that the large diversity of site types indicates that a great variety of resources were utilized, including many not available at lower elevations. In the absence of local, excavated sites, they have relied on Plateau projectile point typologies to estimate the ages of sites, which they place in four major time periods (Zweifel and Reid 1991:11). In terms of site types, the most common are small lithic scatters. Rock alignments, talus depressions, and cairns were also found in mountain areas. Some of the rock alignments are interpreted as hunting blinds. Talus depressions are explained as probable food storage pits, and cairns are thought to possibly represent religious activity. Rock art occurs beyond the forest edge, at the eastern limits of National Forest lands. The largest sites described by Zweifel and Reid are situated at the margins of large mountain lakes. They interpret the sites as base camps occupied by sizable groups of people, and note that "Diversity of artifacts and features at these mountain lakes indicates diversity of activities, including plant processing, hunting and processing of game, and possibly the drying of salmon." (Zweifel and Reid 1991:11).

Upper Cowlitz River Basin

The first archaeological reconnaissance in the upper Cowlitz River watershed south and west of the Park was conducted by David G. Rice between 1963 and 1966. He described several sites in the valley of the Cowlitz River, among them Kitchen Rock rockshelter, and campsites at the mouth of the Muddy Fork and at La Wis Wis (Rice 1964a). Several private artifact collections from the area were also examined by Rice.

One of the collections is from the Packwood Mill Site (45LE271) near Hall Creek, a tributary of the Cowlitz River. Rice (1969) reported that this small, single component site contained abundant evidence for a hunting/fishing economy. Approximately 300 projectile points were found. A small number are corner-notched forms similar to examples known from excavated Plateau sites. In addition, there are a few triangular and leaf-shaped points. The majority are corner-notched arrow points, with basal morphology that led Rice to call them "Packwood tapered stemmed points." Rice notes that 43 of the 46 points of this type were manufactured from local red jasper. Three specimens are obsidian. Other artifacts in the collection include "calcined bone fishing barbs, some end scrapers, and pieces of ground realgar." Associated materials include a number of calcined fish vertebrae and a large quantity of split calcined mammal bone (Rice 1969:13-14).

Rice also examined a private collection from the Siler site (45LE215), located south of Randle. He characterizes this as a single component site, and reports that "About thirty projectile points were recovered, including small triangular corner-notched forms... corner-notched/corner-removed forms... stemmed forms with barbed shoulders... leaf-shaped forms and triangular forms." (Rice 1969:14). Rice believed the small corner-notched points were diagnostic of the Cayuse phase on the Plateau. He felt that Cayuse elements diffused west across the Cascades during the last 2,000 years, becoming superimposed on an older tradition characterized by stemmed/shouldered and leaf-shaped points (Rice 1969:15).

Dancey (1968) conducted investigations at 11 sites in Mossyrock Reservoir (Riffe Lake), south of Morton, prior to inundation. The sites were situated on terraces of the Cowlitz River. All had been disturbed as a result of timber harvest activity. On the basis of artifact typology, Dancey concluded that most of the sites represented "Olcott Phase" occupation and probably dated to before 4,000 B.P. (Dancey 1968). A few sites appeared to include more recent prehistoric occupation. The sites investigated by Dancey included assemblages with high frequencies of "non-cryptocrystalline" lithic raw materials.

Since 1980, most archaeology in the Cascade Range south of the Park has been a product of USDA Forest Service cultural resource management activities. In addition to survey, a substantial number of excavations have been conducted. Large-scale data recovery projects were undertaken at Judd Peak Rockshelters (45LE222) and Layser Cave (45LE223), in the upper Cowlitz watershed, in 1986 and 1987. Test excavations have been conducted at 23 prehistoric sites on Forest Service lands within the watershed. The more significant results are summarized here, beginning with sites nearest to Mount Rainier National Park.

Three of the tested sites are within the Packwood District, Gifford Pinchot National Forest, close to the southern boundary of the Park. The Carlton Bridge site (45LE283) is near the Ohanapecosh entrance, 0.8 km from the Park boundary. Situated at an elevation of 658 m (2,160 ft), the site is associated with the historic Cowlitz-Yakama Trail, a principal trans-Cascadian travel route (Liddle 1988:8). Discovery of the site resulted from timber harvest disturbance in 1986. Subsequent sampling included excavation of three 1 x 1 m test units. Systematic shovel probe sampling was also used to determine site area as 8,500 m^2 on the basis of subsurface lithic artifact distribution. In her assessment of site significance, Janet Liddle (1988:29) suggests a site age range of ca. 1,400 to 500 B.P. using tephrochronology and projectile point typology. Cultural deposits lie immediately beneath a layer of Mount St. Helens set W_n tephra. The small lithic assemblage (n=137) includes two small, triangular side-notched arrow points. Lithic artifact density is low ($10/m^3$ to $125/m^3$) in the areas sampled. Site function remains problematic given the small sample size, but short-term summer use by people traversing the Cascades is suggested by the location and generalized tool types.

Also associated with the Cowlitz-Yakama Trail is the Ohanapecosh site (45LE220), located on the river of the same name 4 km south of the Park boundary, at an elevation of 454 m (1,490 ft). The archaeological site corresponds to the ethnographic fishing site of *awxanapayk-ash* (Hajda et al. 1995:34). The Park Service has adopted this name for the Ohanapecosh Ranger Station and campground near the southeast entrance to the Park. The site was tested in 1984 and 1985, and has produced radiocarbon dates of 3,640±100 B.P., 920±60 B.P., and 500±80 B.P. (McClure 1989). In 1996, a later component of the site was dated to 360±50 B.P. As in the case of the Carlton Bridge site, Mount St. Helens set W_n tephra was an important horizon marker. Burned and calcined bone recovered in association with charcoal dated to 500 B.P. included salmonid vertebrae. The lithic assemblage (n=622) includes debitage, unifacial tools and several projectile points. Obsidian from the site was sourced to the Elk Pass quarry, located near the crest of the Cascades in the Goat Rocks Wilderness (McClure 1989). Site dimensions have yet to be determined.

More recently, test excavations were conducted at Ohana Rockshelter (USFS #14103001), a site found in May 1996 on a ridge near the Cowlitz River 5 km south of the Park. A 50 x 50 cm test unit was excavated to establish the presence of cultural material in the rockshelter. Lithic debitage and two projectile points were recovered in the small sample, as were burned and unburned mammal and fish bone. The fragmentary mammal bone has not been analyzed, but fish vertebrae examined by Virginia Butler at Portland State University were identified as *Oncorhynchus* sp., probably representing coho or chinook salmon. An AMS radiocarbon sample from the test unit produced a date of 750±60 B.P.

One of the largest archaeological samples from the upper Cowlitz area is from the Beech Creek site (45LE415), occupying a small knoll at the edge of the Cowlitz River valley 14 km south of Mount Rainier National Park. The site was inadvertently discovered in 1990 following backhoe trenching for a new septic system at the Packwood Ranger Station. Archaeological fieldwork included recovery of 16,315 lithic artifacts from 31.9 m^3 of backhoe trench sediments (McClure 1992:23). Volumetric sampling of backhoe trench sediments indicate lithic artifact densities ranging from 10 per m^3 to 772 per m^3 across the site (McClure 1992:44-48). Limited controlled excavation provided supplemental information on the vertical distribution of cultural material. Augering was used to determine site boundaries and establish its size at 7,800 m^2.

Lithic raw materials in the Beech Creek assemblage are dominated by andesite, dacite, and argillite, all probably acquired near the site. Jasper, chalcedony, chert, and obsidian are present in smaller quantities. Geochemical analysis of obsidian identified six distinct sources among the artifacts sampled (McClure 1992:51), with most specimens matched to the Elk Pass source. Technological attributes of the assemblage indicate all stages of lithic reduction. Formed tools include bifacial blanks, preforms, projectile points, unifacial tools, and cobble choppers. Leaf-shaped and lanceolate points are the most common forms. No radiocarbon dates were obtained. Results of hydration analysis, identification of tephra, stratigraphic studies, and projectile point typology suggest that prehistoric use may have spanned the period from ca. 6,000 to 2,000 B.P. (McClure 1992:81). The low 329 m (1,080 ft) elevation, valley edge location, proximity to permanent flowing water, and diverse artifact assemblage are factors indicating residential function, possibly as a settlement or field base camp.

Other sites investigated in the Packwood District include the Elk Pass obsidian quarry (45LE286), Packwood Lake (45LE285), and Johnson Butte (45LE417) sites. The Elk Pass quarry is a geochemical parent source of obsidian, the material occurring as nodules within a rhyolite talus slope in an alpine setting near the crest of the Cascades (McClure 1989). Several lithic reduction loci with high densities of surface debitage were identified near the talus source of the material. A single test unit in one of these concentrations indicates debitage densities of nearly 10,000 artifacts per m^3 within site deposits. A radiocarbon date of 6,250±110 was obtained from charcoal at 55 cm depth (McClure 1989:63). Subsequent research has identified obsidian from this source in assemblages from seven prehistoric sites, all within the upper Cowlitz watershed. The geographic range of distribution is limited to a 52 km distance from the source, and a dramatic fall-off pattern of frequency is apparent from east to west across this distance (McClure 1992:52). Curiously, this source is not represented among the samples of obsidian from prehistoric sites east of the Cascade crest that have been subjected to geochemical sourcing.

The highest frequency of obsidian recovered outside the quarry is at the Packwood Lake site (45LE285), located 11 km west of the Elk Pass source, on the shoreline of a mountain lake. Obsidian makes up 14% of the lithic debitage recovered in 1987 excavations at the site. Archaeological investigations were a result of planned trail bridge replacement within the boundaries of the site. Six test units were excavated. Reporting to date includes an initial test report (McClure 1987) and a detailed study of lithic technology (Markos 1990)—initially produced as a Master's thesis for Washington State University. A summary journal article by Markos has also been published. Markos' analysis was based on a sample of 4,631 artifacts recovered from 10.3 m^3 of excavated site matrix.

The time period of use for the Packwood Lake site is estimated by bracketing dates of 1,100 B.P. for underlying landslide debris and 470 B.P. for the Mount St. Helens W_n tephra capping the cultural deposit (Markos 1990:28). Analysis of the lithic assemblage indicates reduction of andesite/basalt and microcrystalline varieties of quartz for flake tools, bifacial blanks, and bifacial preforms. Evidence for final stages of tool manufacture and hunting tool kit maintenance was conspicuously absent. Markos (1990:83) uses the technological data to argue against function as a hunting camp, suggesting that it served as a non-specialized "multi-resource acquisition site."

In contrast, the assemblage from the Johnson Butte site (45LE417), 14 km south of Packwood Lake, reflects a site function oriented primarily toward the maintenance of hunting equipment. The site is located near the western boundary of the Goat Rocks Wilderness, at an elevation of 1,088 m (3,570 ft). It was discovered following road construction and scarification in a Forest Service timber sale on the Packwood District. 1991 test excavations, designed to assess damage to the site, were conducted by Lithic Analysts, Inc., under the direction of Dr. J. Jeffrey Flenniken. The excavations sampled 8.18 m^3 of site deposits and produced a lithic artifact assemblage that includes 1,016 pieces of debitage and seven formed artifacts (Flenniken et al. 1992:38). Artifact distribution and stratigraphic analysis indicate a single component occupation post-dating the deposition of Mount St. Helens set P_m tephra about 2,450 B.P. Obsidian from the Glass Mountain, Glass Buttes, and Whitewater Spring, Oregon source locations was recovered in the sample (Flenniken et al. 1992:51). The absence of Elk Pass obsidian is noteworthy, perhaps suggesting that the Packwood Glacier was a barrier to southern movement along the Cascade Crest within the Goat Rocks area.

Further west, in the Cowlitz River valley near Randle, large-scale excavations were conducted at the Judd Peak Rockshelters (45LE222) on Gifford Pinchot National Forest. The two large rockshelters are located on a low mountain ridge at an elevation of 427 m (1,400 ft). The site is 26 km south of Mount Rainier National Park. Initial testing was conducted in 1982, followed by data recovery excavations at the north rockshelter in 1986 under the direction of Richard McClure and 1986-1987 work at the south rockshelters under direction of Dr. Richard Daugherty. The earliest radiocarbon dates from the site are 5,970±120 and 5,930±100 B.P., associated with a stratum which overlies a presumably older cultural deposit. These early strata are capped by a primary airfall deposit of Mount St. Helens set Y_n tephra. Occupation of both rockshelters was contemporaneous, and both appear to contain multiple late prehistoric occupations. Twelve radiocarbon dates span the period from ca. 1,360 to 260 B.P., and suggest a use hiatus sometime after deposition of Y_n tephra approximately 3,500 years ago.

The formed tool assemblages recovered from early occupations at the site are described as typical "late Cascade subphase" assemblages (Daugherty et al. 1987b:223). Lewarch and Benson (1991) equate the projectile point types from these assemblages with Large Stemmed, Cascade, Mahkin Shouldered, and Cold Springs varieties described for the Plateau. Microblades, microblade cores, and a variety of flake tools were also recovered. Daugherty et al. (1987b) report that artifact types associated with early use of the site, including shouldered points, lanceolate points, and microblades, also occur in late prehistoric deposits where they are associated with arrow points. Lanceolate or leaf-shaped points, variously known as "Cascade" or "Olcott" points, have been assumed to indicate early Holocene occupation. Dancey (1968), in his earlier study of Mossyrock Reservoir sites, interpreted the presence of these points as evidence of a pre-4,000 B.P. culture in the upper Cowlitz basin. Using the Judd Peak sample, Daugherty et al. (1987b:234) argued that lanceolate points remained in use through the late prehistoric period. This assertion is disputed by Lewarch and Benson (1991:33) in an independent review of the excavation data.

Daugherty et al. (1987b) further assert that lanceolate points common in southwest Washington assemblages functioned as armament for hand-held killing lances, used to dispatch wounded animals. They use the presence of these points as evidence for a prehistoric hunting strategy in which, through drives or by other means, multiple kills of deer or elk were made in the same hunting event (Daugherty et al. 1987b:228). The rockshelters are described as hunting camps. Both rockshelters produced bone fragments consistent with game animal butchery and meal preparation. The faunal remains are predominately from deer (*Odocoileus sp.*), but also include significant numbers of rabbit (cf. *Lepus americanus*) bones. Beaver (*Castor canadensis*), muskrat, elk, bighorn sheep, and grouse (*Dendragopus obscurus*) are also represented in the large faunal assemblage. Over 1,200 salmonid bones were recovered.

Bone bipoints and unipoints, an awl, an antler wedge fragment and a needle were also recovered in the excavation sample. In the north rockshelter, bone flakes, flaked bone, bone fragments with patterned breakage, and shaved antler were identified, primarily in association with late prehistoric occupations. A technological and functional analysis of this collection was the subject of a Washington State University Master's thesis by Stacy Clark (1993). Clark's study provides a detailed description of the faunal assemblage from the north rockshelter and a useful classification scheme for this unique collection of bone and antler tool-making debitage.

Richard Daugherty and associates also conducted data recovery excavations at Layser Cave (45LE223), 6.4 km southeast of the Judd Peak site in the Cispus River valley. The Cispus is a principal tributary of the upper Cowlitz River. Results of excavations indicate use of the cave began approximately 7,000 years ago and ended by 4,000 B.P. (Daugherty et al. 1987a). Radiocarbon dates of 6,650±120 B.P. and 6,645±120 B.P. are the earliest for the area. The lithic artifact assemblage includes ovate, shouldered, lanceolate, and large side-notched projectile point forms, microblades and cores, a variety of specialized unifacial tools, and cobble tools. Most of the stone tools appear to be made from locally-available chalcedony, jasper, chert and igneous stone. The presence of marine shell (*Olivella* sp.) beads and non-local obsidian provides some indication of trade links.

The site produced a large and well-preserved assemblage of faunal remains. Deer (*Odocoileus* sp.) predominate, but bone from snowshoe hare (*Lepus* cf. *americanus*), mountain beaver (*Aplodontia rufa*), grouse (*Dendragapus* and *Bonasa*), and salmonids indicate other species of probable economic importance. Archaeobotanical samples from Layser Cave hearth sediments analyzed by Stenholm (1989, 1990) produced a significant amount of oak (*Quercus* sp.) charcoal. Presumably used as fuelwood, the sample suggests more xeric conditions at the time of cave occupation.[20] A charred *Vaccinium* fruit from one of the botanical samples indicates collection of huckleberries by cave occupants.

Besides Layser Cave, seven other archaeological sites in the Cispus River area have been subjected to small-scale testing by Forest Service archaeologists since 1984. Four of the sites, including: Hummingbird Rockshelter (45LE400); Stump's Rockshelter (45LE401); the Em site (45SA205); and the Robber Bend site (45SA115), a lithic scatter heavily disturbed by road construction, produced minimal data. Test excavations at site 45LE451 on the Cispus River terrace produced a distinctive assemblage of red jasper artifact material probably representing a single lithic production event (McClure 1985). The Yuyutla site (45LE413), located in a National Forest campground 12 km south of Randle, was also the subject of archaeological investigations. Test excavations produced a lithic assemblage (n=1,215) from cultural deposits dated to 920±50 B.P. from a fire hearth encountered at over a meter below the ground surface (Lancefield-Steeves and Liddle 1992:21, 24).

The most extensive archaeological sampling has occurred at the Camp Creek site (45LE263), located adjacent to the Cispus River not far from Layser Cave. Preliminary data generated from the 1985 testing of the rockshelter at the site have been reported by Markos (1986) and Tevebaugh (1986) in conference papers. Additional investigations were conducted in 1996, and analysis of field data is in progress at this writing. Occupations within the rockshelter date between ca. 1,500 B.P. and 500 B.P. Earlier and later components were identified outside the rockshelter, where cultural deposits extend for over 100 m across a terrace landform. The excavation in 1985 of three 1 m x 1 m test units within the rockshelter produced a sample totaling 1 m^3 volume that includes debitage (n=892) and tools (n=79), including arrow points, unifacial tools, utilized flakes, and bone points. A total of 7,432 bone fragments

[20] The site's dates are consistent with the peak of the Hypsithermal Interval shown on Table 2.3 in Chapter 2.

were recovered from this small sample, and identifiable specimens include skeletal elements from deer, elk, beaver, mountain beaver, and salmonids. Over half of the collection is burned or calcined. Debitage material types in the rockshelter sample include a high percentage of chalcedony and jasper, with lesser amounts of chert, basalt, and opal. Fire-cracked rock was relatively abundant in the sampled deposit.

Test excavations at nearby Squatter's Knob Rockshelter (45LE259) were conducted in 1984 and 1985, with additional fieldwork in 1988 prompted by illegal digging. Two test units produced 185 lithic artifacts, including debitage, and 285 faunal elements, from 2.05 m^3 of fill. Additional material was recovered from looter backdirt. Three distinct cultural components were identified as a result of the testing. Component 1 is dated from a radiocarbon sample to 980±120 B.P.; Component 2 includes material above Mount St. Helens W_n tephra, deposited 470 B.P.; Component 3 includes cultural material above a probable deposit of Mount St. Helens set T tephra. Identified taxa in the faunal assemblage include deer, beaver, rabbit, salmon or steelhead, and suggest opportunistic hunting of local fauna. The rockshelter appears to have served as a transient field camp.

Outside of National Forest lands, two large-scale excavation projects have been conducted at sites in the upper Cowlitz River basin. Plans to build a third hydroelectric dam on the Cowlitz River prompted nearly a decade of intermittent research at Cowlitz Falls, near the mouth of the Cispus River. Fugro Northwest, Inc. surveyed the proposed dam site and reservoir, recording six prehistoric sites, including Koapk or Cowlitz Falls South site (45LE209) (Fugro Northwest, Inc. 1980). Initial test excavation of the site defined at least three cultural components in deposits that reached 7 ft deep and suggested that occupation may date from as early as 4,000 B.P. to historic times (Ertec Northwest, Inc. 1981). Test excavations also included the Cowlitz Falls North site (45LE211).

Further testing at the Koapk site early in 1988 focused on the previously untested west portion of the site and resulted in refinement of site chronology. In addition to the previously identified early component, dated on the basis of position beneath Mount St. Helens set Y_n tephra, two different spatial components were assigned to the period between 2,000 and 1,000 B.P., and a fourth to the period from 500 to 200 B.P. (Stilson and Thompson 1988:6-19). More recent excavations at the site have included extensive trenching and stratigraphic study. At least six distinct cultural components are now recognized at Koapk (Ellis et al. 1991). Radiocarbon dates for the sub-pumice component span the period ca. 4,300-3,900 B.P. Later occupations span the period from ca. 1,600 B.P. to the early 19th century, when upper Cowlitz or Taidnapam people used the area.

At the Champion Bridge site (45LE225), 4.8 km west of Cowlitz Falls, excavations were undertaken in 1990 in conjunction with proposed recreation developments on Tacoma Public Utilities lands. Excavations under the direction of Gary Wessen sampled 27 m^3 of site area and recovered a sample of 5,202 artifacts (Wessen 1991). A variety of lithic tool categories are represented, and a surprisingly large number of bone tools were also recovered. Hearth features and a pit feature were also encountered. Early use of the site was dated to 4,200±80 and 4,660±50 B.P. (Wessen 1991:3-20), but the majority of the recovered material represents use during the past 1,500 years. Wessen interprets the site as a spring to early fall occupation oriented toward hunting and fishing.

Several prehistoric sites have been identified on National Forest lands which occupy the watershed divide between the Cowlitz River and Nisqually River drainage basins. Test excavations have been conducted at two of these sites, located between 34 and 38 km southwest of Mount Rainier National Park. Both sites occupy ridge saddles at elevations over 1,000 m (3,280 ft) near the headwaters of the Little Nisqually River. Site 45LE277, the Isabell Saddle site, was tested in 1986 and 1987 by National Forest personnel. Five 1 x 1 m units produced a sample of lithic debitage (n=1,322) and tools (n=46), including projectile points, blanks, preforms, cores, unifacial tools, and utilized flakes (McClure 1988:27, 29). A radiocarbon date of 2,240±60 was obtained from charcoal within the principal cultural stratum. Two test units were excavated at Site 45LE288, the Ware Divide site, in 1986, producing a small sample of lithic material from two components (Liddle and Markos 1987). Both of these sites were possible camps along mountain travel routes.

Since 1993, archaeological investigations in the upper Cowlitz area have been limited mainly to cultural resource surveys. A survey of the trail system in Tatoosh Wilderness, adjacent to the southern boundary of Mount Rainier National Park, was completed by Janet Liddle in 1995. Several isolated artifacts and a lithic scatter were identified within 8 km of the Park boundary, on the crest of the Tatoosh Range. Liddle also completed a partial trail survey of the Goat Rocks Wilderness in 1995, identifying several prehistoric sites in a variety of environmental settings.

Chronology and Cultural Process in the Southern Washington Cascades

It should be emphasized that, to date there has been no comprehensive synthesis of the prehistory of the southern Washington Cascades. This report moves in that direction by drawing together site information of particular relevance to Mount Rainier National Park. The subsistence and settlement intensification model offered in Chapter 5 is perhaps the most thorough attempt made to date to order general Holocene land-use patterns for the Park and wider region.

While still limited, a growing body of chronometric data for the southern Washington Cascades is gradually becoming available. Table 3.4 lists current radiocarbon dates (uncalibrated) for archeological sites in the region. Figure 3.5 illustrates the temporal range of these dates to one standard deviation. Though building their inferences on a more limited data set, Dennis Lewarch and James Benson (1991) were the first to develop a preliminary outline of what they believed to be land-use trends in the region's archeological record. They describe an initial period of colonization, characterized by low-density, limited activity settlements taking place between ca. 7,000 to 6,000 B.P.[21] Lewarch and Benson also suggest existence of a possible settlement hiatus ranging from circa 3,900 to 1,840 B.P. (1991:33). While caution must be exercised, radiocarbon data compiled for the southern Washington Cascades can be interpreted as indicating an early phase of Cascades settlement and use followed by an abrupt terminus around 3,500 B.P., much as Lewarch and Benson argue. The gap in the radiocarbon ages and hence possible land-use hiatus, however, does not appear to last as long as suggested.

In support of their proposed cultural hiatus, Lewarch and Benson (1991:33) suggest that the intensity of vulcanism in the region may have disrupted human use during the Middle Holocene. The onset of the Smith Creek eruptive phase of Mount St. Helens, which produced the largest tephra eruptions in the history of the volcano, is dated between 3,900 and 3,400 B.P. They suggest that environmental degradation resulting from Smith Creek phase eruptions may have been the initial cause of human abandonment, lasting for nearly 2,000 years in some areas (Lewarch and Benson 1991:34).[22]

[21] More recent studies of two sites in the upper Lewis River drainage have identified deeply buried site components greater than 7,000 years old, suggesting an even earlier period of colonization (see Table 3.4).

[22] There is room for disagreement. Dunwiddie's (1986) study of floral response to volcanism on Mount Rainier suggests that natural ecosystems quickly return to normal following the volcanic events noted here. It is unlikely that simple volcanic disruptions of plant and animal communities would have been sufficient to have an archaeologically measurable effect on human settlement, let alone adequate to cause a 2,000 year abandonment of the area. In my opinion [Burtchard], relatively brief gaps in the current radiocarbon data base (see Figure 3.4) are insufficient to support cultural hiatus notions, but rather more likely reflect normal gaps expected in a limited early to mid-Holocene data set. In lieu of a satisfactory explanatory mechanism for a hiatus, the possibility of regional abandonment or settlement reorganization from ca. 3,500 to 2,500 years ago should be retained as an intriguing possibility warranting further research.

Table 3.4 Radiocarbon Dated Archaeological Sites in the Southern Washington Cascades

Age (B.P.)	Site No.	Site Name	Lab. No.	Reference
290 ± 120	45PI303	Berkeley Rockshelter	WSU 3665	Bergland 1988
295 ± 80	45LE209	Koapk - Cowlitz Falls	WSU 4079	Ellis et al. 1991
310 ± 50	45LE222	Judd Peak Rockshelter (South)	Beta 18820	Daugherty et al. 1987b
350 ± 50	45LE222	Judd Peak Rockshelter (South)	Beta 18818	Daugherty et al. 1987b
380 ± 90	45SA117	Falls Creek	Beta 18204	Spencer 1987
390 ± 70	45LE222	Judd Peak Rockshelter (North)	WSU 3561	Daugherty et al. 1987b
420 ± 150	45SA117	Falls Creek	Beta 18202	Spencer 1987
440 ± 70	45PI44	Imhoff	UW 253	Hedlund 1973
500 ± 80	45LE220	Ohanapecosh	WSU 3541	McClure 1989
510 ± 80	45LE209	Koapk - Cowlitz Falls	WSU 3942	Ellis et al. 1991
580 ± 70	45LE209	Koapk - Cowlitz Falls	WSU 3943	Ellis et al. 1991
630 ± 60	45SA116	McClellan Meadows	Beta 24272	Jermann et al. 1988
650 ± 70	45LE222	Judd Peak Rockshelter (North)	WSU 3563	Daugherty et al. 1987b
690 ± 50	45LE209	Koapk - Cowlitz Falls	WSU 3944	Ellis et al. 1991
690 ± 85	45PI44	Imhoff	UW 254	Hedlund 1973
700 ± 90	45KI25	Cedar River Outlet (North)	WSU 3744	Samuels 1993
730 ± 60	45KI299	Cedar River Delta Levee	WSU 3806	Samuels 1993
740 ± 80	45SA117	Falls Creek	Beta 18203	Spencer 1987
750 ± 60	1410 30/01	Ohana Rockshelter	Beta 92070	GPNF site records
780 ± 80	45LE222	Judd Peak Rockshelter (North)	WSU 3562	Daugherty et al. 1987b
780 ± 60	45KI299	Cedar River Delta Levee	WSU 3807	Samuels 1993
800 ± 70	45LE222	Judd Peak Rockshelter (North)	Beta 5431	Daugherty et al. 1987b
850 ± 90	45LE209	Koapk - Cowlitz Falls	WSU 4077	Ellis et al. 1991
860 ± 90	45LE222	Judd Peak Rockshelter (South)	Beta 18822	Daugherty et al. 1987b
880 ± 70	45KI435	Huckleberry Divide	Beta 79338	Miss and Nelson 1995
880 ± 60	45LE225	Champion Bridge	Beta 39041	Wessen 1991
910 ± 90	45LE416	Tenzler	Beta 40653	GPNF site files
920 ± 60	45LE220	Ohanapecosh	WSU 3540	McClure 1989
920 ± 50	45LE413	Yuyutla	Beta 40654	Lancefield-Steeves and Liddle 1992
930 ± 70	45LE263	Camp Creek Rockshelter	WSU 3549	McClure 1989
950 ± 80	45LE266	Burton Creek Rockshelter	Beta 33444	Miss 1989
960 ± 50	45SA301	Ice Cave	Beta 55422	Mack 1992
960 ± 90	45SA85	Vine	Beta 29040	Lewarch and Benson 1989
980 ± 90	45KI25	Cedar River Outlet (North)	WSU 3745	Samuels 1993
980 ± 120	45LE259	Squatter's Knob Rockshelter	Beta 12714	McClure and Markos 1990
980 ± 150	45SA41	Fallen Arches Cave	WSU 2518	Landis and Lothson 1982
1010 ± 60	45LE222	Judd Peak Rockshelter (North)	WSU 3564	Daugherty et al. 1987b
1030 ± 60	45LE222	Judd Peak Rockshelter (South)	Beta 18819	Daugherty et al. 1987b
1050 ± 70	45KI25	Cedar River Outlet (North)	WSU 3746	Samuels 1993
1060 ± 60	45LE209	Koapk - Cowlitz Falls	WSU 3945	Ellis et al. 1991
1070 ± 120	45LE222	Judd Peak Rockshelter (North)	WSU 3565	Daugherty et al. 1987b
1070 ± 90	45PI303	Berkeley Rockshelter	WSU 3666	Bergland 1988
1110 ± 70	45SA41	Fallen Arches Cave	WSU 2521	Landis and Lothson 1982
1125 ± 70	45KI5	Jokumsen	UW 285	Hedlund 1976
1150 ± 60	45LE222	Judd Peak Rockshelter (South)	Beta 18823	Daugherty et al. 1987b
1210 ± 70	45LE410	Deceptive Beauty Rockshelter	Beta 32858	GPNF site files
1210 ± 90	45KI32	Cedar River Outlet (South)	WSU 3805	Samuels 1993
1240 ± 120	45LE222	Judd Peak Rockshelter (South)	Beta 18821	Daugherty et al. 1987b
1280 ± 90	45KI25	Cedar River Outlet (North)	WSU 3743	Samuels 1993

Age (B.P.)	Site No.	Site Name	Lab. No.	Reference
1280 ± 75	45LE209	Koapk - Cowlitz Falls	WSU 4081	Ellis et al. 1991
1295 ± 70	45SA41	Fallen Arches Cave	WSU 2520	Landis and Lothson 1982
1320 ± 70	45LE263	Camp Creek Rockshelter	WSU 3542	McClure 1989
1410 ± 80	45SA117	Falls Creek	Beta 18205	Spencer 1987
1440 ± 310	45SA41	Fallen Arches Cave	WSU 2522	Landis and Lothson 1982
1460 ± 60	45SA116	McClellan Meadows	Beta 24275	Jermann et al. 1988
1520 ± 70	45SA41	Fallen Arches Cave	WSU 2517	Landis and Lothson 1982
1540 ± 50	45LE225	Champion Bridge	Beta 39040	Wessen 1991
1595 ± 100	45KI32	Cedar River Outlet (South)	WSU 3804	Samuels 1993
1690 ± 80	45KI435	Huckleberry Divide	Beta 79337	Miss and Nelson 1995
1690 ± 100	45SA85	Vine	Beta 29039	Lewarch and Benson 1989
1840 ± 50	45SA116	McClellan Meadows	Beta 23618	Jermann et al. 1988
1970 ± UK	45PI303	Berkeley Rockshelter		Bergland 1988
2000 ± 100	45KI25	Cedar River Outlet (North)	WSU 3742	Samuels 1993
2220 ± 60	05-07-31	Naches Lithic Scatter	Beta 23967	Blukis Onat 1988
2240 ± 60	45LE277	Isabell Saddle	Beta 23948	McClure 1988
2510 ± 60	45KI435	Huckleberry Divide	Beta 79334	Miss and Nelson 1995
2880 ± 105	45SA41	Fallen Arches Cave	WSU 2519	Landis and Lothson 1982
3540 ± 100	45SA300	Pointless	Beta 55258	Mack 1993
3640 ± 100	45LE220	Ohanapecosh	WSU 3539	McClure 1989
3830 ± 70	45KI435	Huckleberry Divide	Beta 79335	Miss and Nelson 1995
3980 ± 70	45LE223	Layser Cave	Beta 6030	Daugherty et al. 1987a
4200 ± 80	45LE209	Koapk - Cowlitz Falls	WSU 4080	Ellis et al. 1991
4270 ± 80	45LE209	Koapk - Cowlitz Falls	WSU 4078	Ellis et al. 1991
4320 ± 90	45KI435	Huckleberry Divide	Beta 79336	Miss and Nelson 1995
4460 ± 50	45LE225	Champion Bridge	Beta 39039	Wessen 1991
4930 ± 60	45SA264	Lost	Beta 47614	Miss 1992
4980 ± 60	45KI5	Jokumsen	UW 283	Hedlund 1976
5200 ± 170	45LE223	Layser Cave	Beta 18824	Daugherty et al. 1987a
5730 ± 90	45KI5	Jokumsen	UW 255	Hedlund 1976
5750 ± 110	45KI5	Jokumsen	UW 284	Hedlund 1976
5930 ± 120	45LE222	Judd Peak Rockshelter (South)	Beta 22167	Daugherty et al. 1987b
5970 ± 100	45LE222	Judd Peak Rockshelter (South)	Beta 22166	Daugherty et al. 1987b
6250 ± 110	45LE286	Elk Pass	Beta 23949	Daugherty et al. 1987a
6445 ± 120	45LE223	Layser Cave	WSU 3592	Daugherty et al. 1987a
6500 ± 100	45SA202	Council Lake	Beta 32859	GPNF site files
6580 ± 50	45SA85	Vine	Beta 29268	Lewarch and Benson 1989
6650 ± 120	45LE223	Layser Cave	WSU 3593	Daugherty et al. 1987a
8540 ± 110	45KI25	Cedar River Outlet (North)	Beta 25575	Samuels 1993

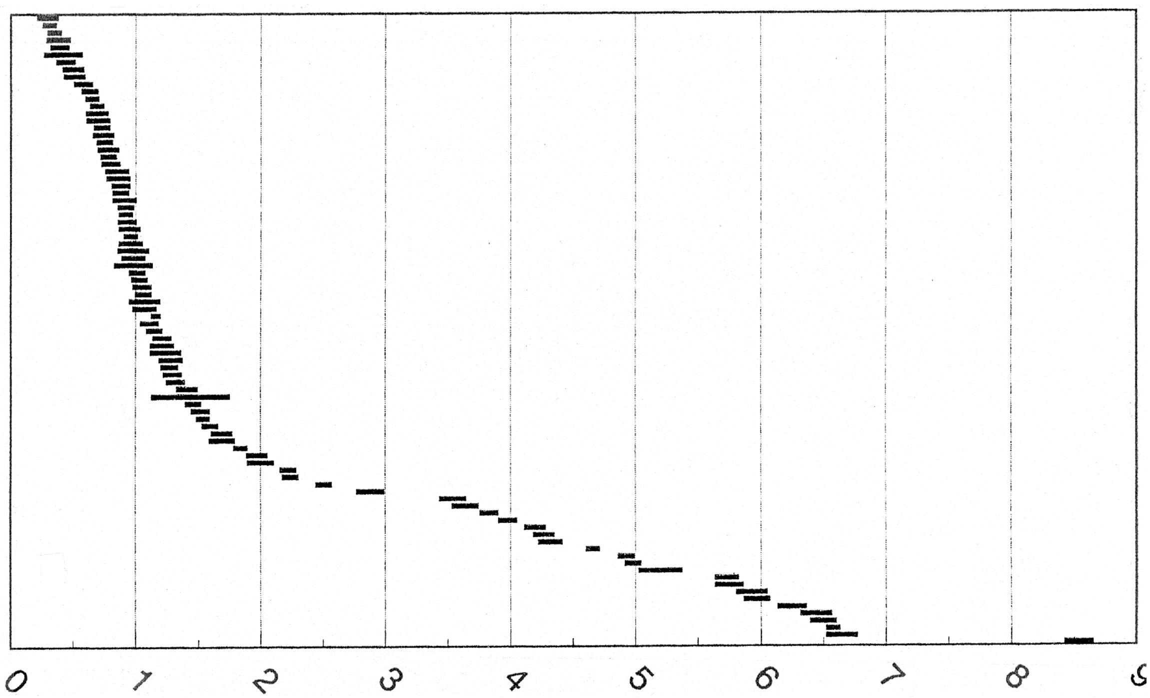

Figure 3.5 Radiocarbon Age Ranges for the Southern Washington Cascades
(Age intervals at one sigma, uncalibrated dates in thousands of years before present, n = 87)

In reevaluating potential casual mechanisms which may underlie the possible hiatus, Kenneth Reid (1993:E.9) suggests that we consider the cooling effects of neoglaciation, documented between 3,700 and 2,000 B.P. A temporal correlation between glaciation records and vulcanism was noted by Loren Davis, in his recent assessment of vulcanism and culture change in southern Washington (Davis 1995:182). Davis acknowledges that direct effects of the Mount St. Helens eruptions were more extensive proximal to the volcano, but hypothesizes that more lasting and widespread *indirect* effects may have resulted from atmospheric loading of sulfuric aerosols during eruptive events (1995:178-179).[23]

Considering the possible significance of past volcanic eruptions in the region, and the utility of various tephra deposits as horizon markers, the eruptive history of Mount St. Helens was used as a framework for a cultural sequence in the upper Cowlitz River basin (McClure 1992:7). The sequence includes initial human occupation during the Swift Creek Interval, a dormant period beginning circa 9,000 B.P. which followed the end of the Swift Creek eruptions. The interval ends abruptly with the Smith Creek eruptions described above, the eruptive phase coinciding with the beginning of the apparent hiatus in dated occupations. Two other eruptive periods (Pine Creek and Kalama) occur during the hiatus, and may contribute to the length of the abandonment, if genuine. Resettlement begins in what is termed the Castle Creek Interval (McClure 1992:13) at the end of the Castle Creek eruptive

[23] The proposed hiatus does indeed correlate with a period of glacial advance shown as the Burroughs Mountain Drift on Table 2.3. However, a more severe glacial advance ca. 900 to 500 years ago (the Garda Stade on Mount Rainier) is not accompanied by a similar reduction in archaeological presence.

period approximately 1,600 years ago. The sequence is broken again with the Kalama eruptive period in A.D. 1478 (470 B.P.) and subsequent dormant interval (McClure 1992:15).

No other attempts have been made to order the cultural chronology of the region. As the previous summary indicates, many archaeologists have chosen to employ terminology developed for phase chronologies of the Columbia Plateau; assuming that these chronologies were also valid in the mountains to the west. We see this in David Rice's early observations of Cayuse phase traits in the upper Cowlitz basin, and again more recently in descriptions of artifact assemblages from the Koapk site, at Cowlitz Falls, and Mule Spring, in the White River watershed. J. Scott King, in concluding his analysis of the Koapk projectile point assemblage, suggests that "Future research in the western Cascades should focus on developing a region-wide rigorous typology to facilitate intersite and interregional comparisons of projectile points, thus improving knowledge of the distribution of and relationships between prehistoric populations in the Northwest" (Ellis et al. 1991:149). Such an effort can do nothing but improve our understanding of the manner in which the southern Washington Cascades are used by populations potentially emanating from various lowland regions both east and west of the mountains.

The foregoing outlines of extant archaeology in Mount Rainier National Park (through 1990) and in immediately surrounding watersheds underscore the rich and varied nature of the archeological record in the southern Washington Cascades. Not only are prehistoric archeological remains common in a variety of montane settings, variation in the character and density of remains suggests substantial functional variation among them. Furthermore, radiocarbon data summarized in Table 3.4 and shown on Figure 3.5 suggest a long Holocene use range; dating to perhaps as early as circa. 8,500 B.P. and certainly well established by about 6,700 years ago.

Our problem now turns away from such issues as *whether* Cascade landscapes were used extensively during the prehistoric past—clearly they were—and toward such issues as clarification of the manner in which montane environments were exploited in the past, how land-use patterns may have changed through time, and the nature of the archaeological signature left by these processes at Mount Rainier. The following chapter describes procedures and results of the present project's attempts to clarify and impose order on the archaeological record of the Park. Subsequent chapters deal with intersite functional variation within the Mount Rainier sample, site-distribution patterns within the Park and long-term settlement and subsistence patterns affecting the Park and the greater region.

Chapter 4

THE 1995 MOUNT RAINIER ARCHEOLOGICAL RECONNAISSANCE

By the end of 1990, at least 34 possible prehistoric sites or isolated finds had been reported for Mount Rainier National Park. Site accounts were present in a variety of books, inventory reports, internal memos and museum notes. Few of these reports, however, were documented formally or integrated into an organized database for the Park. Indeed, all but eight of the field sites (FS) and all of the isolated finds (IF) included in Tables and Figures 3.1 through 3.3 in Chapter 3 remained unverified. Some of the unverified reports included map locations; many did not. Some of the artifacts found their way into museum storage at Longmire; others disappeared to individual or institutional collections. In short, Mount Rainier prehistoric site data and cultural remains were scattered. At the beginning of the present project, then, only eight sites were documented with the Washington Office of Archaeology and Historic Preservation (OAHP)—all but one through efforts taking place from 1986 through 1990. McClure's (1990) research, and perhaps Bergland's (1986) earlier investigations, were the only serious attempts to impose order on the Park's archaeological record.

The present project was intended to expand and impose order on the archaeological record as it appeared in the early 1990s. It was awarded formally to the International Archaeological Research Institute, Inc. (IARII) in 1994 (Park Service Contract 1443-CX9000-93-020, Task 5). Fieldwork was completed in 1995. Primary project goals were to 1) consolidate existing prehistoric site and isolate reports; 2) locate and reevaluate or document as many of these localities as practical; and 3) expand the site database through new survey structured to widely sample Park landforms and environmental zones. In concert with environmental research, these data were to be used to generate environmental and site stratification expectations discussed in Chapter 2 and continued in this and the following chapter.

The preceding chapter consolidated site and isolate information available at the beginning of the present project (also see Appendix A).[24] The sections below describe field procedures, and summarize and interpret various aspects of the results of the 1995 effort. The concluding section, co-authored by Stephen Hamilton, presents lithic analytical results and implications for intersite variation in the current Mount Rainier sample. References should be made to this report's companion *1995 Reconnaissance Data* volume (Burtchard and Hamilton 1998) for site-specific information.

SITE VERIFICATION AND RECONNAISSANCE PROCEDURES

Reconnaissance fieldwork was completed between August 7 and September 21, 1995 by Stephen Hamilton and the author. Assistance was provided by Park archaeologist Gregg Sullivan and IARII's Randall Schalk with additional help from Emma Krzeminski and Michelle Morseth. Because of limited survey time and logistical difficulty inherent in conducting fieldwork around Mount Rainier, the project emphasized documentation of *prehistoric* archaeological remains. Locations of historic period debris were noted in the field, but only two of the most substantial historical complexes were

[24] Several site localities were brought to our attention late in the 1995 field season. These are included in Appendix A and in the 1995 site data Table 4.1 accompanying map Figure 4.1.

documented formally as archaeological sites (FS 95-02 [45PI427] and FS 95-09 [45PI428]) and described in the *1995 Reconnaissance Data* volume (Burtchard and Hamilton 1998).

Recognizing our inability to examine all previously reported finds and conduct a meaningful level of new site survey within a six week field effort, the reevaluation/site verification portion of the project emphasized reported multiple artifact concentrations for which at least approximate map data were available. Our intent was to focus on prehistoric remains most plausibly associated with sustained or redundant prehistoric use; that is, the most probable *site* rather than simpler isolated find localities. These efforts resulted in reevaluation of five of the eight previously documented sites; formal documentation of four previously reported but unverified sites, and documentation as isolates of seven previously reported finds. These 16 verified or reevaluated sites and isolates, plus the three previously documented but not reevaluated sites, are identified by the field site (FS) and isolated find (IF) prefixes on Tables 3.1 through 3.3 in Chapter 3.

New field reconnaissance was completed for approximately 3,550 Park acres. Inventory areas were divided among four quadrants; selected to maximize landform variability, open sediment exposure and access efficiency (see fold out Figure 4.2). In effect, this focused approximately 70% of the new survey on alpine tundra and subalpine parklands with open to patchy forest cover and substantial moderate gradient terrain.[25] Because such areas also tend to be associated with relatively high densities of exploitable floral and faunal resources (e.g., goats, elk, marmots, deer, bears, game birds, huckleberries, alpine lilies, etc.), it is likely that these zones also were among the most heavily used throughout the prehistoric past.[26]

To accommodate small crew size and site discovery difficulties posed by variably dense ground cover and repeated volcanic deposits, particular attention was given to exposed mineral sediments, erosion scars and potential rockshelter locations at cliff bases. The term *reconnaissance* used to characterize this project throughout the report reflects the extensive character of the effort as opposed to more intensive archaeological survey with team members walking at closely spaced, regular transect intervals.

Basic documentation procedures were identical for both reevaluated and newly located sites. After discovery of the initial artifact or feature, intensive survey was conducted outward from that point until no additional materials could be located. Pin flags were used to mark artifacts and features. Localities with three or more visible artifacts were documented as archeological *sites.* Localities for which only one or two artifacts could be found were recorded as *isolated finds.* Descriptive site and local environmental data were entered onto forms adapted from and approved by the Washington OAHP. An abbreviated form was used to record isolated localities. Universal transmercator (UTM) coordinates for datum points at both sites and isolated finds were obtained using a global positioning system (GPS) receiver. These location points later were entered into the Park's geographic information system (GIS) and plotted onto the color Park quadrant maps included as Figures 2.10 through 2.13 in Chapter 2. Sketch maps illustrating artifact and cultural feature distributions relative to local terrain features were prepared for site localities only. Both sites and isolates were plotted onto USGS 7.5 minute topographic quad maps. Finally, sites and prominent terrain features were photographed and cataloged to the appropriate sites. Full descriptive results are included in the *1995 Reconnaissance*

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[25] The high elevation focus is counterbalanced somewhat by the floodplain emphasis of Daugherty's (1963).

[26] A glance at site and isolate distribution and environmental patterns as they unfold on Figures 3.1, 3.2, 3.3 and 4.1 shows clearly that the archaeological record is consistent with focused prehistoric use of subalpine to alpine terrain. Environmental determinants underlying this pattern are discussed at length in Chapter 2.

Data volume (Burtchard and Hamilton 1998), and are on file at OAHP and at Mount Rainier National Park headquarters in Longmire.

In order to provide as objective a descriptive system as practical, a field lithic assemblage inventory was completed for all prehistoric sites and isolates investigated in 1995. Our intent was not only to develop a replicable recording system, but to provide quantitative means to isolate site variability on the basis of surface evident remains. The basic procedure employed for each lithic locality was to flag artifacts as noted above, then investigate all flagged items by isolating artifact type (debitage, core or tool/preform), then tally a set of technical attributes by raw material (see Appendix B). When appropriate, comments on specific artifacts, assemblage character, visibility and other variables were recorded. Artifacts and preforms also were drawn and photographed. Site specific tabular results are included on individual site forms and in the *Site Data* volume. General implications for use of the Park are discussed in a later section of this chapter.

In sum, the 1995 field research was geared both toward consolidating the Park's preexisting suite of prehistoric sites and expanding it as practical within the bounds of a limited field effort. Special note should be made regarding the character of the present inventory. While we have confidence that the Mount Rainier reconnaissance was thorough and provides useful new site distribution information, it is important to recognize that it does not constitute full or final survey of the landforms inspected. Almost certainly intensive survey, particularly if supplemented by subsurface sampling techniques, will identify additional prehistoric sites. For the present, however, reconnaissance data provide a preliminary view of site distribution on these landscapes and expands the existing site database in a manner that allows us to consider site distribution patterns in the Park.

THE NEW PICTURE, REPORTED PREHISTORIC SITES AND ISOLATES 1991-1995

During the present reconnaissance, 28 new sites, isolates, and well substantiated but unverified sites were added to the total documented through 1990. Table 4.1 lists reported finds, sources and site or isolate number. Map Figure 4.1 shows the count of 62 reported prehistoric places, both documented and unverified, in Mount Rainier National Park at the close of 1995.

Twenty-four of the 62 sites and isolated finds reported through 1995 and shown on Figure 4.1 have not been verified in the field or documented in a formal fashion. They are included here to help illustrate the Park's first slow then rapidly growing archaeological record, to show the subalpine and alpine bias in the location of prehistoric use areas, and to provide an organized database for continuing verification survey efforts. Clearly, the site database will continue to grow as verbal accounts and historic period cultural remains are added to the list, and new survey adds as yet unknown cultural remains.

Table 4.1 Sites and Isolates, 1991-1995 (also see Appendix A)

No.	Date	Reported Find	Source	Comment
35	1995	Lithic scatter	Burtchard & Hamilton 1998	FS 95-03; Yakama Park, Sunrise Ridge
36	1995	Lithic scatter	"	FS 95-04; Yakama Park, Sunrise Ridge
37	1995	Lithic scatter	Carl Fabiani, pers com. 1995	FS 95-05; Mist Park
38	1995	Lithic scatter	Burtchard & Hamilton 1998	FS 95-06; Mother Mountain

No.	Date	Reported Find	Source	Comment
39	1995	Lithic scatter	"	FS 95-07; Windy Gap
40	1995	Lithic scatter	"	FS 95-08; Windy Gap
41	1995	Lithic scatter	"	FS 95-10; Forgotten Creek (N of Kautz Creek)
42	1995	Lithic scatter	"	FS 95-11; Sunrise Lake
43	1995	Interior chert flake	"	IF 01-95; Deadwood Lakes
44	1995	Basalt flake	"	IF 02-95; Summerland
45	1995	Obsidian flake, basalt uniface	"	IF 03-95; Grand Park
46	1995	Chalcedony interior flake	"	IF 04-95; Grand Park
47	1995	Biface & uniface frags.	"	IF 05-95; Upper Berkeley Basin
48	1995	Chalcedony flake & core	"	IF 06-95; Yakama Park, Sunrise Ridge
49	1995	Chalcedony interior flake	"	IF 07-95; Yakama Park, Sunrise Ridge
50	1995	Jasper shatter fragment	"	IF 08-95; Spray Park
51	1995	Tabular stone manuport	"	IF 09-95; Spray Park
52	1995	River cobble manuports	"	IF 10-95; Copper Mountain
53	1995	Basalt reduction flake	"	IF 11-95; Mirror Lakes
54	1995	Chert thinning flake	Pam Cox 1995	Unverified locality; Crystal Lakes
55	1995	Jasper projectile point	Carl & Denise Fabiani 1995	Unverified; ridgetop near Tolmie Peak
56	1995	Jasper projectile point	Carl & Denise Fabiani 1995	Unverified; Howard Peak
57	1995	Projectile point, hearsay accounts of Indian baskets	Carl & Denise Fabiani 1995	Unverified; west end of Eunice Lake
58	1995	Point fragment and flakes	Carl & Denise Fabiani 1995	Unverified; fire trail on ridgetop south of Mowich Lake near Park boundary
59	1995	Lithic scatter	Carl & Denise Fabiani 1995	Unverified; ridge between Tyee Peak and Windy Gap
60	1995	Two flakes	Carl & Denise Fabiani 1995	Unverified; trail east of Golden Lakes R.S.
61	1995	Two flakes	Carl & Denise Fabiani 1995	Unverified; trail along top of Sunrise Ridge
62	1995	Yakama Trail Segment	C. Fabiani 1995, J. Morrison 1995, and R. Drake 1996	Undocumented; eastern and southern flank of Sunrise Ridge

Note: Two historic period sites (FS 95-02 and FS 95-11) were also documented during the 1995 reconnaissance. These sites are described in detail in Section 2 and included on Figure 4.2 below. In addition, two culturally peeled cedar trees were reported by Janet Liddle (pers. com. 1996) after compiling the information included here. One tree is situated on the southeast Park boundary north of Carlton Creek; the second north of Skate Creek Road, west of Bear Prairie, north of the Nisqually River.

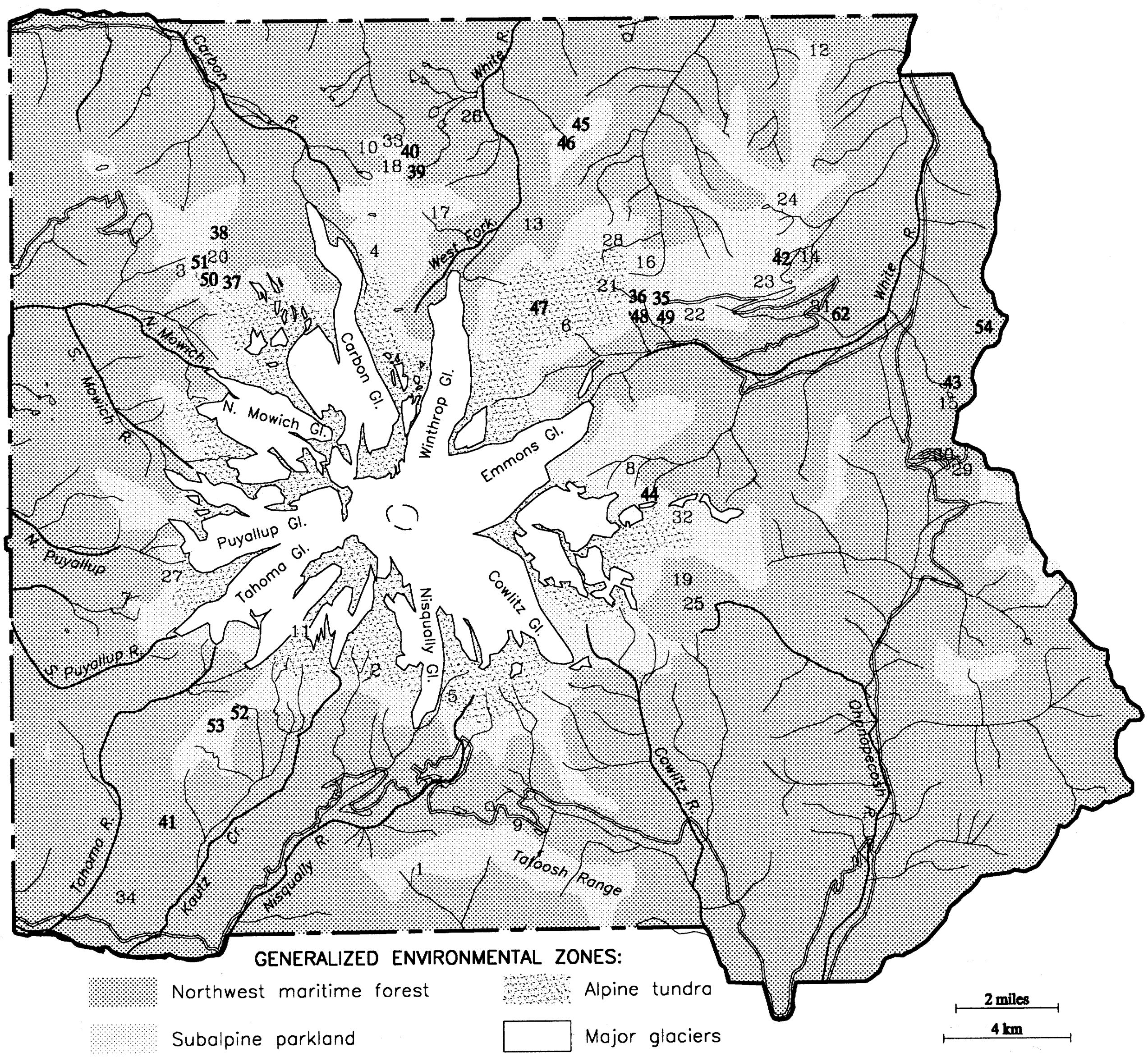

Figure 4.1 Mount Rainier Prehistoric Localities Reported through 1995

Formally Documented Archaeological Sites in Mount Rainier National Park

As noted above, eight prehistoric sites had been formally documented in Mount Rainier National Park at the beginning of the present project. Five of these were reevaluated and documentation updated in 1995. In addition, 11 previously reported, but undocumented, sites (n=4) and isolates (n=7) were recorded during the current project. Newly documented archaeological localities include eight new prehistoric sites, two historic period sites and 11 isolated finds.[27] Combined with reevaluated sites, these results bring to 40 the number of formally documented archaeological localities in Mount Rainier National Park. Fold-out Figure 4.2 shows 1995 reconnaissance areas and the current set of *formally documented* sites and isolates in Mount Rainier National Park. Full descriptive documentation for these sites is included in Burtchard and Hamilton (1998). A tabular summary of results is included as Table 4.2.

It is important to emphasize, that sites and isolated finds included here represent a beginning effort at documenting the Park's archaeological record. The site count will increase further as other localities are investigated, as subsurface techniques are added to surface reconnaissance efforts, and as overall sample areas increase. Please note, too, that due to this study's focus on prehistoric remains, the results substantially under-represent the Park's historic period archaeological record. Finally, additional *hearsay* localities not reflected in written reports probably will be added as efforts to elicit such information from knowledgeable individuals continue.

The above considerations notwithstanding, the current sample reasonably characterizes the general distribution of prehistoric archaeological remains in Mount Rainier National Park. Many of the documented sites and isolates were found over a long period of time by individuals whose observations accommodate a variety of locations, terrain and environmental circumstances. Accordingly, sampled terrain is widely dispersed across the Park landforms and environmental zones. Prehistoric site distribution, however, is not comparably dispersed. As predicted by Smith's (1964) over 30 years ago, the tendency toward location of prehistoric remains in subalpine to alpine settings is clear and represented on all sides of the mountain.

Patterns appear in other aspects of the archaeological record as well. In the sections that follow, extant Mount Rainier data are reviewed and related to implications for long-term land-use practices in the Park. Results of field lithic analyses are considered first; emphasizing artifact classes, technological attributes and raw materials. The lithic assemblage is then discussed in terms of its relevance to functional site distinctions and temporal implications. The final section of the chapter builds on these analyses to propose a nine-part site type model for the park. The final section also considers site type and distribution patterns in relation to a series of specific environmental variables.

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[27] Surface counts of lithic materials associated with Mount Rainier sites are often low. In part, this reflects short-term, non-redundant use, limited on-site manufacture, and implement conservation. It also reflects repeated volcanic deposits covering large areas of Mount Rainier during the Holocene. Sites for which stratigraphic information is available (Berkeley Rockshelter [FS 86-02], Fryingpan Rockshelter [FS 63-01] and Sunrise Ridge Borrow Pit lithic scatter [FS 90-01]) have lithic debris both above and below substantial tephra deposits—especially Mount Rainier C circa 2,300 years ago. Deeply buried Mt. Mazama tephra (circa 6,700 years ago) in a profile from Grand Park suggests that cultural deposits could be found over a meter deep in some locations. It is most probable, then, that a number of prehistoric sites are buried at varying depths with only a fraction (if any) of their lithic debris visible in reworked surface context, and hence, available for documentation by surface reconnaissance techniques such as those employed here. The author believes that when subsurface test procedures are employed, site totals and artifact densities will increase. In addition, subsurface testing probably will reveal that a number of isolated finds also warrants site designation. For purposes of this report, sites and isolates are both used to address site distribution and land-use issues.

Table 4.2 Mount Rainier 1995 Archaeological Site and Isolated Find Summary

Site/Isolate	Site Name	Location / Context	Site Type	Comment
45PI043 FS 63-01	Fryingpan Rockshelter	NE quadrant near Fryingpan Creek / Forested valley floor setting	Shallow prehistoric cave shelter	[Documented 1963, Reevaluated 1995] Large north-facing rock overhang with prehistoric remains. Tested in 1964 by D. Rice (1965). Collections at WSU. Recommend excavation to improve faunal and temporal data, and potentially add floral information.
45PI407 FS 86-01	Frozen Lake Site	NE quadrant W of Frozen Lake / Alpine tundra	Prehistoric lithic scatter	[Documented 1986, Reevaluated 1991 & 1995] Primary reduction site on exposed ridge west of the lake. Debris predominantly red jasper, with chalcedony and basalt. Materials on site and in MORA collection. Several collected bifaces illustrated, but lost. Tephra and debitage relationship suggests post 2,300 B.P. date.
45PI303 FS 86-02	Berkeley Rockshelter	NE quadrant near Lodi Creek in Berkeley Basin / Subalpine parkland	Prehistoric & historic period rockshelter	[Documented 1986] Early 1900s historical artifacts and stratified prehistoric debris in double talus boulder rockshelter. Tested 1987 by Bergland (1988). ^{14}C dated 290 & 1,070 B.P.
45PI406 FS 88-01	Tipsoo Lakes Site	Boundary NE & SE quadrants / Lakeside near subalpine parkland	Prehistoric lithic scatter	[Documented 1988, Reevaluated 1995] Moderate density lithic scatter concentrated from picnic and parking area to western end of lakes. Mixed late stage lithic debris. NPS tests in progress suggest shallow subsurface deposits. Temporal range presently unknown.
45PI408 FS 90-01	Sunrise Ridge Borrow Pit Site	NE quadrant on Sunrise Ridge / Forested SW facing side slope bench	Prehistoric lithic scatter & modern borrow pit	[Documented 1990, Reevaluated 1995] Extensive lithic scatter with ground stone on or near Yakama trail to Sunrise Ridge. Tephra stratigraphy suggests 4,500-2,300 B.P. date. Damaged by road fill & tree planting excavation. *Site erosion ongoing*. Recommend data recovery excavation to establish site content, function and temporal range.
45PI409 FS 90-02	Sarvant Glaciers Site	SE quadrant / Alpine tundra	Prehistoric lithic scatter	[Documented 1990] Low density scatter with arrow point & bifaces. May be a single use site.
45PI410 FS 90-03	Windy Gap Site	NW quadrant on ridge saddle / Subalpine parkland	Prehistoric lithic scatter	[Documented 1990, Reevaluated 1995] Single source chalcedony debitage and dart-sized hafted biface. May be a single use site.
45PI411 FS 90-04	Tum Tum Peak Quarry Site	SW quadrant on forested ridge saddle	Prehistoric chert procurement	[Documented 1990] Interior chert flakes percussion struck from several parent boulders.
45PI438 FS 71-01	Buck Lake Site (a.k.a. Fawn Ridge)	NE quadrant on ridge overlooking lake / Subalpine parkland	Prehistoric lithic scatter & possible historic component	[Reported 1971, Documented 1995] Multiple lithic concentrations on ridge and bench landforms NE of Buck Lake. Probable sustained and/or reused site. Recommend test procedures to better establish site parameters, and survey of surrounding elevated ridge system toward Palisade Lakes. Buck Lake also may be suitable for paleoenvironmental core extraction.

Site/Isolate	Site Name	Location / Context	Site Type	Comment
45PI433 FS 72-02	Mt. Pleasant Rockshelter	NW quadrant at cliff-talus interface/ Subalpine parkland	Shallow prehistoric & historic period cave shelter	[Reported 1972, Documented 1995] East facing shelter above Mist Park at the northern edge of Spray Park. Contains tertiary interior flakes and historic period materials including wood and what appear to be small detonator caps.
45PI437 FS 74-01	Vernal Park Rockshelter	NW quadrant under boulder at talus base / Subalpine parkland	Prehistoric & historic period shelter	[Reported 1974, Documented 1995] Boulder forms a natural overhang on the SE side. Large, low interior space partially enclosed by stacked rock walls. Chalcedony & chert flakes found in 1974. Walls appear to be historical.
45PI426 FS 95-01	Tipsoo Two	Boundary NE & SE quadrants /Lakeside near subalpine parkland	Prehistoric lithic scatter	Seven tertiary interior argilite flakes exposed in trail and under viewing bench. Appear to reflect a single reduction event.
45PI427 FS 95-02	Camp Garcia (Historic Site)	Boundary NE & SE quadrants / Forested terrace above Fryingpan Creek	Historic period camp/ Maintenance area	A series of excavated tent platforms, privy & dump pits, central area with structural elements, and water by-pass ditch. Early to mid 1900s. Possible CCC camp or trail construction station.
45PI436 FS 95-03	Upper White River Trail Site	NE quadrant / Subalpine parkland	Low density lithic scatter	Chalcedony and chert late stage reduction flakes with one quartzite manuport on rodent reworked sediments. Appears to predate pre-date Mount Rainier C tephra (i.e., >2300 B.P.)
45PI435 FS 95-04	Yakama Park Rim	NE quadrant / Subalpine parkland	Low density lithic scatter	Chalcedony and chert late stage reduction flakes on ridge top overlooking White River canyon.
45PI432 FS 95-05	Mist Park Overlook Site	NW quadrant / Subalpine parkland	Low density lithic scatter	Interior chert and fine-grained basalt flakes with associated bird gastroliths (gizzard stones); all exposed in social trail/picnic area at Spray Park rim overlooking Mist Park to the north.
45PI431 FS 95-06	Mother Mtn. Lake 5554 Site	NW quadrant / Subalpine parkland	Lithic Scatter	Expedient polyhedral core and early stage gray chert reduction flakes. May be a single reduction event.
45PI434 FS 95-07	Windy Gap Two	NW quadrant / on pass saddle in subalpine parkland	Lithic Scatter	Secondary to tertiary reddish brown chert manufacturing flakes; two with cortical facies. Probable manufacturing site similar to Windy Gap One (FS 90-03).
45PI430 FS 95-08	Middle Spunkwush Lake Site	NW quadrant / Lakeside setting in subalpine parkland	Low density lithic scatter	Mid to late stage reduction of multiple chert material types scattered on rocky ridge west of small lake. Multiple materials suggest repeated low intensity use of the locality.
45PI428 FS 95-09	Devils' Dream Cache & Cut (Historic Site)	SW quadrant / in Silver Fir - Alaska Cedar Forest	Cedar cutting area, historic cache, and log stockpile	Small rockshelter with circa 1915 cooking gear adjacent to area with multiple ax and saw cut cedars. Skid trail to Devil's Dream Creek. Probable associated stockpile near Squaw Lake.
45PI429 FS 95-10	Forgotten Creek Site	SW quadrant / Headwater spring in patchy forest-beargrass zone	Lithic scatter	Mixed interior reduction flakes, dart-sized projectile point base, and edge battered milling stone located on flat ground near a perennial spring. Recommend testing and intensive survey of adjacent ridge and low gradient slopes.

Site/Isolate	Site Name	Location / Context	Site Type	Comment
45PI439 FS 95-11	Little Sunrise Lake Site	NE quadrant / Lakeside setting in subalpine parkland	Lithic scatter	Late stage red jasper, chalcedony and grayish red chert exposed in game trail on small ridge adjacent to smaller Sunrise Lake. Pecked and battered stone base with minor grinding wear also present. Recommend intensive survey of Sunrise Lake vicinity and of parkland settings north to Buck Lake.
IF 02-63	Bench Lake Trail head	Boundary SW & SE quadrant / Brushy forest cover	Dart point	[Identified 1963, Reevaluated 1995] Single leaf shaped (Cascade) projectile point, apparently at contact below St. Helen's-Y_n tephra (circa 4000-5800 B.P.).
IF 01-68	Yellowstone Cliffs	NW quadrant / Forested side slope bench	Arrow point	[Identified 1968, Reevaluated 1995] Large chalcedony corner notched triangular point and single flake on large side slope bench below Yellowstone Cliffs. Recommend subsurface testing to establish possible site parameters.
IF 01-70 (Unverified)	Success Cleaver Isolates	SW quadrant / Alpine	Biface & Arrow point	Triangular basalt biface tip and chalcedony corner notched arrow-sized point. Reported by Jan Henderson, "lying on sandy pumice."
IF 01-72	Sunrise Creek	NE quadrant / Subalpine parkland	Biface tip & flake	[Identified 1972, Reevaluated 1995] Chalcedony hafted biface tip and flake in/near Sunrise Creek near bridge. Probably displaced from general area use, especially FS 95-11.
IF 01-77	Deadwood Lakes Pass	NE quadrant / Pass saddle, subalpine parkland	Flake (?)	[Identified 1977, Reevaluated 1995] Prehistoric item (not described) in trail at crest of the pass between Deadwood Creek and Rainier Fork of the American River. No additional materials found during reevaluation.
IF 01-84 (Unverified)	Upper Palisades Trail Isolate	NE quadrant / Subalpine	Lanceolate Arrow point	Lanceolate gray chert projectile point with slight stem; 28 x 10 mm with 6 mm haft width. Found by Wendy Burman.
IF 01-87 (Unverified)	Tokaloo Trail Isolate	SW quadrant / Alpine	Probable Dart Point	Triangular, contracting stem projectile point; 39 x 19 mm with circa 8 mm haft width. Red jasper. In trail to Tokaloo Rock at 6700 ft Reported by Chris Jensen.
IF 01-95	Lower Deadwood Lake	NE quadrant / Lakeside subalpine parkland	Flake	Tertiary interior chert flake. On, but possibly reworked from below, Mount Rainier C tephra (> 2300 B.P.). Recommended subsurface testing to determine possible site presence.
IF 02-95	Summerland	Boundary NE & SE quadrants / alpine-subalpine margin	Flake	Medium grained greenish-gray basalt flake contrasts with immediately available raw materials. Possible source material up slope near Panhandle Gap.
IF 03-95	Grand Park One	NW quadrant / Subalpine parkland	Thinning flake & unifacial tool fragment	Obsidian biface thinning flake and unifacially worked andesite flake—possible awl fragment—in seasonal flood channel. Recommend subsurface investigation of surrounding terrain.
IF 04-95	Grand Park Two	NW quadrant / Subalpine parkland	Flake	Chalcedony interior flake. May be reworked from below Mount Rainier C tephra. Recommend subsurface testing of surrounding terrain.

Site/Isolate	Site Name	Location / Context	Site Type	Comment
IF 05-95	Upper Berkeley Park	NE quadrant / alpine-subalpine margin	Biface & uniface flake fragments	Chalcedony *potlid* fragment from probable bifacial tool and unifacially retouched chert flake. Near Lodi Creek headwaters at extreme upper Berkeley Park. Recommend subsurface testing of nearby side slope benches.
IF 06-95	Yakama Park One	NE quadrant / Subalpine parkland	Flake & core fragment	Chalcedony flake and core fragment, possibly reworked from below Mount Rainier C tephra. Spatially associated with FS 95-3 & 4 and Is 7-95. Recommend testing surrounding terrain to better establish possible site parameters.
IF 07-95	Yakama Park Two	NE quadrant / Subalpine parkland	Flake	Chalcedony flake on ridge top overlooking Is 6-95 and immediately east of FS 95-4. As above, general area should be investigated more thoroughly to establish possible site parameters.
IF 08-95	Spray Park Shatter	NW quadrant / Subalpine parkland	Manuport	Large brownish red jasper shatter fragment on deflated flat parkland surface above Mt. Pleasant Rockshelter (FS 95-5).
IF 09-95	Spray Park Slab	NW quadrant / Subalpine parkland	Manuport	Subangular, tabular, course grained metasediment manuport on small side slope bench above Mt. Pleasant Rockshelter (FS 95-5). Possible abrading stone.
IF 10-95	Copper Mtn. Cobbles	SE quadrant / Alpine-subalpine boundary	Cobble manuports	Two river rounded cobble manuports among subangular natural elements on top of Copper Mtn. No obvious battering or other wear.
IF 11-95	Mirror Lakes	SE quadrant / Subalpine lakeside setting	Flake	Fine-grained basalt primary reduction flake in outflow channel of lowest Mirror Lake. May have weathered from adjacent low ridge.

Table Notes: FS and IF designations are field numbers used by Mount Rainier National Park to identify archaeological field sites and isolated finds respectively. Unverified isolates were reported and map plotted prior to 1995, but were not reevaluated directly during the present reconnaissance. Datum points for sites documented or reevaluated in 1995 are fixed by GPS receiver and entered into the Park's GIS system.

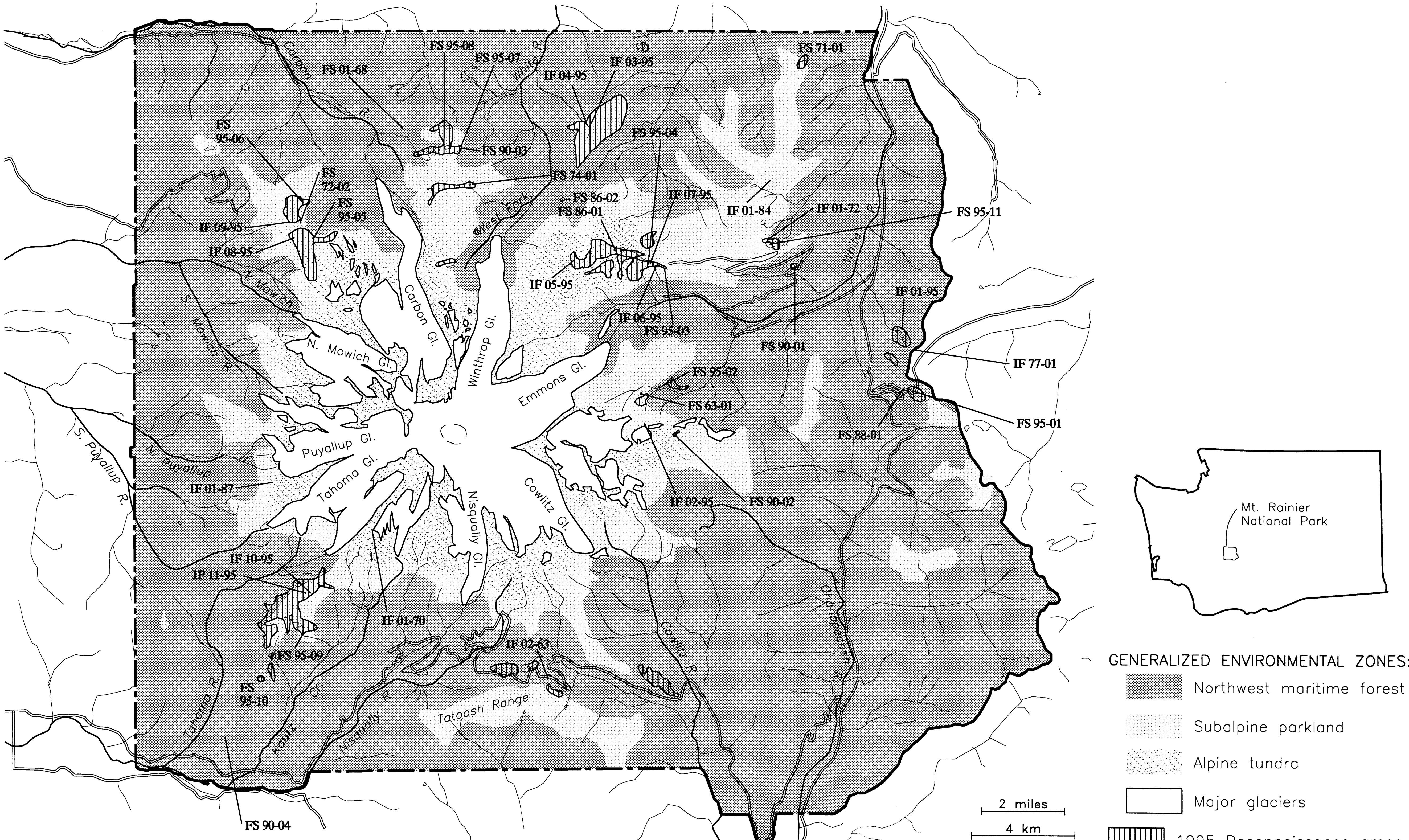

Figure 4.2 Documented Archaeological Sites and Isolates, Mt. Rainier National Park

LITHIC ASSEMBLAGES AND SITE VARIABILITY ON MOUNT RAINIER
by Stephen Hamilton and Greg Burtchard

Lithic materials dominate prehistoric archaeological remains at Mount Rainier National Park. In most cases, lithic remains are our only means, not only to establish the presence of a prehistoric site, but to infer function and temporal range as well. Since site testing and data recovery excavations are rare,[28] preliminary inferences typically must be made on the basis of surface evident remains alone. Because of the importance of these artifacts, and because surface survey is often the only look we can reasonably hope to have for many sites, we believe that field analyses of lithic remains during reconnaissance is an important, if limited, site recording procedure. Accordingly, basic analysis of surface visible lithic remains was a part of the field inspection procedure for sites and isolates investigated in 1995 (see Appendix B for observation categories). Individual site forms (see Burtchard and Hamilton 1998) present specific analytical and inferential results. Here, we focus on general assemblage characteristics and broader implications of the present Mount Rainier sample. General characteristics of the Park's artifact classes, technology and raw materials are considered first. Intersite variability in raw materials and debitage count is employed to generate a preliminary five-part site classification scheme. The combined field identified and curated projectile point sample is then described and related to temporal implications for human use of the Park. Finally, patterned variation in artifact assemblages is partitioned into a second typology of site and isolate groups. Throughout the discussion, please bare in mind that observations are based on small samples from surface context only. Results should be considered tentative in lieu of more extensive data recovery procedures and analyses of larger data sets.

General Characteristics of the Mount Rainier Assemblages

Even though the present sample of prehistoric materials is small, combining curated and field observed artifacts allows a somewhat more robust view of overall tendencies. Not surprisingly, combined data show a general tendency toward portable hunting-related tools, late stage manufacture and repair, and use of locally available materials. Projectile points include both dart and arrow-sized implements, suggesting a wide temporal range for the Park and/or exploitation of large body sized animals. Perhaps somewhat more surprising is the presence of a small fraction of heavier ground stone tools, suggesting at least limited, multiple task residence within Park boundaries.

Artifact Classes

At the time of writing, Mount Rainier artifacts available for analysis included those from current surface observation, previous collections curated at the Park's collection facility in Longmire and the test excavated sample from Berkeley Rockshelter (FS 86-02[d]). Tables 4.3 and 4.4 list general artifact classes and total item counts for sites and isolated finds respectively. Site and isolate locations can be seen most easily on fold out map Figure 4.2, or on Park quadrant color Figures 2.10 through 2.13.

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[28] Three Mount Rainier sites were tested prior to completion of this report—45PI43, Fryingpan Rockshelter (Rice 1965); 45PI303, Berkeley Rockshelter (Bergland 1988); and current work at 45PI406, Tipsoo Lakes (Sullivan pers. com. 1996). Work also has been done in the vicinity of the Ohanapecosh campground in the Park's extreme southeastern corner and at the Sunrise Ridge Borrow Pit Site—45PI408 (Liddle pers. com 1997). Information on Tipsoo Lakes, Ohanapecosh and Sunrise Ridge projects were not made available for inclusion in this report.

Table 4.3 Lithic Assemblage Summary, Mount Rainier Prehistoric Sites

Site No.	Artifact Total	Debitage	Core	Biface	Projectile Point	Flake Tool	Ground Stone	FCR	Other
FS 71-01[a]	36	33			1	2			
FS 72-02[a]	13	11	1			1			
FS 74-01	4	4							
FS 86-01[b]	23	13	3		3	4			
FS 86-02[c]	7	5	2						
FS 86-02[d]	364	327	6	12	10	8	1		
FS 88-01	14	12		2					
FS 90-01[e]	22	34		1			4	2	
FS 90-02	7	3		2	1	1			
FS 90-03	5	4			1				
FS 90-04	27	27							
FS 95-01	7	7							
FS 95-03	6	5							1
FS 95-04	4	4							
FS 95-05	2	2							2
FS 95-06	5	4	1						
FS 95-07	18	17				1			
FS 95-08	4	3				1			
FS 95-10	10	4			1		1	4	
FS 95-11	23	16					2	5	
Total	601	535	13	17	17	18	8	11	3

Table Notes: [a]Totals include 1995 inventory and museum collection.
[b]Totals include 1995 inventory and private collection drawings.
[c]Museum collection surface finds.
[d]Berkeley Rockshelter test excavation sample (see Bergland 1988). Absence of bifaces and projectile points in the surface sample (FS 86-02[c]) probably reflects collector theft.
[e]Totals include 1995 surface inventory, a biface fragment from 1990 site documentation and 19 debitage fragments from a sediment sample collected in 1995.

Table 4.4 Lithic Summary, Mount Rainier Isolated Finds

Find No.	Artifact Total	Debitage	Core	Biface	Projectile Point	Flake Tool	Manuport
IF 02-63	1				1		
IF 01-68	2	1			1		
IF 01-70	2				2		
IF 01-72	2	1		1			
IF 01-75	1	1?					
IF 01-84	1				1		
IF 01-87	1			1			
IF 01-95	1	1					
IF 02-95	1	1					
IF 03-95	2	1				1	
IF 04-95	1	1					
IF 05-95	2			1		1	
IF 06-95	2	1	1				
IF 07-95	1	1					
IF 08-95[a]	1						1
IF 09-95[a]	1						1
IF 10-95[a]	2						2
IF 11-95	1	1					
Total	25	10	1	3	5	2	4

Table Note: [a]Questionable cultural/Native American origin

Technology

In the non-debitage fraction of the Mount Rainier assemblages, bifaces appear to have played a primary role as cores for imported materials. Such a strategy reduces weight by minimizing non-functional stone. Replacement tools can be manufactured as needed on site, using only final retouch techniques. Flake debitage could be used for expedient cutting or scraping activities (not analyzed in this project). Examples of bifaces functioning as potential core/preforms come from Sites FS 90-02 (Sarvant Glaciers), FS 86-01 (Frozen Lake), FS 90-01 (Sunrise Ridge Borrow Pit), and FS 88-01 (Tipsoo Lakes). These larger, percussion bifaces are considered part of flexible biface technology, useful in mobile situations; particularly if raw materials are scarce (see Kelly [1988] for a detailed discussion of flexible biface technology).

The presence of raw material sources on the slopes and in river gravels around Mount Rainier relieves some of the need to carry an extensive tool kit. Presence of expedient cryptocrystalline (CCS) cores, and larger early stage CCS, fine-grained basalt and metasediment flake tools at sites such as FS 86-01 (Frozen Lake), FS 90-03 and 95-07 (Windy Gap One and Two), and FS 95-06 (Mother Mountain) suggests that local materials functioned as an integral part of the Park's technical organization strategy.

Overall, debitage surface assemblages from Mount Rainier reflect this technological organization pattern as well (refer to Table 4.5 below). A significant proportion of flakes are larger cortical flakes (CF = 5% of the sample) and interior flakes (IF = 21%) and shatter (S = 9%). These artifacts were part of a core reduction strategy consistent with use of local materials. Tertiary interior flakes (TIF = 26%) and biface flakes (BF = 26%) typically are associated with prepared core and biface reduction. Tool maintenance and finishing is shown by retouch flakes (RF = 14%).

Table 4.5 Summary of Lithic Debitage from Mount Rainier Surface Assemblages

Site No.	CF	IF	TIF	BF	RF	S	Total
71-01[a]		4	10	4	8	7	33
72-02[a]		1	3	1	4	2	11
74-01		2			1	1	4
86-01	2	7	1	2		1	13
86-02	1	4					5
88-01		2	5	4	1		12
90-01		2	1	9	1	2	15
90-02							3[b]
90-03					4		4
90-04							27[b]
95-01		1	6				7
95-03			2	2	1		5
95-04							4[b]
95-05		1	1				2
95-06	2	1	1				4
95-07	2		7	8			17
95-08		1	1	1			3
95-10		1			2	1	4
95-11		5	2	9			16
Total	7	32	40	40	22	14	189 (155)

Table Notes: [a]totals from 1995 inventory and museum collection

[b]Not analyzed, (155) = Total analyzed

A broad reduction trajectory is represented in the Mount Rainier sample. It is not characterized, as one might expect in a high montane environment, by solely late stage reduction of prepared cores and bifaces or tool maintenance. Rather, it appears to be a combined, material efficient strategy using imported materials with expedient use of locally procured CCS, basalt and metasediments. Local raw materials were used to make both expedient flake tools as well as more completely formed bifacial tools.

Clarification of chronological changes (or absence of marked change) in technological organization at Mount Rainier requires more detailed studies with larger samples and temporal controls not possible here. Comparison between sites such as FS 86-01 (Frozen Lake) containing larger bifaces and dart-sized points only with site FS 86-02 (Berkeley Rockshelter) containing only late prehistoric arrow points would be of substantial value in such research.

Raw Materials

Patterned use of raw materials is an aspect of technological organization that reflects such issues as mobility patterns and the distribution of knapable stone. A number of sites in the Mount Rainier sample provide basic information regarding raw material use. Tool stone found in the Park fall into one of three major categories: obsidian, CCS (subsuming cherts and jaspers), and fine-grained basalt or metasediment. CCS emanating from several sources dominate the sample. These materials appear to be affiliated both with imported and curated tools made from sources located outside and inside the Park. The latter were used for the manufacture of expedient flake tools and some curated tools. Undoubtedly, the fact that raw materials were available on the mountain relieved some of the pressure to carry in all the materials and tools needed while in residence. General observations of materials documented with Mount Rainier sites follow.

Obsidian

Obsidian is the most obvious example of an imported material. Obsidian is found primarily in the form of finished projectile points. Only one piece of obsidian debitage, a tertiary interior flake, was found during the reconnaissance. The dearth of obsidian artifacts suggests limited access to this raw material by the people using the mountain.

Cryptocrystalline Silicates

CCS source materials were much more frequently used than obsidian and comprised the bulk of the lithic assemblages in the Park. A number of sites show the use of CCS raw material sources located on the mountain itself. Site FS 90-04 on Tum Tum Peak is a procurement locality in which flake scars on chert boulders are associated with flakes of the same material. Although a formal analysis of flakes was not conducted, it is all but certain that the site represents initial reduction of chert for tool blanks and/or cores that were taken for final reduction elsewhere. Bergland (1988) notes that red microcrystalline silicate (red jasper) artifacts from the FS 86-02 (Berkeley Rockshelter) assemblage are probably derived from a primary geologic source observed near the rockshelter. My (Hamilton) observations of the Berkeley Rockshelter artifacts are consistent with that conclusion and indicate a complete reduction of the local material into tools. It is interesting to note than at FS 86-01 (Frozen Lake), located relatively close to this same lithic source, most of the debitage is also a very similar appearing red jasper.

Site FS 95-06 (Mother Mountain Lake 5554 Site) also appears to be a single primary reduction event. Represented at the site is a single source scatter of light gray chert with an expedient, amorphous core of the same CCS material. In this case, the raw material source appears to be an exposed chert vein in Mist Park below the site and about 500 to 750 m to the east.

It is likely that Mount Rainier and its associated landforms have numerous CCS sources that could have been exploited prehistorically. During the present reconnaissance, several potential source localities were noted (without associated artifacts). A more detailed study of Mount Rainier CCS sources, their distribution and characteristics (chemical and visual attributes) would be useful in learning about raw material usage in the Park. The present data show that CCS was collected on the mountain as well as imported—the latter probably in the form of tools and cores.

As noted above, not all CCS raw materials associated with Mount Rainier's prehistoric sites are derived from local sources. Frozen Lake and Berkeley Rockshelter, for example, contain various kinds of small CCS cores in addition to the local reddish jasper noted above. At least one of the cores from Berkeley Rockshelter was derived from an alluvial nodule parent, most likely collected from a river bed. Unfortunately, because sources of CCS have not been mapped on Mount Rainier, it is difficult to unambiguously differentiate exotic from local cherts at the present time.

Various stages of CCS manufacture occurred at different sites in the Park. Berkeley Rockshelter shows a complete reduction trajectory from source to tool. At the site, much of the tool manufacture appears to be related to hunting gear maintenance, primarily arrow point production and replacement. Frozen Lake has a high frequency of large CCS bifaces but a relatively low count of debitage suggesting that bifaces were imported as blanks for tools and possibly cores from which flakes were struck as they were needed for butchering.

Single events of late stage CCS reduction is also evident at two sites. Debitage at site FS 95-07 (Windy Gap Two) suggests a single mid to late stage percussion biface reduction event of red jasper—probably locally derived. Nearby is another single chert reduction event (FS 90-03, Windy Gap One). The latter debitage cluster is primarily pressure retouch debitage suggesting either late stage manufacture, or more likely bifacial tool maintenance/rejuvenation. An associated but spatially separated dart point is probably an unrelated isolate.

Basalt and Metasediment

Basalt and metasediment are similar in appearance and appear to have played similar roles on Mount Rainier. Metasediment is slightly more brittle and fine-grained, thus, at times appears to have been used for manufacture of smaller tools. Both materials were found locally and used to supplement finer-grained CCS and obsidian tools with larger, more durable cutting tools. FS 86-01 (Frozen Lake) has the largest assemblage of large basalt flake tools presently known in the Park. Here, all of the basalt tools appear to be made from different (based on visual variation), but presumably local, sources. Visually similar fine-grained basalt, metasediment flakes and at least one flake tool are found at a number of the Mount Rainier sites. The Tipsoo Lake Two Site (FS 95-01) is a small cluster of metasediment flakes that appear to be associated with a single reduction event. The flakes are large, but appear to be derived from a prepared core. Generally, basalt and metasediment are rare in the form of debitage, but probably played a significant role as flake tools.

Coarser grained basalt was found as well, but not for tools requiring a precise cutting edge. Basalt as well as other locally derived volcanic stone cobbles were used for heavier tasks such as grinding, pounding, and cooking (FS 90-01, Sunrise Ridge Borrow Pit Site).

Other Materials

Lithic materials beyond those noted above are relatively rare in the Mount Rainier sample. Miscellaneous imported artifacts of exotic materials consisted of a pumice abrader at FS 86-02 (Berkeley Rockshelter), a pumice pipe bowl at FS 63-01 (Fryingpan Rockshelter), a quartzite cobble manuport at FS 95-03 (White River Trail Top), and various curated ground stone objects in the Park's museum collection. The latter were found at unknown localities within the Park.

Material Variability and Site Function

In a very general sense, a relationship can be expected to hold between the density and variety of materials at a site and the nature of site activities; use intensity, and/or the number of times a given location was reoccupied. In general, sites that have been repeatedly used, occupied by multitask or residential groups, and/or occupied by large groups tend to accumulate the largest variety and density of lithic remains. Single or limited use sites, or limited use task-specific places tend to have low artifact accumulations with low material type variability. Lithic procurement (quarry) sites typically have very high material counts and very low material diversity. It is important to be aware, however, that *many* variables intervene to create exceptions to the above pattern; that observation difficulties exist because of the focus on surface remains only; and that the pattern does not directly consider other indicators of residence such as fire modified stone or heavy stone tools. Even so, material density/diversity patterns provide a preliminary means to discriminate quantitatively between sites in a manner that is both heuristically useful and subject to rejection or refinement at a later date.

Table 4.6 shows the frequency of raw materials presently identified in the Park. Debitage to material and material to debitage ratios are included, though the authors found that with Mount Rainier's small samples, simple count comparisons illustrated variation between sites more dramatically. Note that only data from the 1995 reconnaissance are included in the table with the exception of site FS 90-04 (Tum Tum Quarry). This site is included to illustrate the extreme debitage to material type ratio characteristic of a known lithic procurement site. Figure 4.3 graphically displays site debitage count to raw material variety, showing clear cluster patterns in the analyzed Mount Rainier sample.

Table 4.6 Debitage Raw Material Variability at Mount Rainier

Site No.	Debitage (D) Total	Raw Material (M) Type Count	D:M Ratio	M:D Ratio
FS 90-03	4	1	4.0	0.25
FS 95-06	4	1	4.0	0.25
FS 95-01	7	1	7.0	0.1
FS 95-07	17	1	17.0	0.06
FS 90-04	27	1	27.0	0.04
FS 95-05	2	2	1.0	1.0
FS 95-04	4	2	2.0	0.5
FS 72-02	5	2	2.5	0.4
FS 95-08	3	3	1.0	1.0
FS 95-03	5	3	1.7	0.6
FS 74-01	4	4	1.0	1.0
FS 95-10	4	4	1.0	1.0
FS 88-01	12	4	3.0	0.3
FS 86-01	12	5	2.4	0.4
FS 95-11	16	5	3.2	0.3
FS 90-01	15	6	2.5	0.4
FS 71-01	30	10	3.0	0.3

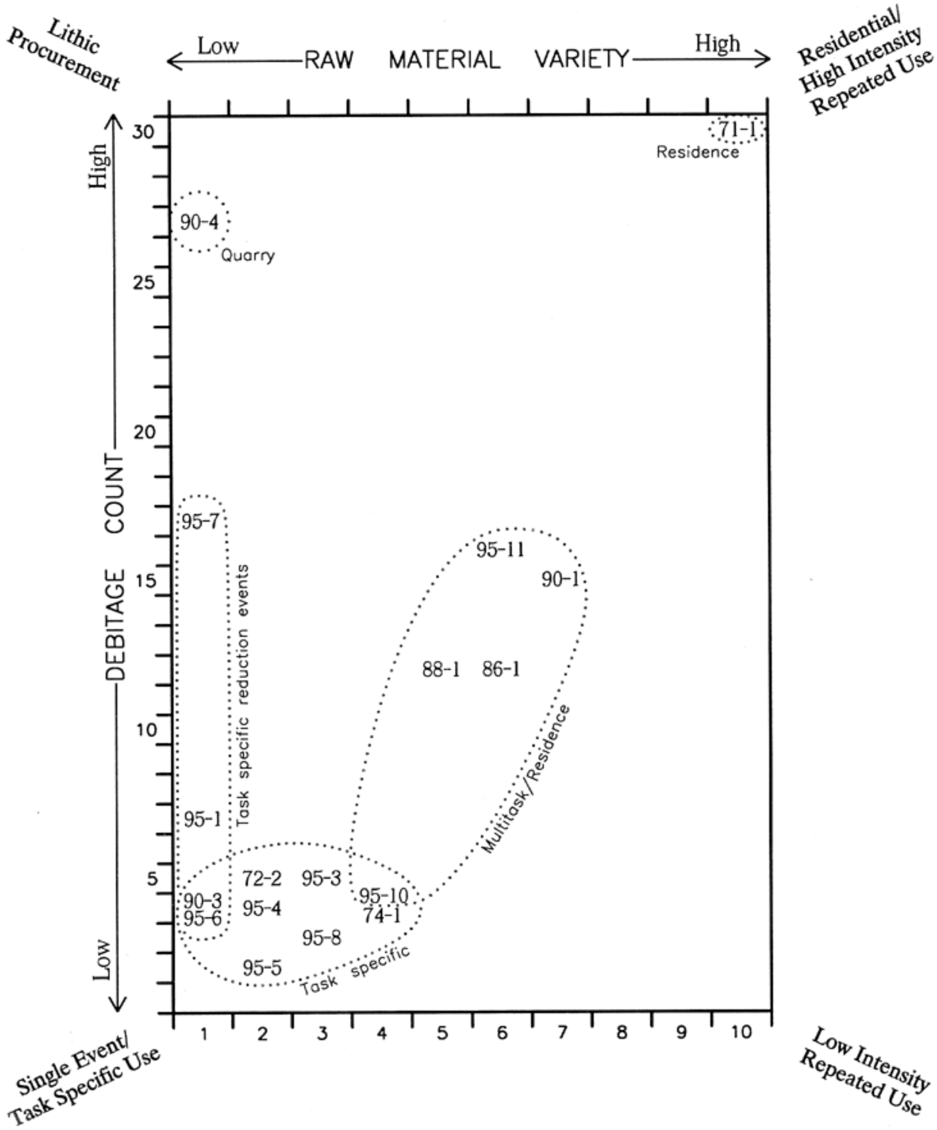

Figure 4.3 Plot of Debitage Counts by Material Variety (1995 Reconnaissance Data)

Four, perhaps five patterns are apparent in the debitage count/variety plot above. The known quarry site on the flank of Tum Tum Peak in the Park's southwest quadrant (FS 90-04) stands out clearly in the upper left *lithic procurement* corner of the graph. In the far left lower portion of the graph are sites characterized by the reduction of a single raw material type. This assemblage attribute, combined with low artifact counts and low technological diversity (not a plotted variable) suggests that these sites reflect *single reduction events*. In comparing sites, however, raw material types vary, as does the reduction stage and/or trajectory represented. Indeed, the four plotted single reduction event sites all appear to be somewhat different. They include: a) expedient core reduction of local chert on the east flank of Mother Mountain (FS 95-06); b) prepared core reduction of local metasediment at Tipsoo Lake (FS 95-01); c) mid through late stage biface manufacture of local jasper at Windy Gap (FS 95-07); and d) tool finishing or rejuvenation of probably exotic chert from an imported tool also located at Windy Gap.

Based on assemblage characteristics alone, it appears that the single reduction event sites cannot be placed unambiguously into a single functional category. As a group, they are technologically diverse and appear to crosscut a variety of environmental contexts. It also is important to recognize that these debitage assemblages may be directly related to an on-site processing task (e.g., expedient tool manufacture) or, alternatively, stone reduction during down-time and therefore secondary to the primary site function. Regardless of apparent inferential ambiguity, it is clear that the relatively small, technologically restricted site assemblages represent very short-term, low-intensity uses of the site locality. The fact that raw material from most of these sites (3 of 4) are from locally derived materials is probably the result of minimizing weight by incorporating locally derived materials into a functional, transportable (or disposable) tool kit. Thus, while not lithic procurement sites *per se,* the single reduction event sites are likely to occur close to the source locality and incorporate some of the reduction stages common to procurement localities.

With the possible exception of the two single source sites noted above and site FS 95-10 at Forgotten Creek in the southwest quadrant, sites clustered at the lower left of the plot (low count/low variety) all display characteristics consistent with low intensity, task specific use. In addition to increased material variety, debitage tends toward later stage reduction and repair expected at a hunting rather than a manufacturing stop. Exceptions include Mt. Pleasant (FS 72-02) and Vernal Park (FS 74-01) rockshelters, both of which have early stage, core reduction as well as secondary and tertiary stages represented. As mentioned above, core reduction may have occurred during down time. Thus, core reduction is expected in these small, high elevation rockshelters use of which may have involved forced down-time as hunters waited for storms to lift. The Forgotten Creek Site (FS 95-10), an upper forest level surface site in the Park's NW quadrant also fits these general parameters. However, presence of a basalt grinding stone at this site coupled with its forest/subalpine ecotonal setting suggest a broader range of activities and perhaps residence.

Several sites provide evidence of multiple task use and/or mixed group residence. These include site FS 95-10 noted above: the central cluster of fours sites in Figure 4.3—an extensive site at Tipsoo Lake (FS 88-01), Frozen Lake (FS 86-01), Sunrise Ridge Borrow Pit Site (FS 90-01), and a site on the northern flank of that ridge (Sunrise Lake Site, FS 95-11)—and the lone high density/high variety site at Buck Lake (FS 71-01) in the Park's extreme NE quadrant. The Frozen Lake Site appears to be a primary reduction and butchering location as noted above. Its exposed alpine setting makes all but very short term residence improbable. The remaining sites are situated in more protected upper forest/lower subalpine ecotonal settings. The mix of materials, artifacts and setting is consistent with the residential inference.

In sum, the variety of artifacts, technological attributes and material classes presently documented at Mount Rainier National Park suggests a limited variety of basic land-use functions. These include (but are not limited to) lithic procurement, early stage lithic reduction and manufacturing, limited-task hunting and hunting/butchering localities, multi-task localities with vegetal processing, and probable mixed group residence. Ecological as well as material contrasts appears to exist between multi-task/residential sites biased toward the upper forest/lower subalpine ecotone, versus limited task sites in subalpine and alpine settings. We urge that more refined test and analytical procedures be directed to a subset of the multi-task/residential sites and to the task-specific localities to better establish functional patterns among Mount Rainier prehistoric site localities. Until such time, patterns discussed here provide a preliminary means to characterize the Mount Rainier prehistoric archaeological record on functional grounds.

Radiocarbon, Stratigraphy, Projectile Points and Temporal Range at Mount Rainier

Functional classes suggested in the sections above and below do not discriminate potential changing use through time, nor do they inform us at all as to the potential temporal depth for human use of the mountain. In Chapter 2, ecological arguments were developed suggesting that human use of Mount Rainier landscapes could have begun as early as about 8,500 years ago and continued throughout the prehistoric period. Unfortunately, Mount Rainier chronometric data unambiguously linked to cultural remains are limited. The only radiocarbon dates currently considered culturally meaningful are two dates from Berkeley Rockshelter (FS 86-02)—1970 ± 80 years: 20 B.C. (Beta 44528) and 1070 ± 90 years: A.D. 880 (WSU 3666).[29] Additional temporal indicators must rely on less precise stratigraphic position and projectile point stylistic attributes. While these data are not sufficient to meaningfully address possible forager to collector land-use changes through time, they nonetheless suggest a long period of use of Mount Rainier landscapes.

Stratigraphic position of chipped stone debitage between Mount Rainier C and Mt. St. Helens Y_n tephra at the Sunrise Ridge Borrow Pit Site (FS 90-01) push the temporal range back to circa 3,750 to 2,300 years for use of that site. Because of the distinct stratigraphic signature left by Mount Rainier's repeated volcanism, it is likely that additional testing at identified sites will expand our stratigraphic/temporal database. At present however, FS 90-01 and FS 86-02 remain our only firmly (if incompletely) dated sites in the Park.

Variation in artifact type, particularly in hafting width, suggests a still longer temporal range for Mount Rainier's prehistoric record. A general, though imperfect, time-related shift from lance to dart to arrow-sized projectile points is now well recognized across North America. At a broad level, large-sized piercing (or multi-task piercing-cutting) points dominated North American hunter-gatherer durable tool kits from earliest entry to about 6,500 to 5,000 years ago. Clovis and Folsom styles—named after type sites in New Mexico but widely distributed across the west—are among the best known of these early tool types. Perhaps responding to the need to exploit medium to large sized fauna at greater distance, the arm extending throwing stick (atl atl) became a common hunting tool during the mid-Holocene. Projectile points attached to dart foreshafts thrown by these implements were smaller than early Holocene lance points, but still large enough to fill multiple piercing and cutting functions. Windust and the locally common, willow leaf shaped *Cascade* point are examples of dart points typically assigned a mid-Holocene date. Plausibly responding to increasing pressure to exploit still smaller, faster moving game, bow and arrow technology became common between about 2,000 and 1,500 years ago (though the atl atl and dart-sized projectile points continued to be used locally). While morphologically varied, arrow points typically are small and intended solely for piercing.

Because they were designed to be mounted on progressively smaller shafts, lance, dart and arrow points can be discriminated objectively (if approximately) by the hafting width of the base (see Corliss 1972; Thomas 1978). Here, hafting width of greater than 16 mm is assumed to be associated with lance technology. A large assemblage dominated by such large points would be of early Holocene origin; certainly dating earlier than 5,000 years ago. A limited assemblage or, more commonly, an isolate can be *very* tentatively assigned to this same period. Points are considered to be dart-sized in the haft width range of 7 to 16 mm. An assemblage dominated by dart-sized points typically is assigned a mid-Holocene age range, circa 5,000 to 2,000 years ago. Because darts continued to be used into the

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[29] The stratigraphically lower earlier date is from non-cultural sediments, but establishes a basal date for the site. A younger age of 290 ± 120 years: A.D. 1660 (WSU 3665) was returned sediments 0 to 10 cm below the modern ground surface. However, this latter age dates a composite sample of near surface charcoal and is not considered to be a reliable temporal marker.

late Holocene in the Cascades (cf., Burtchard 1990:147), isolates, particularly *Cascade* style isolates, should be evaluated with caution. Arrows are assumed to have a haft width of less than 7 mm and are assumed to appear after 2,000 years ago. Accordingly, presence of arrow-sized points, in an assemblage or as an isolate, provides inferential grounds for late Holocene use.[30]

Table 4.7 contains the results of a basic analysis of projectile points observed in the field or curated at Park headquarters in Longmire. Period and age ranges are based on the assumptions outlined above, and should be considered tentative in the absence of larger sample sizes. Such limitations notwithstanding, it should be noted that the wide range of types and haft widths are consistent with a long temporal range for human use of Mount Rainier. These data suggest use from early to late Holocene. Firmer clarification of the extent of that use awaits further archeological research.

Table 4.7 Mount Rainier Projectile Point Types and Inferred Age

Site/Cat. No.	Hafting Element	Style	Haft Width	Technology	Period	Inferred Age
FS 90-02	barbed expanding stem		5 mm[a]	Arrow	Late Holocene (Late Archaic)	< 2000 B.P.
Cat. 131	barbed expanding stem		7 mm	Arrow	Late Holocene	< 2000 B.P.
IF 01-68	barbed straight stem		6 mm	Arrow	Late Holocene	< 2000 B.P.
IF 01-84	shouldered contracting stem		< 5 mm	Arrow	Late Holocene	< 2000 B.P.
Cat. 133	barbed contracting stem	Pin Stem	5 mm	Arrow	Late Holocene	< 2000 B.P.
FS 86-02[b] Cat. 20, 21, 28, 29	four triangular (#20 with concave base)		< 7 mm	Arrow	Late Holocene	< 2000 B.P.
Cat. 3, 11, 36	three side notch		< 7 mm	Arrow	Late Holocene	< 2000 B.P.
Cat. 10	expanding stem corner notch		< 7 mm	Arrow	Late Holocene	< 2000 B.P.
Cat. 2	Unknown		< 7 mm	Arrow	Late Holocene	<2000 B.P.
IF 01-70 (a)	barbed indeterm stem		< 5 mm	Arrow	Late Holocene	< 2000 B.P.
(b)	triangular		22.5 mm	Lance	Early Holocene (Early Archaic)	> 5000 B.P.
FS 71-01	basal notch		10 mm	Dart	Mid-Holocene (Mid Archaic)	5000 - 2000 B.P.
FS 90-03	indeterminent		13 mm	Dart	Mid Holocene	5000 - 2000 B.P.
Cat. 132	shouldered contracting stem		13 mm	Dart	Mid Holocene	5000 - 2000 B.P.

30 The radiocarbon age of 1,090 years and minimally nine arrow-sized points from Berkeley Rockshelter (Bergland [1988] identifies 13) illustrate the temporal utility of small hafted projectile points nicely.

Site/Cat. No.	Hafting Element	Style	Haft Width	Technology	Period	Inferred Age
FS 86-01 (a)	barbed contracting stem		10 mm[a]	Dart	Mid Holocene	5000 - 2000 B.P.
(b)	indeterminent expanding stem		19 mm[a]	Lance	Early Holocene (Early Archaic)	> 5000 B.P.
(c)	side notch	Northern Side Notch	16 mm	Lance	Early Holocene	> 5000 B.P.
FS 95-10	ovate	Cascade	12 mm	Dart	Early Holocene	> 5000 B.P.
IF 02-63	ovate	Cascade	unknown	Dart/Lance	Early Holocene	> 5000 B.P.

Table Notes: [a]Measurement from an artifact sketch.
[b]See descriptions and measurements in Bergland (1988:50) for a slightly different breakdown.

Artifact Variability, and Site and Isolate Groups on Mount Rainier

In Figure 4.3 and associated text, Mount Rainier sites were grouped in a very preliminary fashion into four or five site groups based on a ratio of lithic debitage count and raw material variety (with interpretive complexity added by context and general assemblage considerations). Here, sites and isolated finds are grouped by reference to their broader assemblage composition irrespective of material type. As before, our intent is to provide a descriptive partition of Mount Rainier prehistoric remains that carries implications for site function. Multiple artifact site groups are considered first and isolates second. A summary consideration based on combined criteria concludes the section.

Assemblage-based Site Groups

Sites containing multiple artifacts are grouped by assemblage structure as an index of site types in Table 4.8 below. The table groups sites into three major categories based solely on surface evident remains. Group 1 is defined by the presence of a broad lithic assemblage; including debitage, heavy tools (hammer stones, grinding stones and other large, course grained lithic tools) and/or fire cracked rock. Lightweight tools (cores, bifaces, flake tools and projectile points) may or may not be present. Group 2 includes sites with only debitage and lightweight lithic tools. Group 3 includes sites with debitage only (a quartzite manuport and bird gastroliths are not counted as tools for purposes here). In essence, this grouping includes sites most likely to be associated with longer term, multi-task use (Group 1), a variety of more limited and/or shorter term mixed task uses (Group 2), and a set of sites more likely to have been task-specific or very short-term use localities (Group 3).

As noted above, **Group 1** sites have assemblages that include debitage, heavy tools (particularly ground stone) and/or fire cracked rock indicating cooking activities. We expect lightweight tools to be present as well, though in one case none were found. The artifact assemblage is diverse with evidence that plant food processing is part of a broader range of activities. Combined presence of such remains is consistent with a mixed sex and age, multi-task residential camps. Furthermore, the three Group 1 sites—FS 90-01 (Sunrise Ridge Borrow Pit), FS 95-11 (Little Sunrise Lake) and FS 95-10 (Forgotten Creek) all occupy the upper forest to lower subalpine setting expected to be associated with such use. Interestingly, two of the sites—FS 90-01 and FS 95-11—also appear in the central (multi-task/residential) cluster generated by lithic raw material/debitage count results displayed earlier in Figure 4.3.

Table 4.8 Sites Grouped by Lithic Assemblage Similarities as an Index of Site Types.

Group	Site No.	Debitage	Light Tools	Heavy Tools	Tool to Debitage Ratio	Fire Cracked Rock	Other	Total
1	FS 90-01	15	1	4	.33	2		22
	FS 95-11	16		2	.13	5		23
	FS 95-10	4	1	1	.50	4		10
2a	FS 86-01	13	10		.77			23
	FS 90-02	3	4		1.33			7
2b	FS 88-01	12	2		.17			14
	FS 72-02	11	2		.18			13
	FS 86-02	5	2		.40			7
	(test sample)[a]	(327)	(37)	(1)	(.12)			(365)
	FS 90-03	4	1		.25			5
	FS 95-06	4	1		.25			5
	FS 95-08	3	1		.33			4
2c	FS 71-01	33	3		.09			36
	FS 95-07	17	1		.06			18
3a	FS 90-04	27			.00			27
3b	FS 95-01	7			.00			7
	FS 95-04	4			.00			4
	FS 74-01	4			.00			4
	FS 95-03	5			.00		1[b]	6
	FS 95-05	2			.00		2[c]	4

Table Notes: [a](test sample) results are from Bergland's (1988) work at Berkeley Rockshelter
[b]small quartzite cobble manuport
[c]bird gastroliths (gizzard stones)
Light tools: fine-grained lithic tools including cores, flake tools, bifaces, and projectile points.
Heavy tools: course grained lithic tools, primarily ground stone.

Group 2 sites (surface evident lithic debitage and light tools only) can be divided into three subgroups by markedly different tool to debitage ratios. **Group 2a** sites—FS 86-01 (Frozen Lake) and FS 90-02 (Sarvant Glaciers)—have a very high fraction of formed tools and cores to debitage (above 75%). Indeed in the latter case, tools actually exceed the debitage count. We believe that the high fraction of formed bifaces at these locations is consistent with use for short-term hunting and butchering activities. Both sites are situated in exposed alpine tundra settings, reducing the probability of sustained residence. Combined environmental context and assemblage characteristics suggest mountain goat processing. Because of its high material variety, FS 86-01 grouped with the central moderate intensity/residential cluster in Figure 4.3. It is more likely, however that the relatively large assemblage and material variety is a product of repeated short-term use. Unfortunately, the Sarvant Glaciers site remained under snowpack in 1995 and could not be reevaluated in the field (and hence was not included in Figure 4.3).

Group 2b includes a variety of sites with a tool to debitage ratio falling above 10% and below 50%. As with other Group 2 sites, absence of ground stone and fire cracked rock suggests very short-term use by a segment of a broader social group. The moderate tool to debitage ratio and absence of heavy tools is expected at base camp sites in which people finished and maintained tools, and perhaps conducted limited processing tasks. Such sites may be short-term locations such as resting stops.

Two rockshelters fall within Group 2b—FS 72-02 (Mt. Pleasant) and FS 86-02 (Berkeley Rockshelter). In the latter case, it is interesting to note similarity between surface and test excavated remains. Despite the larger test sample, the only "heavy tool" was an single stone abrader/shaft smoother, suggesting hunting tool maintenance anticipated for such sites. Small surface sites at Windy Gap (FS 90-03), Mother Mountain (FS 95-06) and Middle Spunkwush Lake near Windy Gap (FS 95-08) are all in similar subalpine context and could plausibly have supported short-term hunting camp functions. The larger site at Tipsoo Lake (FS 88-01) is the most problematic of the group. Its higher raw material variety grouped it with the more residential/intensive /repeated use group in Figure 4.3. Ongoing test excavations at the site (Sullivan pers. com. 1996) indicate that a higher fraction of heavy tools may be present in subsurface context, suggesting that the site is better placed with the multi-task, residential group.

Group 2c sites are distinguished from those above by very low tool to debitage ratios (below 10%). Though lumped together by the assemblage criteria applied here, the sites differ substantially in site context, material variety and probable function. Despite its lack of surface evident heavy tools, site FS 71-01 at Buck Lake has both the highest surface count and greatest raw material variety of any site currently documented in the Park. This site's dispersed scatter above and around the northeastern margin of the lake suggests repeated use unmatched by other sites in the sample. Further testing is recommended to determine the extent to which the surface pattern holds (suggesting repeated short-term hunting camp use) or adds a greater array of heavy tools to the assemblage (suggesting multi-task, mixed residential use). Because the subalpine setting near the forest margin, and material density and variety, more closely matches Group 1 residential sites than other Group 2 sites, we consider it likely that Buck Lake ultimately will be shown to be a repeated use residential site. Current data, however, suggest repeated, shorter-term, task-specific use.

Site FS 95-07, a single material site at Windy Gap, qualifies as a Group 2 site solely on the presence of a single use flake scraper. As with nearby Windy Gap Site FS 90-03, task-specific camp function is probable, though the dominant activity here (at least as indicated by the lithic remains) appears to have been a single lithic reduction event using material collected at a primary source located somewhere in the vicinity.

Group 3 sites are those that contain only debitage, or debitage with a small apparently unused quartzite cobble (FS 95-03), or bird gastroliths (FS 95-05). The single **Group 3a** site is the chert quarry on Tum Tum Peak (FS 90-04), which accounts for its high debitage count of single source material (see Figure 4.3). Remaining **Group 3b** sites vary in the specific character of the debitage assemblage, suggesting functional, cultural, or environmental contextual differences (limiting the utility of group classification). Vernal Park Rockshelter (FS 74-01) almost certainly served short-term camp functions similar to other rockshelters included in Group 2b. The site has been used repeatedly as an historic period camping place, and it is likely that surface evident formed tools simply have been collected and removed. Single source assemblage characteristics of the small *Tipsoo Two* Site (FS 95-01) suggest a single event, perhaps related to more general use of the lakeside environment evident at the larger, more complex *Tipsoo One* Site (FS 88-01). Two adjacent small sites on Sunrise Ridge (FS 95-03 and FS 95-04) and site FS 95-05 on the upper cirque rim overlooking Mist Park appear to be single event stops or very limited use areas. Again, such inferences must be considered suspect in the absence of more robust test data.

The three to six-part site grouping suggested here is based on sites documented during the present reconnaissance effort. We emphasize again, however, the limitations of the database upon which the classification scheme relies. Small sample size and data skewing from surface observation in a forested, volcanically active depositional environment undoubtedly color what otherwise seem to be quantitatively sound arguments. As more sites are found and more test data become available, the groupings will need to be changed to fit increasing site diversity. Nevertheless, the site categories defined below provide preliminary organization of Mount Rainier sites on the basis of observed assemblage structure.

Mount Rainier Isolated Find Groups

By definition, isolate assemblages (1 to 2 artifacts) are not amenable to refined quantitative taxonomy. Generally, we expect isolates to represent specific, non-repeated short-term events or tasks—most often spent shots, or lost or broken and exhausted tools. Table 4.9 lists currently documented isolates in Mount Rainier National Park. Be aware, however, that several, perhaps many, of these isolates may be more than they appear. Because Mount Rainier contains Holocene paleosols buried under varying depths of volcanic tephra, it is likely that some localities that appear to be isolates are surface manifestations of substantially larger, more complex buried sites. Both site and isolate locations are shown on Figure 4.2, and on the color quadrant maps in Chapter 2.

Table 4.9 Isolated Finds Grouped by Similarity of Lithic Remains

Group	Isolate No.	Debitage	Core	Biface	Projectile Point	Flake Tool	Manuport	Total
A	IF 01-70				2			2
	IF 02-63				1			1
	IF 01-84				1			1
B	IF 01-87			1				1
	IF 05-95			1		1		2
C	IF 01-72	1		1				2
	IF 01-68	1			1			2
	IF 03-95	1				1		2
	IF 06-95	1	1					2
D	IF 11-95	1						1
	IF 07-95	1						1
	IF 02-95	1						1
	IF 04-95	1						1
	IF 01-77	1						1
	IF 01-95	1						1
E	IF 08-95						1	1
	IF 09-95						1	1
	IF 10-95						2	2

Table 4.9 is intended more as a descriptive listing of isolated remains than an attempt to arrive at functional divisions. Even so, a few comments are in order about the contents of each category. **Group A** isolates are solely projectile points. Such finds are among the most likely tools to be lost during a hunting event. Accordingly, Group A are among the most likely artifacts to represent truly isolated, idiosyncratic use of the landscape. **Group B** isolates are non-projectile point tools. They may represent truly lost tools or a very limited (or buried) specific task locality such as an expedient butchering site. **Group C** includes isolates with both debitage and tools. Because more than one item is involved, the probability is increased that the finds represent specific task localities in which tools were maintained, or a flake tool made and used (as opposed to simple tool loss). **Group D** isolates are debitage only. If flake tools were present, they have been collected and removed or buried. Like Group C, debitage is not likely to reflect simple loss. Accordingly, despite their unassuming character, Groups C and D, and perhaps Group B isolates should be considered likely candidates for site classification when subsurface test procedures become possible. **Group E** isolates are manuports. Manuport functions are unknown, but could plausibly represent raw material transport. Since they cannot be linked directly to predominantly prehistoric technology, isolated manuports cannot be linked unambiguously to prehistoric use. However, manuports included in Table 4.9 are not associated with historic period rubbish and, therefore, are considered most probably prehistoric in origin.

In sum, lithic analyses pursued here have been devoted to developing interpretive discussion of different aspects of lithic assemblages that make up Mount Rainier's prehistoric archaeological record. The foregoing series of tables and accompanying text are intended to provide: 1) a descriptive summary of the currently analyzed lithic sample; and 2) preliminary temporal and functional interpretations based on available assemblage characteristics. These data, while limited, suggest that: a) Mount Rainier landscapes have been used for a period of time exceeding 5,000 years in the prehistoric past; b) such use continued throughout the Holocene; and c) quantitatively discernable, functionally relevant variation exists among sampled sites and isolates in the Park. In Chapter 5, combined assemblage and environmental data are used to develop a working model of Mount Rainier site types and distribution. The section below concludes this chapter's review of reconnaissance results by evaluating the relationship between Mount Rainier's current archaeological database and a set of environmental variables commonly assumed to be linked to presence of prehistoric remains.

ENVIRONMENTAL CHARACTERISTICS AND PREHISTORIC SITE DENSITY

Use of an environmentally grounded approach toward understanding the archaeological record of the Pacific Northwest is not particularly new. Environmentally based predictions have been employed by federal agencies for some time to attempt to determine the location of prehistoric remains in advance of field inventory. Though causal connections are seldom specified, attributes such as elevation, slope, solar exposure, landform type and (especially) distance to water have been assumed to have conditioned human use of the mountains in the past and, hence, considered to be critically associated with the location of archaeological remains in the present (see Kvamme 1988:331-338). These predictions are then used to develop probability zones that serve to simplify survey obligations by directing inventory coverage differentially toward the higher probability landforms predicted by the model.

Elsewhere, I have been critical of these approaches largely because they tend to lack consideration of underlying causes for the patterns they purport to predict and are self-fulfilling in application, thereby hindering empirical falsification of the models' predictions (see Burtchard and Keeler 1991:107-122). In the Burtchard and Keeler study, Mt. Hood National Forest's predictive model (emphasizing distance to water, landform, and slope) was evaluated in light of the Forest's growing site database. While a strong association was found between the relative density of prehistoric remains to elevation and slope, only weak association was found with distance to water, and none with solar exposure. A tendency for site association with montane basins, ridges and saddles, sideslope benches, and valley floodplain terraces is largely subsumed by elevation and slope (Burtchard and Keeler 1991:115-117). Working with these results, Mt. Hood National Forest restructured site inventory procedures to accommodate critical resource distribution patterns related to a less restrictive range of environmental variables.

The questionable utility of non-causal models notwithstanding, it is not unreasonable to expect prehistoric populations to have selected campsites with an eye toward water availability, flat ground, solar gain and so on—particularly when such characteristics occur in association with economically productive habitats. This section examines the association between the current Mount Rainier site and isolated find database with a set of particular environmental characteristics commonly used in the aforementioned survey systems. Table 4.10 summarizes these basic categories for Mount Rainier National Park. Figures and associated discussion that follow illustrate the results. Patterned association between environment/resource zone is presented first to demonstrate the strong relationship emphasized throughout this report. As will be seen, available data also suggest a strong association with elevation (which, of course, is linked to differential use of subalpine and alpine zones) and with relatively flat ground. As in the Mt. Hood study, patterned association with distance to water, landform type and solar exposure is more equivocal, though the present small sample size may color the result. Please note that in order to maximize sample size, no effort has been made to distinguish between site types as has been done above and as modeled formally in Chapter 5. Prehistoric sites and isolates for which sufficient data are available are considered equally.

Table 4.10 Mount Rainier Site/Environmental Associations

Field Number	Environmental Zone	Elevation (ft)	Solar Exposure	Degrees Slope	Landform	Meters to Water
FS 90-04	Forest	4080	S	20	Mtn. Ridge Top	2500
FS 95-10	Forest	4220	E	4	Mtn. Basin Floor	20
IF 02-63	Subalpine/Burn	4550	NE	3	Mtn. Basin Floor	100
IF 01-68	Forest	4760	SW	1	Mtn. Bench Top	40
FS 90-01	Forest	4900	S	2	Mtn. Bench Top	200
FS 95-02	Subalpine	5130	NE	8	Mtn. Basin Edge	20
IF 01-95	Subalpine	5240	SW	3	Mtn. Basin Floor	15
FS 88-01	Subalpine	5320	SE	2	Mtn. Basin Floor	10
FS 95-01	Subalpine	5330	E	1	Mtn. Bench Top	20
FS 95-11	Subalpine	5380	SE	12	Mtn. Ridge Slope	5
FS 63-01	Forest	5400	N	30	Mtn. Valley Cliff Base	60
IF 01-72	Subalpine	5480	W	4	Mtn. Basin Floor	10
FS 95-06	Subalpine	5540	SE	5	Mtn. Bench Edge	12
FS 95-11	Subalpine	5540	W	1	Mtn. Basin Floor	45
FS 71-01	Subalpine	5580	SW	2	Mtn. Bench Top	30

Field Number	Environmental Zone	Elevation (ft)	Solar Exposure	Degrees Slope	Landform	Meters to Water
IF 04-95	Subalpine	5600	SW	5	Mtn. Tableland Top	10
IF 03-95	Subalpine	5640	SW	3	Mtn. Tableland Top	10
FS 86-02	Subalpine	5640	SE	30	Mtn. Valley Talus Base	125
FS 90-03	Subalpine	5690	E	2	Mtn. Ridge Saddle	8
FS 95-08	Subalpine	5720	SE	4	Mtn. Basin Edge	40
IF 01-77	Subalpine	5720	W	2	Mtn. Ridge Saddle	50
FS 74-01	Subalpine	5780	SE	1	Mtn. Talus Base	10
FS 95-07	Subalpine	5870	SE	1	Mtn. Ridge Saddle	200
FS 72-02	Subalpine	5880	E	37	Mtn. Cliff Base	200
IF 01-84	Subalpine	5900	E	2	Mtn. Basin Floor	50
IF 08-95	Subalpine	5980	SE	2	Mtn. Bench Top	75
IF 09-95	Subalpine	6060	E	3	Mtn. Bench Top	150
FS 95-05	Subalpine	6120	NE	4	Mtn. Ridge Edge	50
IF 10-95	Subalpine	6170	SW	10	Mtn. Bench Top	500
FS 95-03	Subalpine	6240	SW	1	Mtn. Bench Top	85
IF 06-95	Subalpine	6240	SW	1	Mtn. Bench Top	15
IF 07-95	Subalpine	6260	SW	1	Mtn. Ridge Top	25
FS 95-04	Subalpine	6290	E	2	Mtn. Ridge Crest	60
IF 05-95	Subalpine	6340	N	1	Mtn. Bench Top	20
FS 90-02	Alpine	6650	S	2	Mtn. Ridge Saddle	250
IF 01-87	Alpine	6700	W	unknown	Mtn. Ridge Crest	unknown
FS 86-01	Alpine	6720	E	4	Mtn. Ridge Saddle	50
IF 01-70	Alpine	7500	SW	unknown	Mtn. Ridge	unknown

Environmental/Resource Zones and Elevation

Throughout this report, it has been argued that high resource productivity of Mount Rainier's subalpine and alpine habitats should have served to focus human activity on these habitats during the prehistoric past. If so, these zones will display high site density relative to other montane habitats. The prediction is deductive in that it flows directly from environmental considerations rather than the archaeological record itself. Archaeological data provides means to test, rather than to generate expectations. While the quality of the test will improve as additional surveys are completed, available site data from Mount Rainier clearly are consistent with the predicted subalpine/alpine pattern.

Table 4.11 displays site count by the five major resource zones employed to characterize the Park—high energy floodplains, maritime forest, subalpine parkland, alpine tundra, and perpetual snowfields and associated glacial rubble. Area for each of these zones is computed from GIS data used to generate color fold-out Figures 2.10 through 2.13 in Chapter 2. Both site count and site density figures show the clear subalpine pattern. Even if site count for maritime forest were tripled to accommodate poorer surface exposure and lower survey fraction, site density results would remain below alpine and well-below subalpine zones. In my opinion, the pattern is far too strong to be product of either chance or site discovery biases.

Table 4.11 Mount Rainier Site Count and Density, by Environmental Zone

Environmental Zone	Total Area Acres	Total Area Hectares	Site Count	Site Density (sites/hectare)
Floodplain	7,882	3,190	0	0.0000
Forest	123,557	50,002	5	0.0001
Subalpine	53,898	21,812	29	0.0013
Alpine	25,404	10,281	4	0.0004
Glacial	24,871	10,065	0	0.0000

Figure 4.4 shows the environmental zone and site frequency relationship graphically. The graph is conservative in that percentages are computed on the basis of simple site count per zone. Had it been normalized to display site density per hectare as shown in the final column of Table 4.11, the contrast between subalpine and forest zones would have been even more pronounced; the contrast between subalpine and alpine zones, somewhat less so.

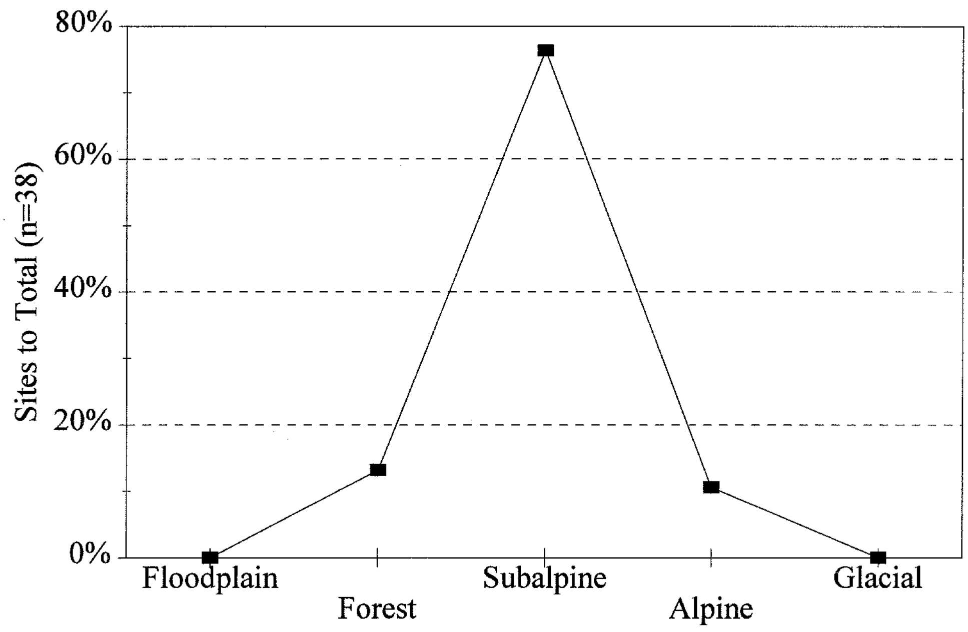

Figure 4.4 Site Relative Frequency, by Environmental Zone

Figure 4.5 shows the relationship between prehistoric site frequency and elevation. The similarity between this graph and Figure 4.4, of course, is due to the direct link between elevation shown here and environmental zones shown above. In concert, the figures reinforce the critical role played by upper elevation landscapes in prehistoric land-use practices and, hence, on the archaeological record of that use. Twenty-nine sites and isolates (76% of the sample) are situated in subalpine contexts. Adding sites in alpine settings increases the fraction to 87%. Furthermore, *all* of the maritime forest sites are located in upper elevation forest contexts between 4,000 and 5,000 ft or higher—locations that arguably provide ready access to subalpine environments and/or were used at times when the closed forest fringe was lower. In short, the upper elevation pattern is clear and robust, and, in light of the manner in which these habitats would have conditioned resource availability throughout the past, should not be surprising.

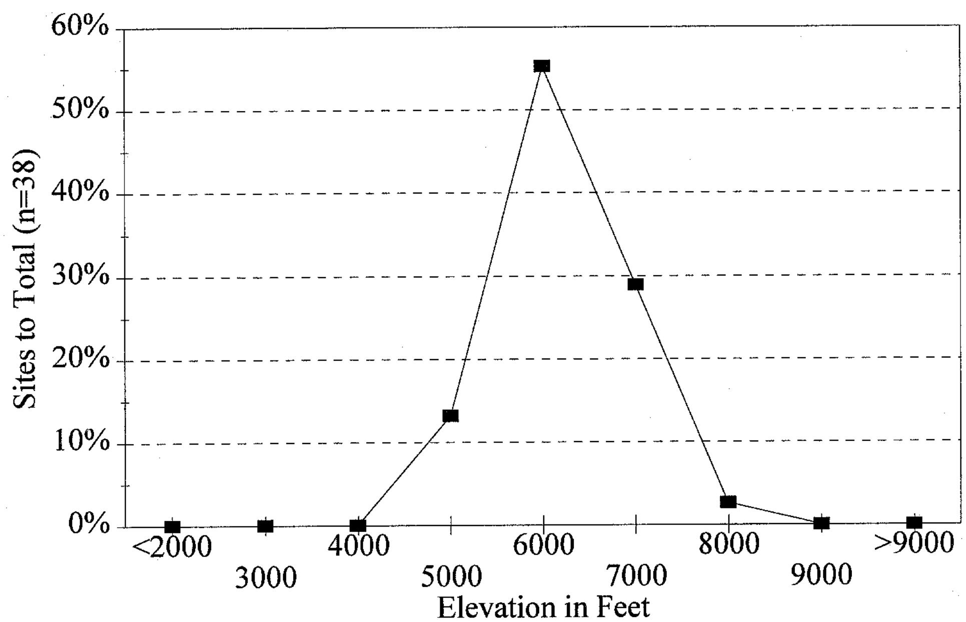

Figure 4.5 Site Relative Frequency, by Elevation

Slope

Figure 4.6 shows the relationship between slope and site frequency in the Mount Rainier sample. Seventy-five percent of the documented sites are found on landforms with a local slope of 5^{o} (8.8%) or less. Assuming that most lithic aggregations represented in the sample are associated with at least short term residence, the tendency toward selection of flat ground is understandable—flat ground simply is best suited to sleep and for conducting a variety of maintenance tasks. Slope is irrelevant, of course, for sites such as quarries (e.g., FS 90-04) and lost implement localities (e.g., IF 10-95), as well as for sites in disturbed, secondary context such as IF 11-95. Cliff and talus rockshelters such as FS 63-01, FS 86-02 and FS 72-02, while often occurring on steep slopes, have interior use spaces which are quite flat. Accordingly, the tendency for sites to be located on low gradient terrain, or to avail themselves of small flat-ground irregularities on otherwise sloping ground, is strong in the Mount Rainier sample (as elsewhere) and may be explained by the tendency to select such ground for a variety of task-specific and residential purposes.

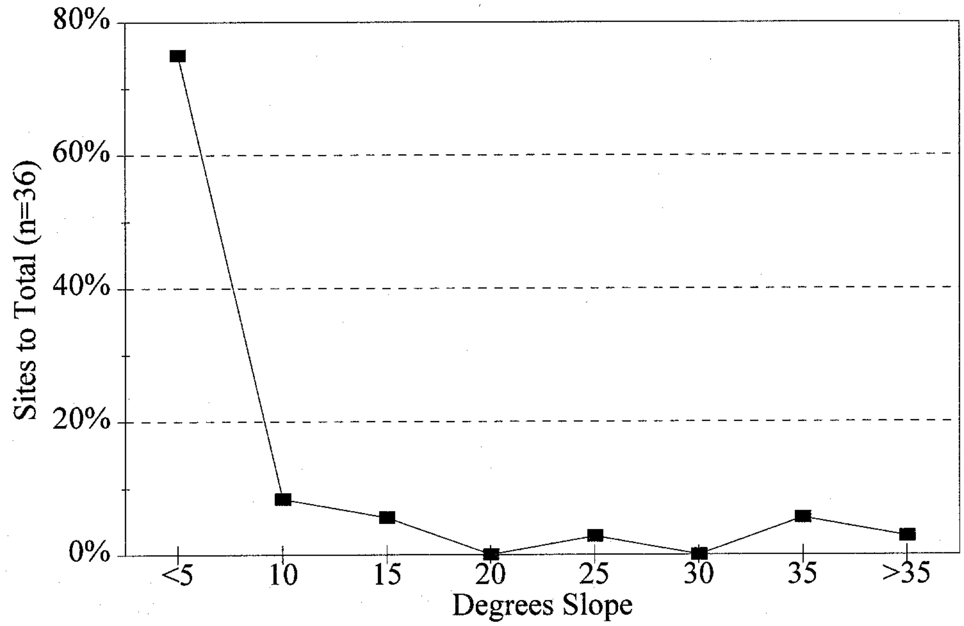

Figure 4.6 Site Relative Frequency, by Slope

Distance to Water

In a similar evaluation of site distribution in the vicinity of Mt. Hood, we found a relatively weak association between lithic scatters and distance to water—47% within 50 m, 59% within 100 m (Burtchard and Keeler 1991:117-119). The water association in the Mount Rainier sample is somewhat stronger—53% within 50 m, 75% within 100 m (see Figure 4.7). It is not clear, however, if the difference is simply due to small sample size for Mount Rainier or if the distinction is genuine. In dry environments, water can be a significant determinant of human movement and settlement patterns. Water is, after all, heavy, difficult to contain and required daily. In wetter environments such as the western and high Cascades, water imposes less of a constraint on human land-use options simply by virtue of its widespread availability. Because Mount Rainier offers a variety of water sources, the relationship between site location and access to water should be weak. Since water is important, it makes sense to settle near a source when it is handy to do so. In a place with many alternative sources such as Mount Rainier, however, it is equally likely that sites will be located well away from visible sources of supply. In the event the Park implements some form of predictive survey strategy, it is suggested that distance to water *not* be considered a key variable in structuring the survey design.

Solar Exposure

While solar exposure seldom appears in predictive site location models, it is not unreasonable to expect people to select sites with good solar exposure in cold environmental circumstances. Since Mount Rainier was almost certainly used during summer months, however, we would expect a tendency to maximize solar gain to be offset by countervailing considerations such as visual exposure, wind direction, natural rockshelter orientation and so on. Accordingly, we would expect to see little relationship between site location and solar orientation. Histogram Figure 4.8 suggests that this is so.

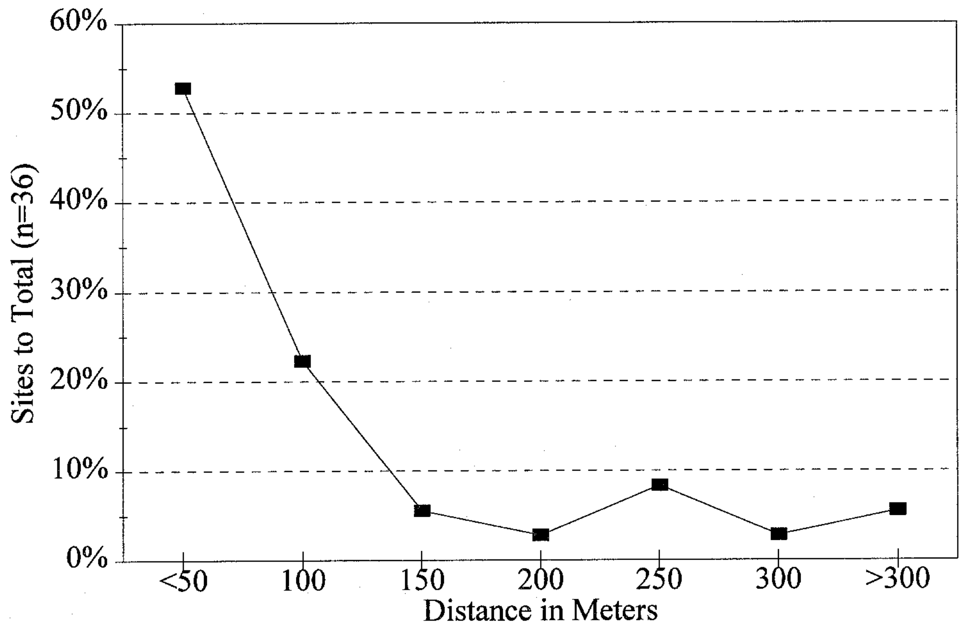

Figure 4.7 Site Relative Frequency, by Distance to Water

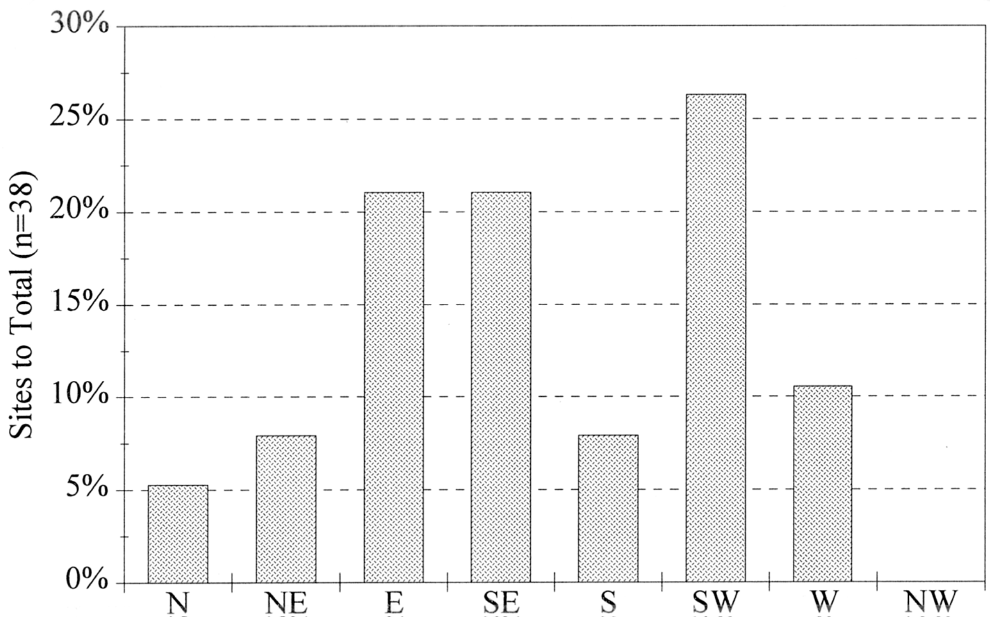

Figure 4.8 Site Relative Frequency, by Solar Orientation

Landform

A glance at the variety of landscapes represented in site/isolate summary Table 4.10 shows that Mount Rainier's prehistoric sites are found in a variety of upland settings. Other than re-emphasizing the tendency toward subalpine/flat ground site selection, little clear patterning is evident in the available data. Commonly represented in the sample are side slope bench settings, ridge crests and saddle passes between drainages, cirque basins, and, of course, cliff face and talus rubble rockshelters. Figure 4.9 below summarizes the landform variety characteristic of the Mount Rainier sample. As with solar exposure and distance to water, specific landform characteristics do not appear to be significantly associated with the location of prehistoric archeological remains.

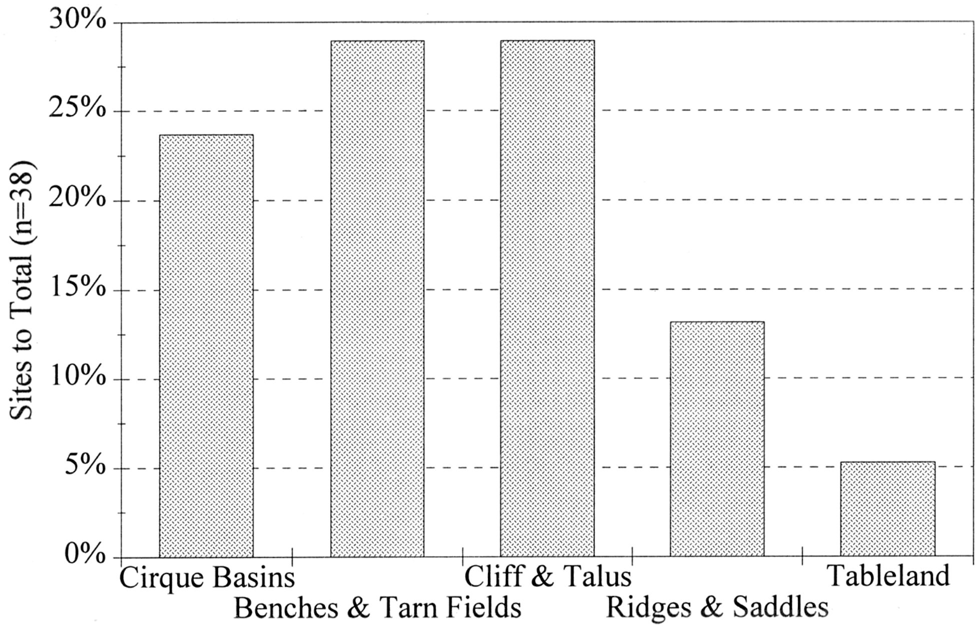

Figure 4.9 Site Relative Frequency, by Landform Group

The most salient pattern that has been emphasized in this chapter is the clear site bias toward subalpine to alpine habitats as predicted by theoretically derived expectations and as observed during the early historic period. Basic prehistoric site and isolate data (as well as that for two historic period sites) have been provided in tabular form and plotted onto a general location map. Professional readers may wish to refer to individual site forms in the project's companion *1995 Reconnaissance Data* volume (Burtchard and Hamilton 1998) for more complete site-specific detail. In the following chapter, site location and environmental data are combined with theoretical expectations regarding long-term human use of the region to develop 1) a site type and distribution model for Mount Rainier National Park, and 2) a general Holocene land-use model for the Park and the southern Washington Cascades.

Substantial attention also has been given to describing and interpreting lithic assemblages observed in the field and curated at Park headquarters in Longmire. Particular attention was given to deriving artifact classes, isolating and describing raw material patterns, discussing temporal indications of these and other relevant data, and considering several functional site taxonomies implied by patterned variation in artifact and material classes in the Mount Rainier sample. These considerations are formally developed into a site type taxonomy in Chapter 5.

Chapter 5

PREHISTORIC SITE DISTRIBUTION & HOLOCENE LAND-USE PATTERNS ON MOUNT RAINIER & THE SOUTHERN WASHINGTON CASCADES

Preceding discussions have included a variety of arguments related to prehistoric use of Mount Rainier with associated implications for the Park's archeological record. Particular attention has been given to resource structure and causal links with prehistoric human use of Park landscapes. These arguments suggest that throughout the prehistoric past, hunter-gatherers routinely favored use of subalpine and alpine landscapes. Related discussions have considered the suite of montane resources believed to have been of critical importance to populations using Mount Rainier; discussed why such resources tended to be most abundant in settings of low ecological maturity; discussed resource implications of mid-Holocene climatic changes to these habitats, and addressed how effective exploitation of the critical resource base determined the character of the archaeological record of Mount Rainier National Park.

I have argued that Mount Rainier was most effectively used by small task-specific groups operating out of short to moderate term residential base camps set near the forest/subalpine ecotone. Earliest use, perhaps dating to appearance of post-glacial floral associations about 8,500 years ago, should have been linked to mobile foraging populations moving to higher ground from lowland settings in late summer to avail themselves of seasonally abundant animal and plant resources in montane habitats. Possible expansion of forest cover in subalpine habitats during the protracted mid-Holocene warming period circa 7,500 to 4,500 years ago is not expected to have significantly altered upland use patterns due to the relative ease with which forest encroachment could be controlled by fire. As regional population density increased, however, it is reasonable to expect uncoordinated inter-group use of the mountains to have become increasingly unreliable. Increasing population density (with or without environmental change), at some point, would have forced a change in regional subsistence systems by virtue of increasing predation pressure on finite, unmanaged animal and plant resources. It is most plausible that use of Mount Rainier shifted away from use by mobile foraging populations to use by more limited-task collection groups emanating from, and returning to, more nearly sedentary lowland villages. Use of higher elevation areas appears to have continued throughout the Holocene (perhaps with a mid-Holocene hiatus), though per capita use may have declined in the face of increased stress on limited resources and conflicting summer season work obligations in the lowlands.

This chapter develops these general arguments into two formal models. The first emphasizes variation in prehistoric site distribution and function *across space* (irrespective of age). The second addresses changes in subsistence and settlement systems *through time*. The following section develops the first model by building on reconnaissance results and environmental assumptions relevant to Mount Rainier. The concluding section builds on extant ecologically oriented explanations of long-term land-use patterns in the Cascade and greater Pacific Northwest to model changes in Holocene land-use systems, with implications for Mount Rainier and the southern Washington Cascades.

MOUNT RAINIER SITE TYPES AND SITE DISTRIBUTION PATTERNS

Within the maze of tables, figures and associated text that summarize prehistoric lithic data in Chapter 4, are two analyses that group sites by quantitative distinctions in raw material frequency (see Table 4.6, Figure 4.3 and accompanying text entitled *Material Variability and Site Function*, and Table 4.8 and associated text entitled *Assemblage-based Site Groups*). While use of numerical data such as these provide a sheen of quantitative objectivity to site groups so derived, it is important to recognize that Mount Rainier data presently are quite thin. Site types do not have an inherent, easily recognizable reality that can be used uncritically as units of analysis. Rather, different site types are the culmination of processes by which empirically observable archaeological phenomena are grouped into like categories for other descriptive and research purposes (cf., Leonard and Reed 1993). Such taxonomic models are useful to the extent that they subsume the bulk of variability in the data and help us generate meaningful—and ultimately falsifiable—ideas about past processes of organized human use of an area.

Sample size limitations, in terms of both site number and low surface artifact density, presently prevent site taxonomies from achieving the level of quantitative rigor necessary for truly powerful arguments based on empirical grounds alone. Such concerns notwithstanding, modeling functional site distinctions for an area such as Mount Rainier (under the rubric of *site type* variability) provides a useful tool to investigate subsistence strategies. Furthermore, overlapping patterns apparent in the Mount Rainier data set suggest presence of genuine functional variation between the Mount Rainier archaeological assemblages. These apparent patterns are the subject of this section, suggestions for refining the system's quantitative rigor are offered in the final chapter of this volume.

Here, site and isolated find information is reconsidered in light of environment and land-use arguments developed in Chapter 2 to build a working model of site types and distribution across Mount Rainier National Park. Even with present data limitations, I suggest that: 1) deductive arguments predicting long-term redundant use of immature, upper elevation landscapes on ecological/resource grounds are theoretically sound; 2) the site taxonomy proposed below subsumes the widest range of location, assemblage and environmental information presently available in and near the Park; and 3) current site data are generally consistent with the site distinctions proposed. The model assumes these considerations to be true. As a working model, however, the scheme should not be considered immutable, but rather taken as a starting point to be refined or changed as additional archaeological data become available.

The 10 part taxonomic model outlined below distinguishes nine basic site types and an isolated artifact category. It offers functional, content and location expectations for each. To the extent possible, I have used terminology compatible with Binford's (1980, 1983) model for hunter-gatherer settlement systems. Consideration also has been given to Ubelacker's (1986:150, 198-200) and Benson and Lewarch's (1989) site type distinctions for the eastern slope of the southern Washington Cascades. In cases where neither system was appropriate, I have tried to keep terms simple and descriptive. Please refer to Burtchard and Hamilton (1998) for site specific detail relevant to prehistoric localities included here.

Type 1: Multi-task, Mixed Group, Residential Base Camps or Residential Field Camps

Predicted Site Function

Residential locations are expected to be base-camp sites repeatedly used by mixed age and sex groups exploiting multiple floral and faunal resources. Because these groups may consist of only a portion of a larger lowland based group (at least in the mid to late Holocene) they may qualify as residential field camps in Binford's (1983:346) sense of the term. Occupation timing and duration should have been linked to late summer/early autumn availability of key upland resources; principally elk, deer, bear, marmot, game birds (ptarmigan and grouse), and huckleberries (and perhaps alpine lilies). Goats are available over a longer season, but are expected to have been exploited concurrently with other game.

Expected Assemblage Characteristics

Lithic assemblages should be varied with a broad mix of both light and heavy tools. Debitage density and raw material variety should be high. Features should include hearths, a possible mix of small shelter depressions and/or post-molds, and plant and animal processing features such as huckleberry drying pits (see below).

Location

Residential base/field camps are expected to be located in upper forest or lower sub-alpine ecotonal settings in order to compromise access to varied upland resources, minimize distance to lowland villages (late Holocene), and to moderate susceptibility to unpredictable high-elevation weather patterns.

Current Representation in the Park

Five of the presently documented Mount Rainier sites are classified as possible residential base camps. Three of these meet basic assemblage expectations noted above—the Sunrise Ridge Borrow Pit Site (FS 90-01) and Little Sunrise Lake Site (FS 95-11) in the Park's northeast quadrant, and Forgotten Creek Site (FS 95-10) in the southwest quadrant. Although heavy tools are not present in the surface assemblage, other characteristics tentatively justify inclusion of the Buck Lake Site (FS 71-01) in the northeast quadrant and Tipsoo Lake One (FS 88-01) on the boundary between the Park's northeast and southeast quadrant. All five sites are located immediately below or at upper forest/subalpine boundaries. The location of plausibly residential sites on various sides of the mountain is consistent with use by varied, socially distinct populations as suggested by Smith (1964) in his *Ethnographic Guide to the Archaeology of Mount Rainier.*

Type 2: Limited-task Field or Hunting Camps

Predicted Site Function

Prehistoric sites in this category are expected to have been places of short-term residence used by small, predominantly adult male hunting groups. Tasks should have been limited to those directly or indirectly associated with hunting and overnight residence; including tool maintenance, repair, and late stage manufacture. Associated uses may include moderate butchering and cooking activities, involving a low frequency of early stage core reduction of locally available materials. Apparent high use intensity is expected to be a function of repeated use events. Sites may occupy open or rockshelter settings.

Expected Assemblage Characteristics

Lithic assemblages are expected to be dominated by late stage debitage and light tools. Core manufacture and flake blank production, if any, should be limited largely to local materials near source localities. Heavy tools are expected to be absent or present in very limited number. Type 2 field camps should be associated with a moderate light tool to debitage ratio (present data suggest between 10% and 50%, and moderate raw material variety. Hearth features may or may not be present. Locations in alpine settings may be associated with stacked stone windbreak features or blinds (none currently documented).

Location

Site location should be biased heavily toward subalpine context. Because they provide construction-free shelter, rock overhangs and shallow caves should have been particularly desirable short-term camp locations. Rockshelter locations may have ranged more extensively from upper forest to lower alpine settings as dictated by geological, rather than floral, characteristics.

Current Representation in the Park

Eight currently documented sites are included as potential repeated use, short-term hunting camps. These include Fryingpan Rockshelter (FS 63-01), Berkeley Rockshelter (FS 86-02), Upper White River Trail Site (FS 95-03) and Yakama Park Rim Site (FS 95-04) in the northeast quadrant; and Mt. Pleasant Rockshelter (FS 72-02), Vernal Park Rockshelter (FS 74-01), Middle Spunkwush Lake (FS 95-08) and Mist Park Overlook (FS95-05) in the northwest quadrant. The absence of hunting camp localities in the southeast and southwest quadrants is believed to reflect greater subalpine landmass in the northern half of the Park, accentuated by small sample size. Early stage core reduction presently is represented only in rockshelters.

Type 3: Low Redundancy, Low Intensity Hunting Locations

Predicted Site Function

Type 3 hunting locations are expected to have functioned similar to short-term hunting camps noted above, but with very low intensity, limited task and/or single event use (or very limited reuse). Hunting stops may not have involved overnight stay.

Expected Assemblage Characteristics

Low intensity hunting locations are expected to be associated with overall low lithic debitage density and raw material diversity. Light tools should be present; heavy tools absent. In depositional environments like Mount Rainier, isolated finds may represent low intensity sites, particularly when represented as debitage or dual item combinations of tools and debitage.[31]

Location

A wider range of environmental zones (forest to alpine) is expected compared with moderate intensity residential hunting camps (Type 2). Overall, locations should continue to express a bias toward subalpine and secondarily to alpine settings.

Current Representation in the Park

Twelve localities are classified as Type 3 low use intensity sites. Eleven of these currently are documented as isolated finds. One is recorded as a site. These localities include Sunrise Creek (IF 01-72), Deadwood Lakes Pass (IF 01-75), Lower Deadwood Lake (IF 01-95), Upper Berkeley Park (IF 05-95), Grand Park One (IF 03-95), Grand Park Two (IF 04-95), Yakama Park One (IF 06-95), and Yakama Park Two (IF 07-95) isolated finds in the Park's northeast quadrant; the Windy Gap One Site (FS 90-03), and Yellowstone Cliffs (IF 01-68) and Mirror Lakes (IF 11-95) isolates in the northwest quadrant; and the Success Cleaver (IF 01-70) isolated points in the Park's southwest quadrant. Again, the tendency toward north and northeast settings is clear, increasing probability that distribution reflects genuine prehistoric use patterns.

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[31] Recall that in the present reconnaissance, localities with either one or two surface visible artifacts were documented as isolated finds.

Type 4: Butchering Locations

Predicted Site Function

Butchering sites are expected to be located near primary kill locations and used predominantly for initial game processing (hide removal, disarticulation and partial drying).

Expected Assemblage Characteristics

Butchering tool assemblages are expected to have a high fraction of light cutting and piercing tools to debitage (over 70% in the current sample). Heavy tools are not expected to be present. Flakes or flake tools may function as cutting and scraping implements. If located near lithic source material, a relatively large fraction of early stage flakes should be present, and should exhibit cutting/scraping wear and potentially retain blood residues on the cutting and scraping edges.

Location

Location should be biased toward kill sites in subalpine to alpine settings. If meat drying and flake production are important concerns at such sites, then locations may be expected to optimize distance to hunting areas and lithic sources. If meat drying is a concern, then sites also may be situated in exposed, windy settings (e.g., Frozen Lake).

Current Representation in the Park

Two localities currently are classified as butchering sites; primarily by virtue of assemblage characteristics and setting. These include the Frozen Lake Site (FS 86-01) and the Sarvant Glaciers Site (FS 90-02). Both are found in exposed, alpine contexts. The Frozen Lake site offers the most inferentially compelling assemblage of butchering-related tools and early-stage reduction flakes currently documented in the Park.

Type 5: Lithic Procurement and Lithic Reduction Locations

Predicted Site Function

Grouped in this designation are direct lithic procurement (quarry) sites located at the point of extraction, plus early stage reduction locations expected to be situated a short distance from source locations. Lithic procurement sites serve to reduce the need to transport heavy, complex tool kits into the mountains. Lithic reduction activities at these sites are expected to be limited to very early stage removal of cortical material and generation of debitage incidental to preparation of curated cores and implement preforms. Residence and hunting maintenance activities are not expected.

Expected Assemblage Characteristics

Quarry and reduction station assemblages are expected to be dominated by early stage flakes and shatter of single material type. Source material may or may not be immediately present. Finished tools should be absent or present in very low frequency.

Location

Quarries and reduction stations are expected to be situated near fine-grained lithic material sources, particularly in close spatial association with subalpine to alpine hunting areas.

Current Representation in the Park

Tum Tum Quarry (90-04) in the Park's southwest quadrant is currently the only lithic procurement or quarry site documented in the Park. Early stage, single event reduction stations are considered to be represented by a small lithic concentration at Tipsoo Lake (FS 95-01) in the northeast quadrant; and at Mother Mountain Lake 5554 (FS 95-06) and Windy Gap (FS 95-07) in the northwest quadrant.

Type 6: Stacked Rock and Talus Feature Locations (not included above)

To date, no stacked rock or talus pit features have been identified in the Park. They are common, however, in the Cascades and have been identified on upper elevation landscapes of Mt. Hood (see Winthrop et al. 1995, and Burtchard and Keeler 1991), in the North Cascades (Mierendorf pers. com. 1990), in the southern Washington Cascades east of the Park (Burtchard and Miss 1998) and at a number of other places in the Cascades and beyond. The category is retained here to accommodate the high probability that such features eventually will be documented at Mount Rainier as well.

Predicted Site Function

Functional interpretations of stacked rock and talus pit features are variable but tend to center on ceremonial or *vision quest* functions, hunting blinds, and territorial or travel markers. I generally favor explanations emphasizing direct material/ functional relationships. Accordingly, for stacked rock features observed on Mt. Hood, I emphasized 1) hunting-related use of alignments, semi-enclosures and enclosures situated on upper elevation scree slopes in ungulate habitat; and 2) travel and territorial markers (often historical) for cairns (Burtchard and Keeler 1991). Similar functions may be anticipated for Mount Rainier. Low stacked walls in exposed alpine settings may have functioned as temporary wind break shelters; simple rock alignments to anchor more ephemeral temporary shelters (e.g., historic period canvas tents). Citing informant interviews, Winthrop et al. (1995) emphasize ceremonial functions. Such use cannot be discounted. Indeed, multi-functional use is consistent with the structural variability characteristic of these features (see below). Specific functions are difficult to establish empirically.

Expected Assemblage Characteristics

Stacked rock and talus features are morphologically varied; typically appearing as piled and stacked stone alignments, circular enclosures, talus pits with low mounded edges, cairns and other similar features. The primary range of features anticipated for Mount Rainier are expected to be hunting blinds, temporary wind shelters and storage pits. Except for storage, features are expected to be associated with very low density, late stage lithic debitage and fractured projectile points associated with implement maintenance and repair.

Location

Stacked rock features should be biased toward upper elevation glacial rubble and scree slopes, particularly in association with alpine to subalpine elk and goat habitat.

Current Representation in the Park

None.

Type 7: Culturally Modified Tree Locations

Predicted Site Function

Culturally modified trees typically include trees blazed during the historic period to mark trail routes; bark stripped mature pines and Douglas fir used to create an insulation layer in earth ovens; and most important for present purposes, bark stripped (or peeled) cedar. Historically, cedar bark filled a variety of functions including use for rain-repellant clothing, woven baskets and mats, and durable expedient containers (see Stewart 1984). At Mount Rainier, Alaska yellow-cedar bark may have been striped for any of these functions or to manufacture low-investment berry containers for transport away from the mountain, thereby minimizing transportation weight and bulk during ingress.

Expected Assemblage Characteristics

Culturally modified trees (here emphasizing wholly or partially peeled cedars) typically appear in small groves of ax cut rectangular scars or as delta (M) shaped scars on the upslope side—with or without cut marks (see Burtchard et al. 1993:49-64 and Mack 1996). Other durable cultural debris generally are absent.

Location

The location of peeled cedars is constrained by habitat. Western red cedar (*Thuja plicata*) is most common in low elevation river valleys. Alaska yellow cedar (*Chamaecyparis nootkatensis*) habitat extends higher through mid to upper elevation forests to circa 5,500 ft. Alaska cedar effectively is limited to well watered valleys with northerly exposures. Because of plausible association with huckleberry collection and denser representation in the Park, peeled Alaska cedars are expected to be the most common.

Current Representation in the Park

No modified tree sites have been formally documented within Park boundaries. However, Carl Fabiani (pers. com. 1995) reports a small grove of peeled Alaska cedars on the banks of Shaw Creek in the Park's northeast quadrant. Working for the Gifford Pinchot National Forest, J.E.D. Garoutte located a grove of eight peeled Alaska cedars on the Park/Forest boundary on the north-facing slope of Laughingwater Creek at the edge of the Park's southeast quadrant (Lake Beverly Site, FS #15N10E-36/01 [McClure pers. com. 1996]). Finally, Janet Liddle (pers. com. 1996) reports a peeled cedar locality on the Park's southern boundary north of Skate Creek Road, west of Bear Prairie on the north shore of the Nisqually River.

Type 8: Plant Processing Locations

No unequivocal evidence of exclusively plant processing locations has been found in Mount Rainier National Park. However, there is no doubt that huckleberries were collected on the mountain in the ethnohistoric past, and were reportedly "...dried, packed in bags, and brought back to the valley homes for winter consumption." (Curtis 1911 in Smith 1964:150). Historically, huckleberry drying involved use of fire. Accordingly, drying features should leave distinct characteristics in the archaeological record. A number of probable huckleberry drying features have been identified on the flanks of Mt. Adams in the Gifford Pinchot National Forest (Mack and McClure 1996). An excavation report from a site north of Mount Rainier (Miss and Nelson 1995) claims to have identified a functionally similar feature at Mule Spring in the (appropriately enough) Huckleberry Mountains. Given abundant huckleberry habitat on Mount Rainier, ethnographic reference to huckleberry collection, and documented huckleberry features in the general vicinity, there is ample reason to expect that presence of such features ultimately will be documented within Park boundaries.

Predicted Site Function

In Mount Rainier National Park, plant processing localities are expected to be limited to huckleberry drying features; probably in association with residential sites as discussed below.

Expected Assemblage Characteristics

Huckleberry processing features investigated historically and archaeologically on Mt. Adams suggest two basic feature types: 1) an elongated trench with huckleberry laden mats on one slope facing a felled and fired log opposite; and 2) pole raised huckleberry (and meat) laden mats over an elongated fire pit fueled with scavenged wood. Rocks may be used to secure the mats and to store and transmit heat (Mack and McClure 1996). The remnant archaeological signature of such features should consist of these elongated, charcoal rich features, fire cracked rock and presence of charred huckleberry in macrobotanical samples. Chipped stone tools and debitage are not anticipated unless multifunctional activities, such as meat processing and drying and/or general residential activities also are taking place in the immediate vicinity of the plant processing feature(s).

Location

Huckleberry processing features should be linked to the distribution of most productive huckleberry habitat—blue and black huckleberries (*V. ovalifolium* and *V. membranaceum*) in mid-elevation forest burns, and dwarf huckleberry (*V. deliciosum*) in subalpine habitats. Because huckleberry drying is a time-consuming process requiring periodic attention and constant scavenger protection, processing may be most effectively carried out at or near residential base camps at the upper forest/lower subalpine ecotone.

Current Representation in the Park

None.

Type 9: Prehistoric to Early Historic Period Trails

Predicted Site Function

Foot and later equestrian trials can be expected to have linked resource zones to lowland communities, assuming that ingress and egress from Mount Rainier was a sufficiently regular occurrence to create and maintain established routes. Trails also provided passage across the mountain to points on the east and west. It is plausible that population densities were high enough to stimulate regular travel routes by mid to late Holocene times. Various references allude to the presence of routine travel into the Park from several sides (Meany 1916; Bjarke 1949; and especially Smith 1964).

Expected Assemblage Characteristics

Prehistoric trails are difficult to identify unambiguously in the field. Where present, trails should appear as faint linear terrain irregularities. In practice, we typically are forced to rely on ethnographic accounts, early maps (e.g., USGS 1915), and assumptions regarding least effort access routes between points—usually without concrete indications of an actual route.

Location

Relying on ethnographic and historical accounts, Smith (1964:229-238) outlines a series of possible trail routes centering on mountain passes. These include Chinook Pass linking Mount Rainier to the American River drainage and Yakama territory on the east; Naches Pass in the northeastern corner of the Park reportedly used by Yakama and Puget Sound groups in the early historic period; Carlton Pass south of Chinook Pass; Cowlitz or Packwood Pass southeast of the Park reported used by the Nisqually to access the Ohanapecosh River area from the southwest; Yakama and Snoqualmie Passes north of the Park; White and Tieton Passes south of the Cowlitz; and Cayuse Pass trending north and south trough the eastern margin of the Park. Smith also discusses direct mountain access trails with specific reference to 1) a side trail from the main Nisqually River-Cowlitz Pass trail up into Indian Henry's Hunting Ground in the Park's southwest quadrant; 2) a trail from Taidnapam by Lookout Mountain in the Tatoosh Range and Reflection Lake to the Paradise Glacier area; and 3) a trail via the Carbon River and Tolmie Creek into the Mowich Lake-Mist Park-Spray Park region in the northwest quadrant (Smith 1964:240).

Because it summarizes both potential trail locations, the probable ephemeral character of prehistoric and early historic routes, and general Mount Rainier land-use patterns, the following indirect citation is offered from Smith's (1964:241) ethnography:

> Speaking of trails in the Rainier area in general, Plummer (1900:89), the author of an early forest survey in the Park and adjacent territory to the south, emphasizes... "The routes of travel ...are few. Most of the trails shown upon the map are hardly deserving of the name, but indicate blazed lines where better progress can be made than taking a course through the timber and brush. The Indian's policy was to go only where his pony could take him, ...; therefore his lines of travel were along the sparsely timbered ridges, where feed was generally plenty, where game abounded, or where huckleberries grew."
>
> Allen agrees. He (Allen 1916:56) writes: "Every summer parties of hunters and berry pickers from the sage-brush plains crossed the Cascades with their horses. They followed the high divides and open summits of the secondary ridges until the came around to the open parks about Mount Rainier where they turned their horses out to graze and made their summer camp." ...

Please note that horse transport only became possible in the very late prehistoric and early historic periods. Use of horses probably affected the specific routes selected. They certainly extended the distance that could have been traveled to access Mount Rainier and increased the weight that could have been carried to and from the Park. With the onset of equestrian transportation, lower value, bulky resources such as huckleberries may have assumed greater importance than when resources had to be packed out of the mountain on foot. Even so, the passages above allude to cultural features worthy of note, point to the resource importance of the uplands, and plausibly draw our attention to the best access routes to these resource areas for the prehistoric past.

Current Representation in the Park

No trail locations have been formally documented in Mount Rainier National Park. In addition to references noted above, however, popular lore alludes to an early historic trail linking Sunrise Ridge to the Yakama area via the southeastern ridge slope in the vicinity of site FS 90-01 (and presumably on across Chinook Pass as discussed by Smith). Sections of this trail are reported to be visible (C. Fabiani pers. com. 1995; J. Morrison pers. com. 1995; R. Drake pers. com. 1996) but had not been recorded at the time of writing. The general area and outline description are included in Figure 3.5 and Table 3.6 to draw attention to the trail segment as a high probability early historic/late prehistoric cultural feature.

Type IF: Isolated Lost Artifacts

Predicted Site Function

Truly isolated artifacts are individual lost projectile points and tools, isolated transported exotic materials (manuports), or individual broken and discarded implements. They are assumed to be unaffiliated with a broader assemblage array, and hence unassociated with base camps or other sustained activity sites. Isolated tools function as part of a spatially extensive, generally hunting related, use of the landscape. As such, they can help inform us as to the distribution of those land-use practices, and (less reliably) the character (principally size) of the animals sought, and general temporal range of those practices. As with the broader lithic array, raw material sourcing and comparative stylistic attributes may provide information of use in inferring originating areas for human populations using the Park.

Expected Assemblage Characteristics

In this classification, artifacts considered most likely to be genuine isolates (as opposed to surface visible representatives of limited use activity areas) consist of single, whole or broken finished tools and manuports not associated with debitage or other lithic remains. Please note that these criteria are more limiting than those used during the present reconnaissance in which two or less surface visible artifacts, regardless of type, were recorded as isolated finds. Given the forested, depositional nature of Park landscapes, I suggest that, in the absence of subsurface discovery techniques (which are highly recommended), future inventories adopt the more stringent isolate criteria applied here.

Location

Because isolates are assumed to be part of extensive, hunting-related use of the landscape, they are expected to be biased toward most productive hunting areas. Accordingly, in the Cascades and at Mount Rainier, most isolated artifacts should be found in subalpine to alpine contexts.

Current Representation in the Park

Seven currently documented finds meet the criteria noted above. These include the Upper Palisades Trail (IF 01-84) and Upper Summerland (IF 02-95) isolates in the Park's northeast quadrant; Spray Park Shatter (IF 08-95) and Spray Park Slab (IF 09-95) in the NW quadrant; Tokaloo Trail (IF 01-87) and the twin Copper Mountain Cobbles (IF 10-95) in the SW quadrant; and the Bench Lake Trailhead isolate (IF 02-63) in the southeast quadrant.

Table 5.1 below summarizes site type distinctions, and brings together several of the more pertinent lithic and environmental attributes emphasized above and in the preceding lithic section. Only documented or well located sites and isolates are included. Site locations can be seen on fold out site distribution map Figure 4.2 in the previous chapter, or on color fold out Park quadrant maps in Chapter 2 (use *Park Quad* to locate the proper quadrant map). Except for Berkeley Rockshelter (FS 86-02) and Fryingpan Rockshelter (FS 63-01), artifact counts are limited to surface observation. Fryingpan Rockshelter material (see Rice 1965) is now housed with the Park's museum collections at Longmire, but were not available at the time present analyses were completed. Material counts for this site are drawn from Rice's report. I emphasize again that site type distinctions outlined above and tabulated below constitute a working model. Refinements and modifications are expected and encouraged.

Table 5.1 Mount Rainier Site Types, Sites and Surface Remains

Site No.	Site Name	Park Quad	Environmental Zone	Debitage	Light Tools	Heavy Tools	FCR & Other	Total Count	Material Variety	Tool to Deb. Ratio
Type 1: Multi-Task, Mixed Group, Moderate-Term Residential Base Camps or Residential Field Camps										
FS 71-01	Buck Lake	NE	Subalpine	33	3	0	0	36	10	0.09
FS 88-01	Tipsoo Lake One	NE	Subalpine	12	2	0	0	14	4	0.17
FS 90-01	Sunrise Ridge Borrow Pit	NE	Upper Forest	15	1	4	2	22	6	0.33
FS 95-10	Forgotten Creek	SW	Upper Forest	4	1	1	4	10	4	0.5
FS 95-11	Little Sunrise Lake	NE	Subalpine	16	0	2	5	23	5	0.13
Type 2: Repeated, Moderate Intensity Use Field or Hunting Camps										
FS 63-01	Fryingpan Rockshelter	NE	Upper Forest	(100)[a]	(13)	(0)	(1)	(114)	($\geq$3)	(n/a)
FS 72-01	Mt. Pleasant Rockshelter	NW	Subalpine	11	2	0	0	13	2	0.18
FS 74-01	Vernal Park Rockshelter	NW	Subalpine	4	0	0	0	4	4	0
FS 86-02	Berkeley Rockshelter	NE	Upper Forest	5 (327)[b]	2 (37)	0 (1)	0 (0)	7 (365)	3 ($\geq$4)	0.4 (n/a)
FS 95-03	Upper White River Trail	NE	Subalpine	5	0	0	1	6	3	0
FS 95-04	Yakama Park Rim	NE	Subalpine	4	0	0	0	4	2	0
FS 95-05	Mist Park Overlook	NW	Subalpine	2	0	0	2	4	2	0
FS 95-08	Middle Spunkwush Lake	NW	Subalpine	3	1	0	0	4	3	0.33
Type 3: Low Redundancy, Low Use Intensity Hunting Locations										
FS 90-03	Windy Gap One	NW	Subalpine	4	1	0	0	5	1	0.25
IF 01-68	Yellowstone Cliffs	NW	Upper Forest	1	1	0	0	2	1	1
IF 01-70	Success Cleaver	SW	Alpine	0	2	0	0	2	2	0
IF 01-72	Sunrise Creek	NE	Subalpine	1	1	0	0	2	2	1

Site No.	Site Name	Park Quad	Environmental Zone	Debitage	Light Tools	Heavy Tools	FCR & Other	Total Count	Material Variety	Tool to Deb. Ratio
IF 01-75	Deadwood Lake Pass	NE	Subalpine	1	0	0	0	1	1	0
IF 01-95	Lower Deadwood Lake	NE	Upper Forest	1	0	0	0	1	1	0
IF 03-95	Grand Park One	NE	Subalpine	1	1	0	0	2	2	1
IF 04-95	Grand Park Two	NE	Subalpine	1	0	0	0	1	1	0
IF 05-95	Upper Berkeley Park	NE	Upper Subalpine	0	2	0	0	2	2	0
IF 06-95	Yakama Park One	NE	Subalpine	1	0	0	1	2	1	0
IF 07-95	Yakama Park Two	NE	Subalpine	1	0	0	0	1	1	0
IF 11-95	Mirror Lakes	NW	Subalpine	1	0	0	0	1	1	0
Type 4: Butchering Locations										
FS 86-01	Frozen Lake	NE	Alpine	13	10	0	0	23	5	0.77
FS 90-02	Sarvant Glaciers	SE	Alpine	3[c]	4	0	0	7	≥2	1.33
Type 5: Lithic Procurement and Lithic Reduction Locations										
FS 90-04	Tum Tum Quarry	SW	Upper Forest	27	0	0	0	27	1	0
FS 95-01	Tipsoo Two	NE	Subalpine	7	0	0	0	7	1	0
FS 95-06	Mother Mtn. Lake 5554	NW	Subalpine	4	1	0	0	5	1	0.25
FS 95-07	Windy Gap Two	NW	Subalpine	17	1	0	0	18	1	0.06
Type 6: Stacked Rock and Talus Feature Locations										
No stacked rock or talus features have been reported or documented in Mount Rainier National Park.										
Type 7: Culturally Modified Tree Locations										
No culturally modified trees have been formally documented in the Park. A small grove of peeled Alaska cedars is reported on Shaw Creek. A grove of eight peeled Alaska Cedars, as well as two additional isolated peeled cedar sites have been reported on or near the Park's southern boundary with the Gifford Pinchot National Forest. All places are forested river valley settings.										

Site No.	Site Name	Park Quad	Environmental Zone	Debitage	Light Tools	Heavy Tools	FCR & Other	Total Count	Material Variety	Tool to Deb. Ratio
Type 8: Plant Processing Locations										
No plant processing localities have been documented in Mount Rainier National Park.										
Type 9: Prehistoric to Early Historic Trails										
Even though no trails have been formally documented in the Park, trail segments are reported in the southeastern flank of Sunrise Ridge. Historical and ethnographic accounts allude to others in various parts of the Park.										
Type IF: Isolated Lost Artifacts										
IF 02-63	Bench Lake Trailhead	SE	Subalpine	0	1	0	0	1	1	0
IF 01-84	Upper Palisades Trail	NE	Subalpine	0	1	0	0	1	1	0
IF 01-87	Tokaloo Trail	SW	Alpine	0	1	0	0	1	1	0
IF 02-95	Upper Summerland	SE	Alpine	0	0	0	1	1	1	0
IF 08-95	Spray Park Shatter	NW	Subalpine	0	0	0	1	1	1	0
IF 09-95	Spray Park Slab	NW	Subalpine	0	0	0	1	1	1	0
IF 10-95	Copper Mountain Cobbles	SW	Subalpine	0	0	0	2	1	1	0

Table Notes: [a]Fryingpan rockshelter totals are extrapolated from results of an unscreened test unit excavated in 1964 and reported by Rice (1965).
[b]Berkeley Rockshelter test results (indicated by brackets) are extrapolated from Bergland's (1988) work at the site.
[c]Counts extracted from Bergland's 1990 site form.

HOLOCENE LAND-USE PATTERNS; AN INTENSIFICATION MODEL

On Mount Rainier, the consistent site distribution bias toward subalpine habitats, the apparent tendency toward low density, low diversity assemblages and, most of all, the limitation of the currently known archaeological record to the latter half of the Holocene create an impression of long-term stability in settlement and subsistence practices. This impression may not be accurate. Indeed, there is compelling reason to believe that the way in which the region's upland landscapes were linked to lowland populations may have changed dramatically from early to late Holocene. However, the manner in which these changes are mirrored by corresponding variation, if any, in the character of upland archaeological assemblages has yet to be demonstrated. The intent here is to lay the groundwork for anticipating the nature of these changes by drawing attention to 1) basic shifts in regional and montane land-use practices through time; and 2) impacts, if any, on the archaeological record of the southern Washington Cascades as represented in Mount Rainier National Park.

To date, the most thorough ecologically oriented long-term settlement and subsistence models for Pacific Northwest montane environments are those developed by Randall Schalk (1988) for Olympic National Park, by Robert Mierendorf (1986, 1996) for North Cascades National Park, and by the author for the northern Rocky Mountains and the northern Oregon Cascades near Mt. Hood (Burtchard 1987, 1990:14-26).

Others also have employed ecological arguments to help understand site distribution patterns in Northwest mountains. Morris Uebelacker (1986), for example, develops a habitat model for the eastern flank of the southern Washington Cascades and relates it to site type distribution patterns and ethnohistoricly reported subsistence strategies. Paul Baxter (1986) and Sandra Snyder (1987) address human population movements and location of habitation sites in relation to patterned availability of upland plants and animals in the central Oregon Cascades. While employing ecological principles, however, these approaches rely heavily on early ethnohistoric patterns, projected into the prehistoric past. They do not come to grips with subsistence and settlement changes that we now believe differentiate early from later Holocene land-use systems, nor do they deal with causal mechanisms underlying such social and land-use changes.

The long-term models are built on similar theoretical foundations. In particular, all view human populations as an integral part of larger environmental systems; all see the balance between human population density and resource abundance as central to understanding basic structure and change in subsistence systems; and all are constructed around basic organizational components of the *forager/collector* continuum originally proposed by Binford (1980) to explain latitudinal variation in hunter-gatherer settlement patterns. This three-part foundation is important to understanding and evaluating the Holocene land-use model and archaeological expectations offered here.

Humans and Ecology

The view that human organizations are an integral part of their larger environment and respond to ecological variables in a manner comparable to other organisms is what confers predictability through time and across space. Perhaps most important is the role of language and complex cultural behavior—the characteristics most often touted as those which separates *Homo sapiens* from the *lower* species; freeing humans from ecological constraints that regulate other species less sophisticated existence. Here and in the models noted above, it is assumed that, while culture and the technological capacity that flows from it confer substantial competitive advantage to human populations, it *does not* *free them* from the ecological constraints that affect other organisms. Their primary effect, rather, is to increase the range of potential human responses and dramatically enhance the speed at which those responses can be made. Human group behavior patterns constitute cultural traits than can figuratively "turn on a dime" when factors inducing change are severe. Because cultural characteristics are subject to rapid and varied change, attempts to explain such phenomena as subsistence and settlement practices by reference to culturally-based group mind-sets, expectations, differences and so on, are inherently tautological and non-explanatory. Such attempts can never reach to more basic causes of the cultural phenomena themselves and, hence, cannot come to grips with regularities and variation that take place over very long periods of time.

It is more productive to view regularities and variation in regional cultural patterns in their broader environmental context. Dominant cultural patterns at any given point in time and place reflect dynamic system states rooted in complex and ongoing feedback relationships between humans and the environments within which they strive to survive and reproduce (cf., Leonard and Reed 1993:649-650). Cultural systems—including settlement and subsistence systems of primary interest here—can be expected to remain relatively stable so long as they function well enough to reliably sustain most of their members most of the time. Systems can be expected to change, perhaps rapidly, when critical shortfalls become widespread and chronic. The explanation for relative stability and/or change, then, does not lie in the cultural system itself, or even in introduction of new cultural systems or ideas into a region, but rather in the selective context through which some ideas are adopted and transmitted, while others are ignored or fall into disuse. It is this focus on selective context that underlies the long-term land-use approaches and allows them to predict basic settlement and subsistence patterns well beyond the shallow temporal depth of ethnohistoricly based models. Equally important, archaeological predictions derived through application of ecological models provide direction and interpretive context for continuing research efforts, and permit rejection or refinement of ideas as new data become available.

It must be emphasized, however, that ecological arguments made here do not imply that all cultural manifestations are *adaptive* or that cultural systems cannot act, for a time, in ways that are actively maladaptive (i.e., that serve to reduce the fitness of its members) in the face of environmental pressure to the contrary. They simply hold that cultural traits respond to external stimuli, and that the relative stability of these traits through time may be understood by reference to cause and effect relationships. In essence, traits serving to enhance the fitness of the members (or that are at least neutral) tend to be differentially replicated and perpetuated through time. Traits that reduce fitness tend to be lost.

Population Density, Resource Availability and Land-use Intensification

Implications of population and resource processes in the Northwest have been discussed in some detail by Schalk (1988:10-12), Burtchard (1987, 1990:15-16) and Schalk and Atwell (1994:[5]1-42).[32] Central to these ecological approaches is the notion that resource distribution and abundance relative to population density is of fundamental importance in determining the basic form and relative stability of regional settlement and subsistence systems. It is suggested further, that the natural biological tendency toward increasing population density among successful species—particularly pronounced among colonizing species such as early Holocene humans in North America—will, over time, result in resource instability sufficient to cause reorganization of subsistence strategies—even in

[32] The Schalk and Atwell reference is recommended for thorough background into this issue.

the absence of environmental change. In essence, the process creates a natural distinction between economies of 1) colonizing systems functioning in a context of low population density and relative resource abundance, versus 2) regionally packed systems forced to develop mechanisms to support higher population density in a context of heightened competition for limited critical resources.

Though the process is most easily viewed in terms of polar extremes, it should be borne in mind that actual circumstances at different times and places lead to variable responses in the face of dynamic resource options and population demands. The common thread, however, is a tendency toward more intensive exploitation of the landscape as population density increases and/or critical resources become limiting. *Intensification*, or the process of extracting increasing amounts of energy from finite land area (Schalk and Atwell 1994:[5]15; cf., Boserup 1965:43-44), is the heart of changing land-use strategies and the *forager to collector* shift as it is applied to land-use systems in the Pacific Northwest.

Imbedded within the population/resource/land-use arguments developed here is the contention that the manner in which humans organize use of the landscape at any point in time reflects feedback relationships between established practices rooted in the past and the practical need to maintain a stable supply of critical resources in the present and predictable future. Because these feedback relationships are complex, because solutions to resource problems are generally experimental and multifaceted, and because of lag time between individual recognition of the need for change (stimuli) and the general adoption of modified land-use practices (response), there is no reason to expect any land-use system to be truly optimal when viewed only in a narrow time frame.

Despite this complexity, the most viable and hence successful groups over the long-term are those whose land-use systems are best fit to local resource constraints. Accordingly, while recognizing that the fit will not be perfect, over the long-term hunter-gatherers should 1) exhibit regularities in the ways subsistence and settlement practices accommodate resource abundance and distribution patterns; and 2) tend to optimize return of critical resources (particularly staple food supplies, clothing, shelter and implement materials) for labor investment.

Successful groups must routinely adjust subsistence and settlement strategies as members strive to maintain a stable resource base in the face of variable climate and rising population density. During periods in which resources are stable and abundant relative to demand (e.g., the early Holocene) it is reasonable to expect relatively simple land-use systems, minimal intergroup contact, and relative stability in land-use practices through time. Times of acute shortfalls should narrow the range of successful subsistence strategies. Social responses to chronic shortfalls (ostensibly in the mid-Holocene) should include increased competition and punctuated change in the form of emigration, development of social mechanisms to buttress resource supply (e.g., territorial boundaries and trade networks), increased labor investment relative to return, and/or focused management or exploitation of lower return resources and those most responsive to intense exploitation (e.g., increased reliance on domesticates or intensively exploitable non-domesticates). These are all elements of the intensification process envisioned here.

It is the predictable regularity of such tendencies that facilitates model building and generation of objective tests for the archaeological record without regard to racial or cultural differences, or even necessary prior reference to ethnographic sources.[33] The general manner in which resource/population processes play out through time will vary with the capacity of regional resources to sustain intensive use without collapse. In essence, regions with edible resources amenable to domestication or capable of

[33] Ethnographies, while constituting an interesting and fertile source of ideas to apply to the archaeological record, reflect highly disturbed system states, characteristics of which should be projected into the more distant past with great caution.

sustaining high exploitation levels will tend to develop settlement and subsistence systems oriented around them. Regions lacking intensively exploitable commodities cannot be expected to witness comparable changes and will instead tend toward mechanisms to cope with chronic resource pressure within the basic *status quo anti* (e.g., emigration and population control).

In the Pacific Northwest, we can expect such processes to underlie a series of resource-related mid-Holocene changes; all leading toward more intensive use of the landscape and elevated social complexity. Resource changes include: a punctuated shift toward greater reliance on anadromous fish along productive river systems; increased reliance on storable staples such as camas or wapato in appropriate habitats; increased reliance on marine resources and lower return resources such as smaller body size game and marginal plant resources; and increased efforts to improve ungulate habitat with fire (cf., Schalk 1988:11-12). These processes also selected for aggregated settlement in places that optimized access to mass harvested and stored staples. Exploitation of resources at logistically challenging places like Mount Rainier would have had to accommodate scheduling and labor demands of more critical lowland commodities. Accordingly, at a broad scale, we can expect land-use practices to have become logistically tethered to lowland villages. The change from mobile, small group foraging economies to such logistically constrained strategies is an essential element of forager to collector land-use models, and is the central concept of the model offered here.

A Brief History of Forager to Collector Intensification Models[34]

Origins: Willow Smoke and Dogs' Tails

Though anticipated in *Nunamiut Ethnoarchaeolgy* (Binford 1978), Lewis Binford (1980 [republished 1983]) formally presented his forager to collector ideas in the *Willow Smoke* article. Binford's interest lay in explaining what he believed to be a fundamental organizational contrast between low and high latitude hunter-gatherers. His two-part model contrasted settlement systems adapted to 1) regions lacking marked seasonal or spatial variation in critical resource abundance; versus 2) highly seasonal or extremely patchy environments. All else being equal, more temporally and spatially uniform environments tend to be located in non-desert, equatorial settings. Resource seasonality—what Binford termed *temporal incongruity* or *phasing*—generally increases with latitude north and south. *Spatial incongruity* may occur in any latitude where critical resources are widely separate.

Simply put, Binford argued that the most viable adaptive strategy in uniform environments is a *foraging mode of production* in which consumers maintain a high level of residential mobility, moving to new resource procurement areas as local productivity declines. Accordingly, forager settlement systems are characterized by frequent, relatively short distance residential moves with negligible storage at any of the residential bases. Due to relatively short duration stays, bulk resource input and processing tends to be minimal at any specific point.

Redundancy in land-use practices from place to place tends to limit forager site type variability. Binford suggested that forager sites could be collapsed into two basic kinds—residential bases and resource acquisition locations. Binford (1983:343) saw residential bases as the "hub of subsistence activities, the locus out of which foraging parties originate and where most processing, manufacturing and maintenance activities take place." Locations are places where extractive tasks are carried out. Use

[34] Readers more interested in immediate application to Mount Rainier and the southern Washington Cascades may wish to jump ahead to the intensification model beginning on page 140.

limitations are expected to affect the character of the archaeological record of these places. Binford (1983:343) notes that:

> Since foragers generally do not stockpile foods or other raw materials, such locations are generally 'low bulk' procurement sites. That is to say only limited quantities are procured there during a given episode, and therefore the site is occupied for only a very short period of time. In addition, since bulk procurement [for storage] is rare, the use, exhaustion, and abandonment of tools is at a very low rate. In fact, few if any tools may be expected to remain at such places.

The similarity between Binford's locations and many of the sites recorded on Mount Rainier is striking, despite the Park's marked seasonality and high latitude setting.

In contrast, a *logistic* or *collecting mode of production* is the most viable strategy for groups residing in environments with a temporally or spatially incongruous resource base. Because food resources tend to be unavailable for an extended winter period and/or too distant to be accessed by repeated short-distance, short-duration moves, the most practical strategy tends to be one in which goods are moved to consumers by logistically organized food procurement groups. Collector residential bases tend to be situated in places that optimize access to resources or at places where particularly critical resources are abundant. Residential moves are infrequent. Rather than shifting primary residence to multiple procurement areas, collected goods tend to be returned to the center for storage and redistribution. Because of more intricate organizational requirements, collector systems tend to be more socially complex than foragers. While not addressed in the *Willow Smoke* article, collector systems generally are capable of supporting higher population densities than foraging systems (when not in a severely resource limited environment), and importantly, often require elevated population levels simply to meet labor requirements of the logistic system itself.[35]

Intersite variation is greater among collector populations because of greater functional variation in use of space. Binford attempted to accommodate this variability by adding field camps, stations and caches to residential bases and locations common to all hunter-gatherers. He defines field camps as places where hunting parties are maintained while away from the residential base—essentially short-term, task-specific (or limited-task) residences in which only a portion of the larger group resides. Locations are defined above, but now may be tethered either to residential bases or to field camps. Stations or observation sites are used for information collection on game presence or movement. Caches are temporary storage places. Again, though simplified, the similarity to Mount Rainier sites is clear.

Foragers and Collectors; Spatial Variation Versus Temporal Change

The power of Binford's forager/collector model lies in its capacity to subsume much of the basic organizational variability in ethnographically documented hunter-gatherer populations worldwide, and do so by relying on pan-cultural causal principles that facilitate empirical examination of archaeological expectations. The power of Binford's work notwithstanding, there are two obvious problems involved in applying the dichotomy to long-term changes in hunter-gatherer settlement and subsistence systems in the Pacific Northwest. First, and most obvious, the model originally was developed to explain patterned variation in recent hunter-gatherers around the world. It was not intended to apply to change through time. Second, casual application of the model's resource

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[35] Wagner (1960) used the terms *Gathering, Predation* and *Collecting* to discriminate among non-agricultural peoples on the basis of mobility and reliance on storage. These concepts, and especially use of *Collecting* to identify sedentary hunter-gatherers with storage, anticipate several aspects of Binford's model, albeit with very different causal mechanisms.

uniformity versus spatio-temporal incongruity arguments imply that *only collectors*, not foragers, would be best fit to the seasonal environmental constraints of the Pacific Northwest. Each of these issues warrants brief comment.

Binford's ideas address graded variation in hunter-gatherer subsistence systems from simple (i.e., foragers) to complex (collectors) across space. He did not consider comparable change through time. Even so, the capacity of the forager/collector model to subsume basic distinctions in subsistence strategies extends beyond Binford's self imposed limits. Independent, small group foraging economies tend to function poorly in a context of high population density. Faced with regional population packing, successful foragers must either emigrate to new areas, find ways to arrest population at sustainable levels or develop means to squeeze more food energy out of existing space. The latter option involves adopting more intensive and complex resource acquisition, storage and distribution strategies. To do so in a seasonal environment, hunter-gatherers must develop subsistence practices centered on seasonally abundant staple resources that can be mass harvested for storage and redistribution without collapsing from intensive use.

In the Pacific Northwest, resources that can sustain intensive exploitation are few—anadromous fish, marine resources, camas, wapato, lomatium and perhaps others. It is a central premise here, that a mid-Holocene shift toward intensive use of these resources and development of aggregated, semisedentary to fully sedentary communities is most parsimoniously explained by population/resource imbalance due primarily to population levels elevated beyond carrying capacity sustainable with a forager based economy (cf., Schalk 1988:10-12; Mierendorf 1996; Burtchard 1987, 1990:14-25). Less labor-intensive high return wild game could not indefinitely support increasing human predation pressure, ultimately forcing region-wide logistical reorientation toward reliance on alterative resources capable of withstanding intensive exploitation. In the southern Washington Cascades, this means salmon.

Some of the above considerations apply to the second "problem" as well. Binford's original criteria imply that a foraging mode of production would not be expected in regions with marked winter seasonality like the Pacific Northwest. Indeed, this is the point of view taken by Aikens et al. (1986) in their *Affluent Collectors* article. This certainly was so when the ethnographic record that figures in Binford's (1980) and Schalk's (1978) ideas was made. The ethnographic pattern, however, is temporally shallow. There is compelling reason to believe that early Holocene land-use patterns differed fundamentally from those of the late Holocene. There is no doubt, for example, that early Holocene group sizes were smaller, residential mobility was higher and assemblages less complex than during the late Holocene. In any case, even if early Holocene, winter season mobility was reduced somewhat relative to summer, there is little doubt that such restriction did not approach the level of sedentism and logistical organization common to later collectors. In my opinion, the forager distinction is warranted.

It is important to recognize that a clear forager/collector pattern should not be expected to occur as a simple dichotomy or to be everywhere uniform (see Kelly 1995). Binford (1983:355) himself recognized that "...logistical and residential variability are not to be viewed as opposing principles ...but as organizational alternatives which may be employed in varying mixes in different settings." Across the greater Pacific Northwest, a settlement and subsistence pattern characterized by high residential mobility, low bulk processing and negligible storage appears to have sustained the early Holocene's low density populations. Regionally, a relatively abrupt change toward restricted residential mobility and high bulk procurement and storage of anadromous fish took place during the mid-Holocene; most plausibly to accommodate increased population demands. Accordingly, despite differences in focus from Binford's original intent, the forager/collector model remains a useful tool to characterize subsistence and settlement systems of early versus mid to late Holocene hunter-gatherers in the Pacific Northwest.

Forger to Collector Intensification in the Pacific Northwest

Beginnings

Randall Schalk's dissertation (Schalk 1978) and subsequent article on organizational complexity among Northwest foragers (Schalk 1981) develop many of the ideas relevant to resource distribution and hunter-gatherer organization outlined above. Like Binford, Schalk did not attempt to model change through time, but rather focused on differences in complexity between coastal groups on a south to north gradient from northern California to the Alaska panhandle. Consistent with Martin (1974) and emerging optimal foraging theory (see summary in Kelly 1995:73-108) Schalk preferred to use "forager" as a general replacement term for the older, somewhat clumsy "hunter-gatherer" label. It is clear, however, that the diversity he examines in organizational complexity and logistic mobility extends well into the "collector" taxon as defined subsequently by Binford and outlined above.

The first use of intensification principles to explain and model change through time was by Schalk and Cleveland (1983) in their *Chronological Perspective on Hunter-Gatherer Land Use Strategies in the Columbia Plateau.* In essence, they applied what had heretofore been solely a spatial concept to organizational variation between early and late Holocene hunter-gatherers in the inland Northwest.

Schalk and Cleveland's model divided the Holocene into three temporal periods based on subsistence and settlement patterns believed to predominate over much of the region: *Broad Spectrum Foraging* from earliest human entry into the region to circa 4,500 years ago; *Semisedentary Foraging* from 4,500 to about 500 years ago; and *Equestrian Foraging* from introduction of the horse until mobility was restricted by enforcement of the reservation system in the mid-1800s. Feeling that it oversimplified organizational diversity among complex hunter-gatherers, Schalk and Cleveland refrained from using the term "collector." Even so, the mid-Holocene shift to semisedentary foraging involved changes in procurement, processing, storage and settlement practices comparable (at least seasonally) to Binford's collector terminology as it now is commonly applied.

I prefer to call the southern Columbia Plateau model and related approaches that followed (e.g., Schalk 1984; Thoms and Burtchard 1987; Mierendorf 1986; Ames 1985, 1988; Burtchard 1990) *forager intensification* models. The differences between them and forager-to -collector constructs is largely semantic. Binford's use of forager-collector labels to contrast residential versus logistic mobility among hunter-gatherers, may be mnemonically awkward, but has become common parlance. It is important not to be distracted by labels, but rather focus on land-use implications of the strategies modeled. The mid-Holocene shift toward more nearly sedentary, logistically organized hunter-gatherers appears to be well-grounded whether called semisedentary foragers or collectors. Schalk and Cleveland deserve credit for drawing attention to these processes in the greater Pacific Northwest.

Forager Intensification in the North and Central Cascades

Forager intensification models were applied directly to Northwest montane environments by Schalk (1984) and Burtchard (1987) for the northern Rockies, Mierendorf (1986) for the North Cascades, and Burtchard (1990:14-25) for the northern Oregon Cascades in the vicinity of Mt. Hood. Like Schalk and Cleveland, Mierendorf and I retained the forager nomenclature, but tried to refine the original three-part model by proposing a five-part structure incorporating increasing regional population density with major Holocene environmental changes. The Mt. Hood model was somewhat more explicit in this regard. Its five temporal periods include 1) *Early Broad-spectrum Foraging* during which colonizing human populations are assumed to have focused largely on Pleistocene megafauna east of the Cascades; 2) *Mesofaunal Broad-spectrum Foraging* (ca. 8,500 - 5,000 B.P.) which assumes a shift toward medium body size ungulates (primarily elk and deer), and initial use of the Cascades following extinction of the large

Pleistocene mammals and opening of montane ungulate habitats; 3) *Early Semisedentary Foraging* (ca., 5,000 - 2,500 B.P.) anticipating a population density induced shift toward logistic land-use strategies focused on anadromous fish and camas in the lowlands, supplemented by continued montane summer foraging enhanced by fire suppression of forest maturity; 4) *Intensive Semisedentary Foraging* (ca. 2,500 - 500 B.P.) which assumed modern floral associations, increasing population density and highest development of centralized, logistically oriented settlement systems;[36] and finally 5) *Post Apocalypse Strategies* (ca., 500 B.P. - Present) dealing with organizational land-use impacts of abrupt population loss, introduction of the horse, the reservation system and the modern American economy.

The primary refinements of these models to Schalk and Cleveland's (1983) original lay in 1) distinguishing very early post-Pleistocene foraging from broader spectrum foraging focusing on medium sized species; 2) incorporating montane habitats; and 3) suggesting that intensification processes may have increased pressure for logistic reorganization even after semisedentary foraging (collector) strategies were begun. The Mt. Hood model also considered social, subsistence and settlement reorganization caused by precipitous population loss following introduction of European diseases.

Cordilleran Foragers and Collectors on the Olympic Peninsula

At roughly the same time as the above forager intensification models were developed, Schalk (1988) refined his earlier work for application to Olympic National Park and the Olympic Peninsula. While the ecological perspective remained unchanged, he adopted terminology common to cultural historical approaches to montane hunter-gatherers. Specifically, he dropped the "cultural" reference from Butler's (1961) "Old Cordilleran Culture", but retained the montane (cordilleran) reference. He did so for consistency with earlier literature and because he believed that "mountains played a pivotal role in the early Holocene land use strategies" (Schalk 1988:87). He also reluctantly switched from "semisedentary forager" to "collector" to accommodate Binford's (1980) widely established nomenclature. While clearly an intensification model in the sense described here, the model employs a somewhat confusing hybrid combination of culture history and settlement system terminology. Modifying Schalk's nomenclature slightly, its four prehistoric land-use periods include 1) Paleo-Indian Foraging (>10,000 B.P.); 2) Early Old Cordilleran Foraging (ca. 10,000 - 3,000 B.P.); 3) Late Old Cordilleran Foraging and Riverine Collecting (ca. 6,000 - 3,000 B.P.); 4) Riverine and Maritime Collecting (ca. 3,000 - 200 B.P.).

The Olympic model is a hybrid in nomenclature only. It develops important resource related implications for long-term use of Northwest mountains—implications with direct predictive consequences for the late Holocene archaeological record of high elevation landscapes. Despite differences in titles and temporal ranges, the Olympic model shares structural similarities with North Cascades and Mt. Hood intensification models (see Table 5.2 for comparison). Like Mierendorf and Burtchard's *Early Broad Spectrum Foraging* category, for example, Schalk's *Paleo-Indian Foraging* period is intended to accommodate earliest colonizing populations (as evidenced by lance-sized projectile points—especially Clovis fluted and large stemmed points). Schalk (1988:88-90) improves on our efforts by summarizing then available regional Paleoindian data, and summarizing and calling attention to the problems with dates purporting to age archaeological remains earlier than 11,000 B.P.

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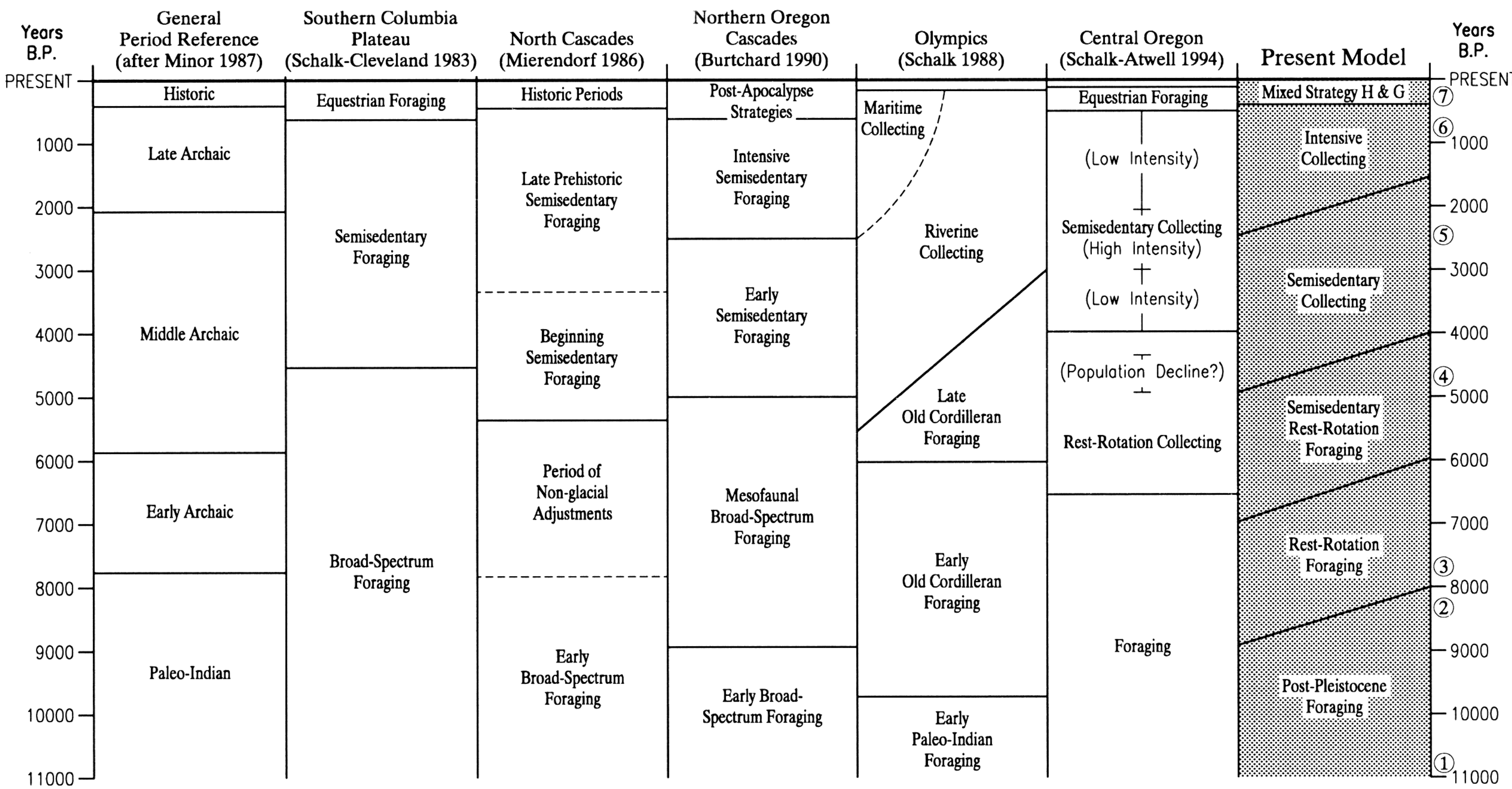
[36] In the years since developing the Mt. Hood model, I have become more suspect of the gradualism inherent in this approach; favoring instead a more rapid, punctuated shift toward collector land-use practices as suggested by Schalk (1988:13) and incorporated into the present Mount Rainier model. Accumulating climatic information also suggests that environmental patterns were not so simple as assumed, and arguably had an indirect feedback relationship on subsistence strategies rather than direct effects as implied in the earlier model.

Table 5.2 Northwest Land-Use Intensification Models



1. Early Pleistocene Extinctions (Taylor et al. 1996)
2. Rapid Wasting of Terminal Fraser Glaciation, Final Post-Pleistocene Extinctions, Earliest Plausible Use of Mt. Rainier Uplands
3. Hypsithermal Onset
4. Hypsithermal End
5. Burroughs Mountain Glacial Advance and Retreat
6. Garda Glacial Advance and Retreat
7. Disease Related Population Loss

Most of Schalk's effort is given to Old Cordilleran foraging systems in the montane and marine context of the Olympic Peninsula. He notes widespread occurrence of willow-leaf shaped dart points with lenticular cross-section (i.e., *Cascade* points) [37] and, consistent with forager expectations, limited spatial or temporal intersite variability (Schalk 1988:90-91). He argues that a mobile foraging economy is particularly well suited to Northwest mountains, despite northerly latitude, due to the tendency of large ungulates to aggregate in the foot hills and intermontane valleys during the winter and to move to high elevation pastures during the summer. Accordingly, a high mobility *rest-rotation* foraging pattern shifting between relatively closely spaced upper and lower elevation landscapes, moving to new locations as local productivity declined, would have been well suited to the mountains so long as population density (hence, predation pressure) remained low. The early Holocene should have been particularly well suited to the low competition requirements of this *Early Old Cordilleran Foraging* pattern due to low population density and enhanced ungulate forage in the foothills during the Hypsithermal Interval.

Late Old Cordilleran Foraging (beginning circa 6,000 years ago) was intended to accommodate elevated resource stress caused by population increase and loss of ungulate forage at the end of the Hypsithermal Interval (see Table 2.3 on page 37). Forest expansion and elevated population density may have led to increased use of fire to reduce forest maturity plus "increased use of fish and littoral resources in the spring-summer-fall months for immediate consumption, increased residential mobility especially during the winter..." (Schalk 1988:103). Except for these changes, most groups should have maintained the uplands/foothills rest-rotation foraging pattern established earlier. However, in places where food stress was particularly severe and/or riverine resources particularly productive, foragers may have adopted collector characteristics—restricted mobility, reliance on over winter storage, logistic procurement and so on. Accordingly, the period may have witnessed existence of both forager and collector economies as groups came to grips with diverse regional population and resource dynamics.

Assuming that population density continued to increase, demands on ungulate resources ultimately reached level beyond which herds had sufficient predation-free time to recover. That is, rest-rotation periodicity became too short for game populations to rebound sufficiently to tolerate continued human predation. Faced with collapse typical of predator/prey relationships everywhere, successful human groups were those that developed strategies that intensively exploited alternative riverine and eventually marine resources. Because of the relative abundance and predictability of anadromous fish, and proximity of fisheries to montane hunting areas, river-based collector systems are expected to predate those focusing on marine resources.

The Olympic model anticipates disappearance of the last vestiges of high mobility foraging systems about 3,000 years ago with replacement by aggregated, semisedentary to fully sedentary communities focusing primarily on lowland based procurement and bulk storage of anadromous fish (*Riverine Collecting*). A shift to marine resources (*Maritime Collecting*) followed. Most importantly, Schalk (1988:150-151) suggests that upper elevation mountain use was dramatically reduced in favor of summer exploitation of lowland species. Ungulates, he believed, were better managed by permitting untouched summer grazing in subalpine habitats with hunting restricted to winter when elk and deer moved to downslope forage areas. He suggests that the virtual absence of late Holocene style projectile

[37] Schalk accepts a temporal relationship between *Cascade* dart points and early Holocene use of the Olympics. While such points appear to be widely distributed in the early Holocene, there is compelling reason to believe that similar points continued to be used well into the late Holocene in montane contexts (Daugherty et al. 1987b:234; Burtchard 1990:144-149). This suggests 1) that such points were functionally well suited to upper elevation hunting, and 2) that atl atl, darts, and montane land-use continued into the late Holocene; overlapping bow and arrow hunting. Accordingly, while Cascade style points may be associated with early Holocene sites, their presence alone does not necessary indicate great antiquity.

points in the available Olympic National Park montane sample was consistent with early to mid-Holocene use and marked reduction in late Holocene use of the uplands.

Schalk's Olympic model is discussed in some detail here because it was designed to accommodate mountain land-use approximately comparable to Mount Rainier, and because of two critically important, theoretically well-grounded assertions: 1) that Olympic and Cascade montane geomorphology and climate acted to aggregate game and minimize distance between winter and summer pastures sufficient to facilitate successful exploitation by early Holocene foragers; and 2) that use of upper elevation landscapes ceased, or was reduced dramatically, following development of collector land-use systems in the mid-Holocene. If the first assertion is true, then we should see unequivocal evidence of earliest mountain and mountain fringe use dating to the early Holocene. If the second assertion is true, then we should see a marked drop in upland archaeological materials dating to the late Holocene.

Multiple Strategy Intensification Models; The PEP Project

The final settlement and subsistence model considered before turning directly to Mount Rainier and the southern Washington Cascades was developed by Schalk and Atwell (1994) as part of the extensive Pipeline Expansion Project (PEP) in Idaho, Washington, Oregon and northern California. Because of its breadth of scope, the associated archaeological sample was drawn from a wide variety of environmental contexts. Because of regional variation in resource potential, intensification processes may generate very different subsistence and settlement responses across the greater region.

The PEP intensification model attempts to accommodate this variability by contrasting probable intensification trajectories in different subregions[38] in terms of five land-use strategies—1) Foraging; 2) Rest-Rotation Collecting; 3) Semisedentary Collecting; 4) Fully Sedentary; and 5) Equestrian Hunting and Gathering. Each of these strategies is contrasted in terms of three key variables: food storage, residential mobility and resource transport. Consistent with earlier use of the concept, the *Foraging* strategy assumes a fully nomadic land-use system (i.e., high residential mobility) with no systematic dependence on food storage (Schalk and Atwell 1994: [5]180). Related expectations include large range size, low population density, and winter season dependence primarily on animals killed for immediate consumption.

Rest-Rotation Collecting incorporates food storage in order to bridge brief periods of winter sedentism. A "key feature of this strategy is the regular rotation of settlements on a yearly or multi-yearly basis to new areas to avoid the declining rates of return associated with continuous exploitation of the same areas" (Schalk and Atwell 1994:[5]19). To function properly, such systems depend on low population density and existence of open, competition free alternative foraging areas.

Semisedentary Collecting differs from the above largely by loss or absence of the rest-rotation option. In such systems, the annual range of winter settlement and warm season movement through a series of procurement camps can no longer shift to areas that have not been exploited in the recent past in order to alleviate declining productivity. Ostensibly, such restrictions result from elevated population density and competition for available space and resources (see Schalk and Atwell 1994:[5]20). A restricted long-term range implies that resources capable of withstanding repeated (i.e., intensive) exploitation will tend to be favored over those that cannot. Accordingly, subsistence patterns tend to emphasize bulk procurement of temporally or locally abundant commodities (e.g., acorns, camas,

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[38] These include the northern Rockies in Idaho, the John Day-Deschutes drainages in central Oregon, Klamath-Modoc in southwestern Oregon and northern California, and Upper Sacramento and Lower Sacramento-San Joaquin Valleys in north central and central California.

anadromous fish) with lengthened storage period and increased labor and redistributive costs. While the total spectrum of resources used may remain broad, effective niche width narrows by virtue of increased dependence on fewer critically important commodities (see Schalk and Atwell 1994:[5]21).

Fully Sedentary systems are the most labor intensive, residentially restricted systems modeled in the PEP report. In this strategy, "residential centers are occupied throughout the year. Intensive harvesting of resources within the day-radius provides most of the annual food supply" (Schalk and Atwell 1994:[5]21). Longer distance commodities may be acquired through trade networks. Niche width tends to be very narrow, storage requirements high, home range restricted, social organizational and redistributive mechanisms complex, and division and labor costs high. Such systems are rare among hunter-gatherers because undomesticated plants and animal populations seldom are capable of withstanding such intense pressure in the long-term. Essentially, hunter-gatherers cannot be fully sedentary without very abundant unearned resources (perhaps exceptionally prolific anadromous fisheries) and/or effective water-borne trade networks.

Finally, *Equestrian Hunting and Gathering* is intended to distinguish terminal prehistoric systems dependent on horse transportation. Newly acquired long distance travel options, occurring in close coincidence with extensive disease related social dislocation, spawned a variety of long distance hunting and trade systems that are difficult to classify other than by reference to dependence on the horse. In the southern Washington Cascades, huckleberry bulk processing and transport arguably became economically viable only after horses became generally available—particularly to east slope populations like the Yakama—about 250 years ago.

Because the pipeline route that spawned the PEP project did not cross the Cascades, no regional progressions were generated that are specifically applicable to Mount Rainier. Even so, one of the PEP model's most substantial contributions is its emphasis on regionally variable intensification trajectories. In some places, particular settlement and subsistence systems may be emphasized while others are absent altogether. In the highly seasonal, intensifiable resource limited northern Rockies, for example, Schalk and Atwell (1994:[5]24) predict maintenance of foraging strategies throughout the Holocene, only changing to equestrian-based rest-rotation collecting at about A.D. 1800. In the John Day-Deschutes drainage basins of central Oregon, they model a more complete sequence from foraging, to rest-rotation foraging, to semisedentary collecting, and finally, to equestrian hunting and gathering. Patterns in both regions reflect responses to population/resource dynamics operative in environments with very different intensification options.

It is important to note that the PEP model assumes that, while organizational responses may vary, the general tendency is directed toward greater land-use intensification, logistic reorganization and increasing social complexity through time. In so doing, the model remains consistent with general forager/collector expectations. Its greatest refinements lie in directing our attention to subsistence and settlement variability that may be hidden within simple forager to collector jargon, in accommodating regional land-use variation within a single scheme, and in building a compelling ecological foundation in support of its arguments.

An Intensification Model for Mount Rainier and the Southern Washington Cascades

To this point, discussion has focused on theoretical background linking human and environmental systems, with particular emphasis on basic causes of organizational change in subsistence and settlement systems through time. Particular attention has been given to implications of human population density relative to the distribution, density and seasonality of critical resources—particularly ungulates and anadromous fish. I suggest that chronic shortfalls in availability of key resources induced primarily by increasing regional population density and/or resource degradation have over the long-term been met by increasingly intensive use of the landscape. That is, as the Holocene progressed, population and resource variables interacted to create selective contexts favoring development and continuance of land-use systems capable of extracting and distributing increasing resource levels from fixed or declining territory.

Substantial attention also has been given to providing background to *intensification models* which attempt to describe and explain basic processes of change in subsistence and settlement systems in the Pacific Northwest. I have focused on Binford's (1980) forager/collector ideas as the intellectual foundation for these approaches not so much because his views can be applied uncritically or without modification, but because 1) of their capacity to subsume critical organizational elements of both ends of the hunter-gatherer continuum; 2) of their predictive power for basic site type and distribution patterns; and 3) they constitute a baseline, widely referenced approach with established application to regional prehistory. Examples have been given of intensification models built on this foundation to develop familiarity with the approach, provide a "road map" through changing nomenclature, and, hopefully, convince the reader of their value as a framework for interpreting long-term patterns in human use of the region. Figure 5.2 compared these models, as well as the one proposed for Mount Rainier and the southern Washington Cascades.

The present model predicts patterned change in subsistence and settlement systems from early Holocene hunter-gatherers moving between resource patches as small, residential groups with minimal reliance on bulk procurement and storage (*foragers*); to late Holocene populations obliged to reside, at least seasonally, in sedentary villages reliant on over winter storage and relatively complex resource procurement and distribution strategies carried out to varying degrees by task-specific collection groups tethered to the village center (*collectors*). The model is organized into six temporal stages which summarize basic subsistence and settlement characteristics expected to dominate the region for the indicated time period. Also included are implications for the archaeological record of the southern Washington Cascades and Mount Rainier National Park. Nomenclature has been selected to maximize compatibility with existing intensification models while incorporating parameters (particularly mobility and rest-rotation options) considered to be of central importance to prehistoric subsistence and settlement patterns.

It is important to recognize that this, and all models, simplify reality. They smooth intergroup organizational variability and understate system dynamics taking place within each of the temporal periods. The advantage of simplification lies in the capability of a macroscopic view to clarify patterns within more complex systems' states, and to isolate (we hope) basic causes underlying development and change in human subsistence and settlement systems through time. Because of theoretical grounding and links to objectively observable phenomena, we can move beyond speculation about the past to use of the archaeological record as a data source for testing and rejecting or refining the land-use patterns proposed.

Post-Pleistocene Foraging (>11,000 to ca. 8,000 B.P.)

Environment

Terminal Pleistocene floral and faunal patterns across much of northern North America were regionally variable and dynamic. On the Columbia Plateau east of the Cascades, the climate was cooler and drier than present. The region supported a variety of large bodied fauna including mastodon, bison and caribou which, along with a variety of smaller species sharing similar habitat requirements, declined to extinction as the climate warmed and human predation began (see Schalk and Atwell 1994 and Gustafson et al. 1979). According to Taylor et al. (1996:516), initial extinctions may have begun about 11,000 years ago. *Bison antiquus* may have been the longest surviving of the large Pleistocene grazers, declining to extinction circa 8,500 to 8,000 years ago.

Abundance of these herds in the Pacific Northwest and their capacity to sustain human predation, is difficult to establish. However, given the tendency of the region's bunch grass prairies to degrade under heavy grazing pressure (Mack and Thompson 1982), it is reasonable to assume that density of these megafaunal grazers was more limited here than on the high plains further east. Even so, scattered distribution of large fluted Clovis-style lance points typically associated with exploitation of these animals suggests human presence in the Columbia Plateau and eastern Cascades foothills, probably focused on exploitation of early post-Pleistocene megafauna and other habitat-sharing species.

West of the Cascades, plant and animal communities appear to have dispersed into previously ice mantled areas of the Puget Trough and Olympic Peninsula during the Everson Interstadial circa 13,500 to 11,000 years ago. This period may also have witnessed colonization by some Pleistocene megafauna. It is plausible that the elephant excavated at the Manis Mastodon Site near Sequim on the drier east flank of the Olympics (Gustafson et al. 1979) is part of a population established during this time period.

Glacial ice advanced again during the Sumas Stade, pushing megafauna habitat further south into the southern Puget Trough (or eliminating it altogether). The ice retreated rapidly after about 9,500 years ago, allowing rapid development of dense lodgepole pine forest succeeded by more nearly modern floral associations.

In the Cascades, the Cordilleran ice mantle retreated dramatically during the Everson interglacial, opening lower elevation passes such as Snoqualmie north of Mount Rainier. On Mount Rainier itself, McNeely drift (a.k.a. Sumas Stade in the Puget Trough) ice again advanced down the major river valleys, lowering the snowline to about 5,900 ft. At this elevation, most of the Park's larger mid-elevation ridges, cirque basins, tarn fields, and open parklands would have lain under perpetual snowpack or been subject to vegetation depleting impact of extended snowpack and frost heaving (see Chapter 2). It is likely that near-modern floral associations became established briefly during the Everson Interglacial, retreated during the Sumas (McNeely) advance, and were established again following Sumas retreat circa 8,500 years ago.

Land-Use

The first colonizing populations probably penetrated the continent south of Alaska during the Everson Interglacial circa 13,000 to 11,500 years ago[39] following the movement of Pleistocene megafauna south through an ice-free seam between cordilleran and continental ice masses east of the Canadian Rockies. Though controversy remains as to timing of initial colonization, a selected suite of 20 firmly dated and calibrated Clovis and Folsom assemblages scattered across the continental United States (Taylor et al. 1996) are consistent with this time frame. It is reasonable to expect some of these colonizing populations to have spread into the Northwest during terminal Pleistocene and very early Holocene times. Human activity, however, was most likely focused on megafaunal habitats on either side of the mountain—particularly the Columbia Plateau.

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[39] Because of the variety of sources that make up age estimates employed in this volume, I have used radiocarbon ages as a standard temporal referent. Taylor et al. (1996) recently calibrated 20 Clovis and Folsom sites using both Quaternary Research Center (Stuiver and Riemer 1993) and uranium/thorium procedures. Their results suggest that radiocarbon ages in this range may reflect calendar dates 1,000 to 1,500 years older still. If so, the Everson Interglacial and earliest human colonization of North America south of Alaska may date to 14,500 to 12,000 B.P. or 12,550 to 10,050 B.C.

Schalk and Atwell (1994:[5]88) argue that no securely dated cultural remains in the Northwest predate 11,000 B.P. Nonetheless, presence of Pleistocene megafauna and early fluted points attests to an early post-Pleistocene human presence across the broader region A few of these points have been found in the Cascade fringe. Northeast of Mount Rainier, a Clovis find near Cle Elum suggests early human presence in the general Snoqualmie Pass area (Hollenbeck and Carter 1986:26). Note, however, that other than the East Wenatchee Clovis Site (45DO482), Clovis or other early Holocene sites in the Northwest have been found only in surface or compromised contexts, making their age difficult to establish unambiguously. Unfortunately, radiocarbon dates on bone from the East Wenatchee site did not return early Holocene ages. Even the Manis Mastodon Site lacked clear association with diagnostic artifacts, though presence of a single used flake plausibly (if uncertainly) indicates human presence in the Puget Trough perhaps as early as 12,000 years ago.

On Mount Rainier, open forest/tundra habitats probably became established as early as 12,000 B.P. on its lower to mid-elevation flanks. Most economically important Holocene fauna probably became established during this period as well. These habitats would have retreated downslope during McNeely Drift times and advanced again as ice retreated circa 9,000 to 8,500 years ago. It is possible that earliest human use of the lower southern Washington Cascade passes dates to the post-Pleistocene period. Use of Mount Rainier itself is less likely. However, most foragers probably focused on the most productive megafauna habitats east, and to a lesser extent west, of the Cascades. Montane game density would have been too low and exploitation costs too high to have attracted significant use by the few human groups entering the region during post-Pleistocene times. The probability of human forays into the midst of the southern Washington Cascades and onto the flanks of Mount Rainier increases sharply with massive glacial retreat and establishment of modern plant and animal communities after 8,500 years ago.

The Archaeological Record

For the southern Washington Cascades, archaeological evidence of human occupation should be minimal and restricted to lower elevation passes. To date, the Cle Elum Clovis find is the only very early fluted point form plausibly linked to montane landforms in this region. Because of its surface context, the age and even location of original use cannot be determined unambiguously. Even so, its location near Snoqualmie Pass is consistent with post-Pleistocene foraging in the eastern Cascades foothills and/or with cross-Cascades travel at an early date.

Extant radiocarbon data are consistent with these expectations. The earliest, plausibly culturally related, radiocarbon age presently known in the southern Washington Cascades is a circa 8,500 B.P. date recorded near the Cedar River north of the Park (see Table 3.4). Cultural deposits radiocarbon dated to the mid 6,000s B.P. are common (see Table 3.4), more firmly establishing human presence by this time. Currently, the oldest known site on Mount Rainier proper is the Sunrise Ridge Borrow Pit (45PI408), containing lithic debris sandwiched between 2,300 year old Mount Rainier C and 3,400 year old Mt. St. Helens Y_n tephras. For Mount Rainier National Park, however, cultural remains are not expected to date terminal Pleistocene or very early Holocene times prior to 9,000 B.P.

Rest-Rotation Foraging (ca. 9,000 to 6,000 B.P.)

Environment

Environmental parameters for the period have been anticipated above. During these three millennia, the earth rebounded from its long Pleistocene glacial episode (albeit with interglacial breaks) and entered a protracted period in which the general climatic conditions were measurably warmer and drier than present. In lowlands like the Puget Trough, forest succession was arrested or reversed as an increasingly xeric climate selected for brushier, more open forest stands. In the Cascades, tree-line crept further upslope, plausibly reducing the size of subalpine habitats as permanent snowline moved upslope and growing season lengthened. Assuming fire frequency remained stable, ungulate habitat would have improved in the lowlands and Cascade foothills, while it became more restricted at higher elevations.

The onset of the period is keyed to extinction of the last of the Pleistocene megafauna and full development of characteristic Holocene plant and animal communities in the Northwest. In the high Cascades, Cascade foothills and surrounding lowlands, near modern floral and faunal patterns became well established except as affected by Hypsithermal warming. Included are species believed to be of particular economic importance for hunters and gatherers now deprived of larger megafauna alternatives—elk, deer, mountain goat, bear, marmot, game birds, camas, huckleberries, and so on. Mountain sheep also appear to have been present during much of the prehistoric period. Anadromous fish populations are expected to have become reestablished in most Northwest watersheds.

Land-Use

Human population density is expected to have increased slowly but remain at relatively low levels during the early Holocene. With extinction of Pleistocene megafauna, resource productivity on the Columbia Plateau declined substantially. Even at low population density, extinction of these large animals should have induced increased use of a broader resource spectrum focused particularly on the habitats of the most productive surviving ungulates—ostensibly elk and deer. Assuming that the densest distributions of these ungulates were biased toward Cascade foothills and surrounding lowland landscapes, it is reasonable to expect their human predators to have increased their presence in these areas as well. Accordingly, the model anticipates that Pleistocene extinctions were associated with punctuated increase in hunter-gatherer activity in the Puget Trough and southern Washington Cascade foothills east and west of the range.

Lowlands and Cascades foothills are emphasized because of the presumed impact of the Hypsithermal climate on forest structure. If ungulate habitat became more productive in the lowlands and simultaneously less productive in the uplands due to forest encroachment, then it is reasonable to expect human populations to have focused attention on low to moderate elevation landscapes with less attention to high elevation places. Given the combination of relatively low predation pressure (low human population density), productive lowland habitats, and tendency of game to aggregate in mountain foothills (Schalk 1988:90-91), hunter-gatherers probably emphasized use of valley and foothill environments throughout the period. Use of subalpine uplands, such as those on Mount Rainier, is also possible. However, relative difficulty in entering these areas, and absence of compelling need to do so on a regular basis, probably combined to limit use until later in the Holocene.[40]

The period title reflects subsistence and settlement patterns expected to have characterized the region from circa 9,000 to 6,000 years ago. Because of high game density relative to demand and tendency for ungulates to aggregate in open lowland and foothill habitats, it should have been possible to sustain a foraging strategy with relatively short distance residential moves and minimal dependence on bulk processing and storage. Foraging may have focused on a broader spectrum of resources relative to the Post-Pleistocene period, but plants and animals selected are expected to be dictated by seasonal availability and proximity to ungulate hunting areas. *Rest rotation* refers to the capacity of groups to move to new foraging areas as hunting productivity declines, thereby allowing predation-free time for game density to regenerate naturally. Ability to do so depends on availability of abundant open space with minimal resource

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[40] Despite similar orientation, this argument is contrary to Schalk's (1988) ideas for early use of the uplands in Olympic National Park. The difference is due, I believe, to his assumption that upper elevation forest cover would have been reduced by Hypsithermal warming rather than expanded by suppression of snowpack and lengthened growing season.

competition by other groups. The pattern is of key importance to maintaining a forager strategy, because it insures resource stability without sophisticated logistic strategies or intergroup coordination. In an environment like that of the Pacific Northwest, I believe that it is only practical in a context of very low population density and high resource abundance.

Archaeological Record

No sites have yet been dated to the 9,000 to 6,000 B.P. period in Mount Rainier National Park. While it is possible that such sites eventually will be found, strict application of the present model suggests that such sites will be rare. Without intentional burning to enhance upland forage (considered unnecessary in the low population/abundant resource context of the early Holocene), foraging activity should have emphasized lower elevation foothill and valley landforms. These sites should be limited in size but contain a functionally varied array of artifact classes consistent with residential use.

Radiocarbon dates from sites in the southern Washington Cascades (see Table 3.4) are strongly consistent with human presence in these contexts near the close of the period. A circa 6,250 B.P. radiocarbon date from an obsidian quarry in alpine context (45LE285 at Elk Pass) also suggests at least limited early use of higher elevation landforms dating to the close of the period. Additional research geared toward developing a larger set of dated upland sites in firm stratigraphic context will be useful for determining the extent to which land-use emphasized lower elevation landscapes as predicted here or incorporated subalpine habitats, requiring modification of model expectations. Ostensibly early "diagnostic" artifacts, such as leaf-shaped *Cascade* style dart points, are not sufficiently temporally sensitive to establish early Holocene time frame in the absence of firm stratigraphic or chronometric supporting data.

Semisedentary Rest-Rotation Foraging (ca. 7,000 to 4,000 B.P.)

Environment

Present data suggest that the Hypsithermal Interval gave way to a period of generally cooler and moister conditions about 5,000 to 4,500 years ago—conditions that persist with shorter-term perturbations to the present. Termination of the Hypsithermal had significant, but opposite, effects on lowland versus upper montane forest structure. In lowland valleys and foothills, forest cover became more uniform and began to approach more nearly closed canopy cover. That is, overall ecosystem maturity increased toward the Maritime Forest pattern that now dominates the region. In these areas, ungulate forage should have been restricted by the shrinking size and number of grassland and brushy habitats.

In the mountains, where upper elevation forest cover is controlled more by snow pack and growing season than by moisture, forest cover should have retreated downslope to approximatly present elevations. Increasing expanses of alpine tundra, and subalpine parklands should have attracted correspondingly increased numbers of elk and deer during the late summer months when forage was at its peak. Coincident degradation of forage in the lowlands with seasonal improvement in the uplands is expected to have contributed substantially to punctuated increase in human use of places like Mount Rainier National Park during this time frame.

On Mount Rainier, climatic impacts are complicated by Holocene vulcanism. The mountain experienced a particularly destructive series of volcanic events beginning about 6,600 years ago and culminating in the massive Paradise-Greenwater-Osceola mud flows circa 5,000 to 4,500 years ago (Harris 1988, Scott et al. 1995). These events removed circa 2,000 ft from the summit, altered landscapes on the mountain's northeast and eastern slope and inundated the White River floodplain almost to Tacoma (see Figure 2.2).

Land-use implications of mid-Holocene volcanic events are difficult to gauge. Clearly the summit collapse and larger lahars were catastrophic events destroying plants, animals and people unfortunate enough to be in their path. However, early succession processes involving growth of rapidly reproducing grasses and brushy plants most valuable as ungulate forage generally began immediately. Succession may be well advanced in several years. It is likely, then, that habitat destruction was short-lived and followed quickly a slightly longer period of ungulate habitat improvement. Accordingly, I assume that these events, while dramatic, did not significantly affect (and certainly did not reduce) forager use of the uplands or major lowland river valley in the long-term scale with which we are dealing.

Land-Use

To accommodate low but gradually increasing population density and loss of lowland and foothills ungulate habitat at the end of the Hypsithemal Interval, Northwest groups should have increased exploitation of a wider range of variably productive habitats, including higher elevation montane landscapes. Consequent changes in foraging strategies are expected include limited sedentism and storage to bridge short-term winter food shortages. It is reasonable to expect, however, that competitive resource pressure was not yet high enough to cause loss of at least two options central to forager production: continued existence of enough uncontested territory to maintain rest rotation movement, and ability to move to most resource patches as full residential units rather than as limited-task groups tethered to larger central villages. In essence, the model assumes that mobility became restricted slightly by incorporation of limited bulk harvest and storage activities, but not enough to lose rest-rotation and full residential movement options.

As noted above, forage should have become more productive in the uplands as forests retreated downslope to near modern elevations. Accordingly, use of subalpine and alpine zones on Mount Rainier and the southern Washington Cascades is expected to increase as a direct consequence of their increased foraging value.

In short, the most salient aspects of the forager strategy (e.g., small group size, relatively frequent residential moves, minimal bulk processing and storage, limited intersite variability) are expected to remain region wide. However, combined population and environmental circumstances are expected to have operated to cause 1) settlement in less optimal habitats, 2) increased variability in foraging strategies, 3) short-term bulk processing and storage, and 4) punctuated increase in use of upland habitats coincident with environmental cooling at the end of the Hypsithermal Interval.

Archaeological Record

Site types should remain roughly comparable to those from the early Holocene, but with 1) a higher site total consistent with increased regional population density, 2) dispersal into a wider range of habitats on both sides of the mountains, 3) increased representation in montane uplands, and 4) a fraction of larger, more complex sites in lowland settings with evidence of storage facilities or use of resources such as anadromous fish, camas and/or other storable plants and animals. Site density in Mount Rainier subalpine and alpine zones should increase abruptly, particularly as the Hypsithermal climate weakened in the second half of the period.

An increased number of radiocarbon aged montane sites dating between about 5,500 and 6,500 B.P. (Figure 3.5) is essentially consistent with these expectations. Unfortunately, an insufficient number of securely dated sites is available from subalpine contexts to address the expectation of punctuated increase in use of high elevation settings in a meaningful fashion. Because of its growing number of documented sites and substantial subalpine and alpine habitat, Mount Rainier may offer an unusual opportunity to investigate expected environmental and land-use changes. Environmental patterns could be addressed through pollen core extraction and paleoenvironmental reconstruction. Land-use changes can be examined through test or data recovery excavation at a set of upper elevation site locations.

Semisedentary Collecting (ca. 5,000 to 1,500 B.P.)

Environment

This period saw full termination of the Hypsithermal Interval followed by oscillating, but generally cooler and moister climatic conditions as shown on Table 2.3. Forest density in the lowlands and western foothills, if unaltered by fire, should have continued in a high maturity state with concomitant limitations to ungulate forage. Subalpine to alpine plant and animal communities should have remained at approximately modern levels. Indeed, both uplands and lowlands probably appeared essentially as they do at present, except as modified by fire and short-term climate changes.

Massive volcanic events had lowered Mount Rainier's peak and altered upper elevation landscapes and major river valleys at the beginning of the period. About 2,500 years ago, a second volcanic cycle rebuilt the summit to is present height. It also deposited from one to eight inches of tephra (Mount Rainier C) over much of the mountain's northern and eastern flanks (Crandell 1987:14-15). Vegetation alteration and land-use implications of this event, however, appear to have been insignificant (cf., Dunwiddie 1986). Most of the volcanic activity took place in the summit caldera at elevations of little consequence to human use of the mountain. Effects of tephra deposits on northeast slope plant and animal communities certainly were less significant than original summit destruction about 2,000 years earlier. Accordingly, Mount Rainier C events probably had negligible effect on settlement and subsistence practices on the mountain and across the broader region. Similar expectations hold for land-use effects of earlier Mt. St. Helen's series Y eruptions occurring between 3,250 and 4,000 years ago.

In general, there is no indication that mid-Holocene environmental circumstances improved the regional resource/population equation. Subalpine habitats, because they are limited in total area, are not likely to have compensated for lost winter forage in the lowlands and foothills. In a natural state, ungulate population density, particularly on the wetter westerns slope, should have decreased overall.

From a human standpoint, lost ungulate habitat probably was not critical so long as population density remained low relative to abundance. By about 4,000 years ago, however, it is likely that demands on available resources reached a point beyond which they could be reliably met with previous hunting and gathering strategies carried out by small autonomous forager groups. It is assumed that combined impact of rising human population density and restricted ungulate habitat constituted an environmental context favoring 1) increased use of fire to expand ungulate habitat, particularly in lowland and foothill settings; 2) loss of rest-rotation options; 3) more intensive reliance on mass harvested and stored anadromous fish and other storable commodities; 4) loss of residential mobility; and 5) logistic reorganization consistent with intensive land-use requirements.

Pacific Northwest Forager to Collector Land-Use Changes

A shift to winter reliance on mass harvested and stored anadromous fish is the key element underlying land-use change from the high mobility foraging pattern to the limited mobility collector pattern that dominated Northwest hunter-gatherer economies in the latter part of the Holocene. The model assumes that between about 5,000 and 4,000 years ago, elevated population density and declining ungulate habitat reached a point at which competition for available resources was too high to reliably sustain rest-rotation foraging practices. Loss of rest-rotation recovery options set up a positive feedback response, quickly leading to over predation and precipitous decline in game abundance. In this context, foraging land-use systems, critically dependent on closely spaced resource patches and high game abundance relative to population density, became untenable; causing a rapid shift toward logistically organized subsistence and settlement strategies centered on major salmon bearing rivers and streams (cf., Schalk 1988:99-104).

There are only a few Pacific Northwest resources capable of meeting bulk acquisition and storage requirements needed to bridge winter shortfalls and withstanding continuous intensive use without collapse. Foremost among these is anadromous fish. Others include winter collected marine resources, camas in very productive habitats, and perhaps wapato and biscuit root in places where they grow best. Anadromous fish, however, offer the highest return for effort of the available options. Salmon bearing streams are widely distributed across the region, the oceanic growth cycle supports very large populations, runs are predictable in place and time, and food return per harvest event can be high if labor is sufficient.

Despite these qualities, there is compelling reason *not to expect* mass harvest and storage of anadromous fish before being forced to do so. Large-scale salmon procurement and storage is a labor intensive undertaking entailing loss of residential mobility through an extended harvest and storage period. As a central feature of a collector economy, it also involves a host of subsistence and social adjustments. Schalk (1988:98-99) describes costs and risks of dependence on mass harvested salmon as follows:

> The costs of food storage in this environment are quite high... Due to the high precipitation and humidity as well as the mild winter season temperatures, effective storage of fish through desiccation or through freezing is impractical. Saturation of fish flesh and oils with the phenols in wood smoke (Schalk 1984) was essential to effective storage of oily fish like salmon. To effectively store salmon in this environment for winter consumption requires technology for mass harvest, appropriate structures for smoking the fish, containers and sheltered space for storing it, and large inputs of human labor spanning the entire interval from the time the fish are caught until eaten months later.
>
> There are also *risks* involved in dependence upon stored foods to survive productive lows. Poor runs or even run failures occur naturally and, even if very infrequent, would have necessitated fall-back strategies. Perhaps a greater risk though is the potential that fish successfully stored may not be successfully consumed. Spoilage, loss to predators and scavengers and even loss to other human groups are some of the more obvious sources for this kind of risk.

It was costs and risks such as these that made reliance on mass harvest and storage of anadromous fish undesirable prior to onset of chronic resource related needs to do so. Intensive use of marine resources entails even greater liabilities. According to Schalk (1988:109):

> ...the more productive marine resources are only seasonally available and tend to be restricted in abundance or entirely unavailable during the winter months. Added to this are ...accessibility problems... The weather can be stormy for days on end making travel by watercraft difficult or impossible. Many shellfish are only available at low tide and ...during the winter months [the tides] are not as low as during the spring and early summer and they occur at night time.

Plants do not fare any better than marine life as over-winter stored staples. Suitably productive habitats, while locally important in the absence of anadromous fish, are too few and far between to sustain a region-wide forager to collector shift. Camas, arguably the most valuable of the plant staples, entails high harvest and preparation costs and requires a long storage period (see Thoms 1989). Bulk storage of plant products generally entails greater labor and storage costs due to the need to collect, process and store larger quantities than their salmonid equivalents. Furthermore, because of intensive harvest needs, other than in exceptionally productive areas, non-horticultural plants cannot sustain intensive long-term use in the absence of alternative resource supplements.

Largely due to widespread availability and sustainable productivity, anadromous fish were therefore most plausibly the earliest resources relied upon for over-winter mass storage. Schalk (1988:110) suggests that initial settlement should have been geared toward larger rivers providing stable fisheries in areas that also maximized continued access to ungulate procurement places. Through time, we should see progressive expansion onto less productive streams, followed by adoption of lower return resources as intensification pressure continued to increase.

Once required to change to primary subsistence reliance on mass processed and stored fish, remaining characteristics that define collector systems fall into place. Perhaps the most important change is to nearly sedentary residence in relatively large aggregated villages. With a fishing dominated economy, residence is restricted to riverine settings from autumn through winter by the extended procurement and storage needs that anadromous fish entail. Group size increases to accommodate higher regional density overall and meet elevated labor requirements. Indeed, *increased* population may be expected to closely follow a shift to collector (or agricultural) strategies, in part, to meet these new labor demands (cf., Schalk 1988:111).

Because of large group size and scheduling requirements related to reliance on anadromous fish, collectors forfeited the capacity to move freely across the landscape as a residential unit at times at times optimal for procurement of non-salmonid resources. Late summer to fall use of subalpine habitats, for example, conflicts directly with salmon harvest and storage in the lowlands. In short, sedentism, bulk storage, group size, scheduling requirements and degraded game habitat combine to force a shift to a full collector systems in which relatively few resources become the central focus of attention and supplemental resources are either sought by limited-task groups tethered to the residential hub or are supplied by trade. There is no middle ground. Even social complexity must increase to regulate the more involved tasks required to sustain larger groups in limited territory.

Changes to Montane Land-Use Patterns

Widespread adoption of riverine collector strategies implies primary settlement and subsistence focus on lowland and foothills settings through most of the year. Due to presence of upstream barriers, productive salmon runs seldom penetrate deeply into high elevation landforms, and almost never in close proximity to subalpine habitats. As discussed in Chapter 2, anadromous fish were probably never an important resource in Mount Rainier National Park. Subalpine to alpine habitats, arguably once a normal part of the forager seasonal round, became logistically challenging areas at the margin of effective resource gathering territories tethered to lowland villages. Transportation difficulties inherent in using upland habitats were not great so long as game was plentiful and used primarily to supply immediate consumption needs. Costs increased sharply, however, in a context of depleted game and use by collectors charged with transporting resources back to a distant residential base.

In his Olympic Peninsula study, Schalk argues for declining use of the uplands during the late Holocene.

> Early in the ...project it was postulated that subalpine areas were likely to have been used more intensively during the early and mid-Holocene than after the emergence of semi-sedentism in the region (Schalk 1985). This expectation derives from the fundamental

> differences between land use systems that emphasize residential mobility versus those which emphasize logistic mobility. The implication ...is that native usage of the Olympic mountains prior to the appearance of the riverine and maritime collecting systems involved systematic exploitation of resources in Zone IV [*Subalpine and Arctic*]. After the appearance of the collector systems, however, the focus of exploitation shifted downward in elevation onto the ungulate winter ranges that are generally below 2,000 ft in Zone II [*River Valleys and Lowlands*] (Schalk 1988:150). [*Zone titles added.*]

Schalk (1988:151) goes on to suggest that available archaeological data from Olympic National Park were consistent with a bias toward early Holocene use. Later, during the Mount Rainier project, he reemphasized the point verbally; arguing that optimal foraging principles lead to the expectation that the most efficient season for exploitation of ungulates would be winter when these animals are at relatively low elevations and when scheduling conflicts with other subsistence activities would be minimized. After moving back downslope, game could be taken nearer the residential base in the winter season when food need was highest. Subalpine zones essentially would serve as unmanaged summer pasture land where elk and deer could fatten for later use.

The arguments make sense. Interestingly, compelling as they may be, they *are not consistent* with archaeological data from Mount Rainier. Extant Mount Rainier data presently lack clear evidence for very early use. More significantly, radiocarbon dated sites, wide distribution of arrow-sized projectile points and presence of cultural debris atop 2,300 year old Mount Rainier C tephra leave little doubt that upper elevation Mount Rainier and southern Washington Cascade landscapes continued to be used throughout the Holocene coincident with full development of collector strategies in the lowlands.

This deviation from expectations despite compelling optimal foraging arguments to the contrary provokes intriguing land-use possibilities that must be accommodated in the model. I suggest that use of high elevation places did indeed decrease on a per capita basis, but that use of subalpine landscapes can be expected to continue for one or all of three reasons: 1) uplands could not be left as unmanaged pasture land in a population packed region without being further degraded by "cheaters", and/or 2) marginal populations continued low intensity forager practices on the fringes of increasingly centralized lowland society, and/or 3) limited task groups tethered to lowland villages acquired high return commodities not available in the lowlands.

Garrett Hardin, an ecologist who developed much of the competition theory imbedded here, also advanced explanations as to why unmanaged resources tend to degrade to crisis levels when used in common by people lacking clearly defined mutual obligations. In *Tragedy of the Commons*, Hardin (1968) uses the example of pasture land commons in Britain to argue, in essence, that such circumstances always serve to the selective benefit of over-users. That is, "as long as a pasture [or any other resource] is considered to be unlimited and for common use by everybody without constraints, then ...overuse is inevitable since the individual gains a temporary advantage by overstocking [or overuse] and only at some later time ...begin[s] to suffer the collective consequences of overuse" (Odum 1971:245). In this light, the expectation that Mount Rainier's subalpine "pastures" will be left untouched by linguistically and socially distinct groups on all sides of the mountain with, at best, marginal obligations to one another is unreasonable. Despite its degrading state, it is more reasonable to expect a) marginal groups to continue to exploit remnant resources at a low level and/or b) groups dependent on winter hunting to establish territorial rights over critical portions of the uplands and protect them from overuse. In the latter case, limited task groups may have been dispatched to the mountains less to collect and return stores to lowland centers, than to insure that ungulate resources return to the lowlands with the onset of winter.

In addition to protecting montane resources or continuing exploitation by marginal foragers on the fringes of collector dominated society, is the possibility that late Holocene hunting focused less on ungulates and more on alternative high value resources such as mountain goats (wool), marmots (fat) or huckleberries (dried) that are not available in the lowlands. Because of transportation difficulties and scheduling conflicts noted above, it may be impractical to expect these resources to be taken in abundance unless affiliated with other land-use needs as outlined below or prior to transportation enhancing introduction of the horse.

Recognizing the dangers of a complex scenario, I suggest that a combined explanation is most plausible. It is likely that early in the Semisedentary Collecting period, upland ungulate hunting continued to be carried out by a decreasing number of marginal forager groups. As resource pressure mounted, lowland groups extended territorial rights over critical watersheds and upland summer game habitats. This assumes that ultimately, benefits of protecting game populations became great enough to warrant the costs of dispatching limited-task groups to protect territorial/resource rights during the critical late summer months. To be effective, it would have been necessary to extend protection over a circa two month period. Accordingly, such groups would have been obliged to establish residential base camps (very likely much the same as foragers), carry out low-level maintenance hunting while in upland residence, and ultimately return to the lowland center in late autumn with the highest value for weight commodity(ies) available on the mountain.

In short, it is reasonable, indeed expectable, for human use of the mountains to continue throughout the Holocene, albeit on a restricted per capita basis and oriented to fill different social/economic needs. Rather than use dominated by mobile mixed sex and age residential groups, the mountains became tied into more complex land-use practices ancillary to intensive use of riverine resources in the lowlands. Changing mountain land-use practices were part of a regional shift in settlement and subsistence practices from forager dominated systems fit to a context of low population density relative to terrestrial game abundance; to collector systems better able to cope with increasing demand and restricted availability of wild terrestrial resources.

Archaeological Record

The present archaeological record of Mount Rainier and the southern Washington Cascades leaves little doubt that human use of the uplands continued throughout the Holocene. What remains is not to debate the fact of continuing uplands use, but rather to address how land-use practices may have changed and how those changes affected the archaeological record. Interestingly, it is possible—I believe probable—that site type and distribution patterns in the mountains may not appear to be substantially different if forager and collector land-use practices developed as outlined above. Due to the need to maintain upland residence during the subalpine/alpine summer, factors affecting site selection and use may have been much the same in early through late Holocene times. Because of occupation length, both foragers and collectors would have been obliged to establish residential base camps in settings fit to unpredictable high elevation weather patterns. Both foragers and collectors probably operated out of these camps through a series of task-specific resource acquisition locations or information stations. Differences between the two systems may lie largely in 1) the social composition of the groups; 2) the suite of upland resources sought; and 3) the composition of tool kits and features employed in carrying out these tasks.

Due largely to the need to maintain extended residence, archaeological signatures differentiating early from later sites are expected to be subtle. Each of the three areas of variation noted above may be detectable in the archeological record given directed research and a large enough sample size. For example, the expectation of differences in social composition assumes that earlier forager groups would have sex and age range reflecting the full social unit in residence on the mountain. Collector residence is more likely to consist of a subset of the larger population, the remainder of which would have been occupied by lowland tasks in the late summer. Unfortunately, because maintenance and food preparation tasks may have been varied in both cases and because both may have selected similar base camp settings (I have proposed the upper forest/subalpine ecotone), the archaeological signatures may be similar. Indeed, it is possible that mixed sex and age groups may have used the mountain through time, even if representing a social subset in later times. Archaeological variation, if any, must be the subject of empirical investigation. I suggest that most robust early to late Holocene changes will lie in other archaeologically observable domains.

If the resource arguments above have merit, the greatest single source of variation between early and late sites should lie in the relative proportions of game animals sought and, in principle, preserved in the archeological record. All else being equal, early Holocene deposits should contain a high fraction of large ungulate remains (principally elk and deer). Late Holocene collector components should show a higher fraction of smaller animals, including particularly a higher fraction of remains linked to potentially high value transportable commodities—goat and perhaps marmot remains.

Potential change in artifact and feature complexity associated with early versus late Holocene land-use practices reflects the need to maintain high residential mobility with relatively low site reuse among foragers versus greater potential for redundant site use and exploitation of a somewhat broader range of resources among collector groups. To accommodate high residential mobility, forager tool kits should be small, portable and suited to multi-functional applications centered on the need to kill and butcher large body-sized animals. Such needs may characterize later Holocene use as well, but modified by incorporation of a higher fraction of small body-sized game, greater functional variability among site types, and enhanced potential to reuse site locations and thereby lessen transportation weight by caching tools. With lessened weight restrictions and a potentially greater number of tasks to be performed, tool kits should be more complex and contain implements such as arrows, darts and distinct butchering tools suited for extraction of wider size ranges without as pressing a need for multi-functional portability. Feature variability may increase in the later Holocene as well; particularly if goat hunting (high elevation blinds) and huckleberry processing (fire drying features) become integrated into the range of upland tasks.

Unfortunately, extant data do not allow us to address possible early to late Holocene site variation patterns in more than an impressionistic sense. It is interesting that, despite currently limited research in the Park, at least three sites have qualities consistent with the general tenor of the collector end of the land-use continuum. Goat (or sheep) teeth at Fryingpan Rockshelter excavated from sediments circa 1,500 to 2,500 years old are the only firmly identified faunal remains yet obtained from the Park. Artifacts from the 2,300 to 3,400 year old Sunrise Ridge Borrow Pit site are consistent with residential base camp expectations and include a ground stone hammer not expected in portable forager assemblages. Artifacts dating to the last 1,200 years at Berkeley Rockshelter, show substantial diversity including both dart and arrow sized projectile points, suggesting a mixed hunting strategy late in the Holocene.

Clearly, existing Mount Rainier archaeological data are too limited to constitute a rigorous test of expectations offered here, particularly in the absence of any clearly early to early middle Holocene components. It is likely that present absence of early sites is a product of poor site visibility due to mid-Holocene vulcanism and limited subsurface archaeology in the Park. With currently available information, it is clear that extensive use of Mount Rainier subalpine to alpine habitats took place during the last 3,000 years. It is reasonable to believe that such use extended at least several thousand years deeper into Mount Rainier's prehistoric past. I suggest that it is reasonable to model processes underlying such use as outlined above. Refinement of these ideas in light of concrete archaeological data awaits directed research to that end.

Intensive Collecting (ca. 2,500 to 400 B.P.)

Environment

Late Holocene climatic conditions remained relatively cool and included an acute glacial advance between about 900 and 500 years ago (the Garda Stade on Mount Rainier). The extent to which this advance influenced resource patterns is difficult to determine. All else being equal, high elevation ungulate forage should have been improved by snowpack suppression of forest cover, while low elevation forests expanded in response to increased moisture overall. On strictly environmental grounds, there is reason to expect seasonal hunter-gatherer use of high elevation landscapes to have continued throughout the period unless upland hunting was restricted to maintain elk and deer populations as proposed by Schalk. In the lowlands, cool and moist conditions would have further exacerbated problems related to increased forest maturity (and reduced ungulate habitat) operative since the close of the Hypsithermal Interval. Such resource limitations, probably further heightened by elevated population density, can be expected to have selected for efforts to intensify resource acquisition through 1) fire maintenance of lowland and foothills ungulate habitat; 2) more intensive use of anadromous fish and intensively exploitable plant resources such as camas and wapato; and 3) increased reliance on collection of marine resources.

Land-Use

Most implications for increasing land-use intensity have been addressed in the preceding section. Considerable attention has been given to causes and effects of the forager to collector transition because such land-use changes entail substantially different organization of resources, territory and labor while remaining within the general bounds of hunter-gatherer economy. As modeled here, the Intensive Collecting period assumes mounting population pressure on available resources countered by incorporation of additional mechanisms to increase food output and buffer resource shortfalls.[41] Expected changes include an incremental shift toward 1) incorporation of a higher fraction of lower return mass harvestable resources; 2) expansion into marginal habitats; 3) extension of trade networks and development of alternative mechanisms to extend resource capture; 4) more tightly defined and defended territorial boundaries; and 5) increased intergroup competition and conflict.

Perhaps most obvious of the regional changes is development of maritime economies in coastal settings with productive off-shore waters. For the Olympic Peninsula, Schalk (1988:111-116) discusses the energetics of a shift to primary dependance on marine resources, providing compelling arguments for progressive incorporation of this resource base as population demands increase.

Nearer Mount Rainier, we may expect settlement on less productive salmon-bearing rivers and streams further inland. Collector settlements can also be expected to incorporate lower return bulk commodities such as camas, wapato and biscuit root in moderately productive habitats, particularly where they occur near salmon streams. Huckleberries may also be incorporated as a stored resource if procurement and processing costs are minimized by proximity to other less labor intensive resources.

Use of montane uplands on Mount Rainier itself is not expected to change perceptibly from Semisedentary Collecting to Intensive Collecting periods. It is plausible that competitive pressures for extension of territorial boundaries to stake claim to critical upland pasture areas was more acute near the beginning of the Intensive period rather than earlier in the Holocene. If so, it is possible that human presence in subalpine habitats would have increased because of increasingly regular dispatch of limited-

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[41] Please note that for the present I do not accept the notion of a mid to late Holocene population drop for the southern Washington Cascades.

task groups to protect summer ungulate herds and perhaps return with high value alternative resources as described earlier. The period is expected to end abruptly with precipitous population losses and social dislocation associated with introduced eastern hemisphere diseases 400 years ago or less.

Archaeological Record

Most dated prehistoric remains in the Park date to the latter part of the Collecting period or to the Intensive Collecting period as structured here. Because of the predominance of 2,300 year old Mount Rainier C tephra on the eastern and northeastern slopes of the mountain, it is likely that many of the currently documented sites and isolates found on top of this horizon date to this period (though some probably are reworked from below). There is little doubt that a larger number of earlier sites will be documented as additional firmly dated subsurface components are added to the Mount Rainier database.

Southern Washington Cascade radiocarbon data also imply a high level of montane land-use activity during the late Holocene (see Table 3.4). The elevated regional site total dated to the period shown, also is consistent with increased regional population density as predicted here. It is not surprising since many of these dates come from contexts in settings lower than the subalpine exposures represented on Mount Rainier. These are the kind of places that intensive collectors are expected to have been forced to use with greater intensity as population/resource pressures mounted in the later Holocene.

Mixed Strategy Hunting and Gathering (ca. 400 B.P. to near Present)

Environment

The last 400 years have witnessed a series of climatic changes—most within the "modern" range shown on Table 2.3. The most significant of these is the "Little Ice Age" that extends through most of the period from about 400 to 100 years ago. Circumstances initiating the period and its dramatic land-use changes, however, had little to do with climatic events. Indeed the period's climatic oscillations probably do not differ substantially from those of earlier times; our data are just more accurate. The most dramatic land-use changes, rather, reflect the impact of diseases and interaction with expanding Russian, British and especially American economies. Basic changes expected for Mount Rainier and the southern Washington Cascades are outlined below.

Land-Use

The time since America's discovery and colonization by European states has been marked by devastating change to Indian populations. While sources of change have been many, among the most dramatic are abrupt population losses and social dislocation due to introduction of old-world epidemic diseases, substantially expanded transportation and mobility made possible by introduction of the horse, and ultimately land-use and social changes resulting from overwhelming competition with the expanding American agricultural/industrial system.

The Pacific Northwest was not free of these processes. Epidemic losses, particularly among larger aggregated village populations, were dramatic (see Boyd 1985, 1990). Lewis and Clark, for example, visited the nearly deserted remnants of *Nechacole*—a 226 ft long multi-compartment plank house and ruins of associated buildings on the south shore of the Columbia River east of Portland—in April of 1806. Remaining inhabitants attributed the village demise to a smallpox epidemic circa 30 years earlier (Coues 1893:926-927). It is plausible that population reducing epidemics swept through the region earlier still. The period's 400 year initiation date anticipates that epidemic losses could date to as early as A.D. 1520 to 1600; related to overland transmission of diseases from central Mexico. Boyd (1992) believes that disease introduction post-dates direct Euroamerican contact in 1774—a time that correlates closely with Clark's observation at *Nechacole*. The precise date of the actual onset is less important than the extent of the impact on indigenous people, social organization and land-use practices.

Effects of rapid population loss on Northwest settlement and subsistence practices were almost certainly catastrophic. A conservative estimate of 60% decline (Boyd [1992:135] believes that 80% losses are likely) would have altered the population/resource equation and brought on sudden and severe stress to the structure of social and land-use systems. An earlier Cascades land-use model developed for Mt. Hood National Forest, anticipates the general character of these events (Burtchard 1990:24).

> Rapid population decline, while superficially appearing to ease resource stress, would result in the inability to provide organizational or labor support needed to maintain systems as previously structured. Massive short-term stress should have occurred as a function of inadequate labor to continue previous intensive food acquisition practices, and short-term lag in the regeneration of alternative hunted game to support the remnant population. People could not simply return to a broad-spectrum foraging pattern because game abundance would have been suppressed by previously heavy exploitation. We should expect, rather that surviving populations would again aggregate into composite groups attempting to maintain the *status quo ante.* Initially, at least, we should continue to see semisedentary settlements and seasonal upland foraging sites, though in substantially reduced number. Surviving settlement locations should tend to be those situated at optimal access points for camas, wapato, salmon and/or big game. In relatively short order, mesofaunal game densities should have begun to recover due to reduced human predation pressure. As herds increased, we may expect to see defections from the cold season village centers, as sub-groups split off to reform more mobile foraging adaptations.

It is possible, perhaps probable, that expected re-emergence of foraging land-use practices may have been cut short by extension of the fur trade into the Pacific Northwest, accelerating immigration, and repeated epidemic outbreaks. This is particularly likely if Boyd is correct about the relatively late date for regional introduction of epidemic diseases. At least since the mid-1800s, it is more likely that Indian populations maintained themselves at the margins of Euroamerican society, responding in various ways—including montane foraging/collecting—in an attempt to maintain viable existence in the face of severely disruptive pressures on their indigenous lifestyle.

While hardly as debilitating as diseases, introduction of horses at about the same time had a locally significant impact on indigenous land-use practices. Development of the plains equestrian "bison cultures" are among the most dramatic and best known examples. In the Northwest, impact of the horse was mixed. Clearly, horses altered transportation options and became an important part of some Northwest land-use systems—particularly in basin and range environments east of the Cascades. Other groups appear to have been affected very little. Schalk and Atwell (1994:[5]23) suggest that for groups situated between major resource foci, equestrian transportation may have been adopted in support of a role as middlemen in long distance trade (e.g., The Dalles fisheries/trade center on the Columbia and bison hunting grounds further inland). In the mountains, the horse's value is not as clear. So long as ungulates remained an important part of upland use and long distance transportation was not critical to maintaining newly formed composite collector or split off forager systems, the horse may have represented an undesirable competitor for available forage. Availability of canoes in the west side and Columbia River lowlands further reduced the transportation value of the horse in these areas (Burtchard 1990:24).

Horses, however, may have played a more important role in late prehistoric and early historical use of the southern Washington Cascades and Mount Rainier for huckleberry collecting. Indeed such use may have been particularly intense on eastern and southeastern slopes, where villages linked to equestrian based economies—like the Yakama—were relatively close to historically productive berry fields. Availability of equestrian transportation may have been an important element underlying the apparently intensive use of huckleberries reported in the ethnographic record (see Smith 1964:149-179)—both for packing storage containers and ancillary equipment in and dried huckleberries out.

The present model recognizes huckleberries as a storable resource that increased in importance during the Intensive Collecting period after 2,500 years ago, particularly where productive berry grounds were situated in close proximity to winter village locations. Because of high labor and transportation costs relative to return, use was expected to be restricted by the limits of pedestrian transport so long as alternative food options remained viable. With acquisition of the horse, however, huckleberry use may have increased dramatically, particularly if alternative upland resources were depleted. If so, Smith's (1964:155) allusion to huckleberries as "the primary attraction of the [Mount Rainier] mountain slope" while probably true, was a relatively young phenomenon in marked contrast to earlier land-use patterns dominating early to mid-Holocene times.

Ultimately, indigenous land-use systems were effectively overwhelmed by expansion of the American agricultural/industrial system into the Pacific Northwest. Indeed, the Lewis and Clark expedition was first overland extension of this system. President Jefferson is quoted as funding the expedition, in part, to find the "most direct and practical water communication across the continent, for the purpose of commerce" (Parsons and Shiach 1902:8). The inland water route was not found, of course, but commerce did indeed follow. By the mid to late 1800s, the region was filling rapidly with settlers, miners, entrepreneurs and others with little interest in or concern for the welfare of indigenous populations—people already suffering the consequences of epidemics, and severe social and economic dislocation. The Mt. Hood model summarizes general impact as follows:

> ...Reforming indigenous economic systems could not long compete with the intrusion of a complex state with very different, and generally conflicting land-use requirements. The Euroamerican industrial system relies on the extension and maintenance of very long distance supply lines for critical resources. Even in the mid 1800s, fossil fuel subsidized industry and transportation made possible the exploitation of regions that had heretofore been too remote for effective integration into the larger system. Settlers established farms, logging, fishing and industrial operations in areas that previously supported the indigenous economy. Eventually, surviving Indian populations were congregated [in most cases] into confederated reservations at places that represented minimal intrusion on the new land-use system. To partially ameliorate the effects of social disruption and relegation to marginal habitats, the new sub-systems were, and continue to be, subsidized by the new industrial state. The continuing development of water, rail, highway and air transport has tied the regional economy into the larger national and international system. Presently, the economy of the Northwest is critically tied to events emanating far beyond the spatial limits operative in the past (Burtchard 1990:24-25).

On *Tahoma*, human use shifted from the berrying and limited hunting activities that lingered on through the 1800s and early 1900s, to primary use as the recreation and wilderness preservation area known now as Mount Rainier National Park.

Archaeological Record

Combined effects of population loss and reorientation around the newly emerging agricultural/industrial land-use systems can be expected to have reduced and redirected use of upper elevation landscapes. Clearly, however, use of montane landscapes did not stop altogether. Indian familiarity with various parts of Mount Rainier and the southern Washington Cascades is indicated in accounts by early explorers and adventurers in the region. Early historic period use of Mount Rainier is discussed in passing by Schmoe (see 1925 and 1967) and in detail by Smith (1964). These accounts indicate a continuing interest in hunting and particularly huckleberry gathering directed to subalpine and alpine habitats on all sides of the mountain. Smith (1964:177-179) also describes characteristic fired berry drying features. For both theoretical and ethnographically reported reasons, then, we should expect to see at least a limited number of residential base camp and task specific locations on Mount Rainier, dating to very late prehistoric and early historic times. The latest of these locations should contain some European trade goods and utensils.

At least five of the presently documented sites in Mount Rainier have early 1900s historic materials or combined prehistoric and historical remains—Vernal Park, Berkeley and Mt. Pleasant rockshelters (FS 74-01, FS 86-02 and FS 72-02), Devil's Dream cache (FS 95-09), and Forgotten Creek site (FS 95-10). Historical remains at Mt. Pleasant rockshelter probably are related to mineral prospecting. The cache of cooking implements near Devil's Dream Creek in the Park's southwest quadrant appears to be related to cedar logging in the vicinity, though alternative indigenous uses cannot be discounted altogether. Multi-component materials at other sites may be related to very late (and perhaps earlier) uses of the mountain. Finer resolution awaits testing and data recovery research. Note, too, that because the present reconnaissance emphasized prehistoric rather than historical sites, early historic indigenous materials may be under-represented in the current sample. Additional systematic survey with a broader focus should improve our understanding of the more recent archaeological record of both Indian and Euroamerican based use of Mount Rainier.

In addition to residential base camp and hunting location remains, surveyors should be sensitive to characteristic signatures of huckleberry processing features—which may or may not be directly associated with base camps. Allan Smith's informants allude to two general procedures for drying berries: 1) on mats stretched between poles and suspended several feet above small fires; and 2) on a low linear mound opposite a burning log. A number of these latter type features have been found in the Gifford Pinchot National Forest and a few have been excavated (Mack and McClure 1996). On the modern surface, features tend to appear as low linear mounds. Excavation reveals elongated charcoal deposits opposite a sloping mound, often in association with fire cracked and unbroken rock. Deposits also should produce, of course, *Vaccinium* remains in macrobotanical samples.

Concluding his discussion of huckleberry use on Mount Rainier, Smith (1964:179) suggests that

> Under favorable conditions of preservation, evidences of ...gathering baskets, of storage and transportation baskets and bags, and of drying mats might be found in archaeological deposits. More particularly, the remains of the drying racks or mounds and the fires in association with them might be sought for. On the basis of the available data, it would be expected that the drying mounds would be limited to the eastern flanks of the mountain within the territory assigned here to the Yakima and that the racks would be present elsewhere. It would be of interest to determine if the archaeological data confirmed the mutually exclusive distribution of these two items of material culture.

While the preservation conditions Smith hopes for may be unrealistic in Mount Rainier's wet climate, linear charcoal and mound features, fire cracked rock, and residential artifacts and features should remain. Efforts to identify and document such remains should be included as part of the larger continuing effort to develop a clearer understanding of the Park's broader cultural resource base and Mount Rainier's place in long-term processes of human use of the southern Washington Cascades.

This chapter has presented two models related to the archaeological record of Mount Rainier National Park. The first model deals with prehistoric site types and distribution patterns on Mount Rainier irrespective of age. Available prehistoric site data and assumptions relevant to optimal use of Park landscapes were employed to develop a 10-part prehistoric site-type taxonomy. Nomenclature and type distinctions were selected to exhaust the range of presently documented prehistoric remains, and to the extent possible, maintain consistency with forager/collector terminology used by Binford (1980) and with extant regional site-type schemes. As presently structured, the model recognizes 1) Residential Base Camps, 2) Field Hunting Camps, 3) Low Intensity Hunting Locations, 4) Butchering Locations, 5) Lithic Procurement and Reduction Locations, 6) Stacked Rock Locations, 7) Culturally Modified Trees, 8) Plant Processing Locations, 9) Trails, and 10) Isolated Lost Artifacts. Text associated with each site-type class discusses predicted site function, expected assemblage characteristics, location, and current representation in the Park. Presently documented sites and tabular summary of remains are organized by site class in Table 5.1. Readers are encouraged to review that table and relevant text for a more thorough understanding of the model and the Park's prehistoric archeological record.

The second model is devoted to developing a broad-scale view of changing subsistence and settlement patterns through time. It is assumed that from early to late Holocene times, basic land-use practices have shifted from mobile foragers with minimal need to rely on mass harvested and stored food resources, to semisedentary collectors critically dependent on mass harvest, over winter storage and logistic acquisition of food resources by limited task groups tethered to a village center. Substantial attention has been given to developing ecological principles and historical precedents underlying the model's structure and key assumptions.

The processual model is divided into six temporal periods. Text accompanying each period summarizes environmental and land-use characteristics expected to dominate the region and Mount Rainier during the interval in question. Anticipated implications for the archaeological record are considered as well. As with the spatial/site type ideas, readers are encouraged to consult the text for a more complete understanding of the model and its critical assumptions. Table 5.3 below closes this chapter by summarizing its more salient expectations.

Table 5.3 Mount Rainier Environment, Land-Use and the Archaeological Record

Land-Use Period	Environment	Land-Use Expectations	Archaeological Expectations	Rainier-S. Wash. Cascades Data
Post-Pleistocene Foraging (ca. 11,000-8,000 B.P.)	Mount Rainier glaciated early retreating rapidly near period end; modern habitats established near period end. Megafauna present in Puget Trough during Everson Interglacial, extinct by period end.	Very low population density, foragers east of Cascades focusing on megafauna habitats. Limited use of Puget Trough and Cascade foothills. Increased use of Cascade foothills with megafauna extinctions at period end. Earliest plausible use of Mount Rainier (not expected).	No archaeological remains expected for Rainier during the period. Earliest use of southern Washington Cascade (SWC) foothills and lowlands during the period.	**Extant:** No remains dating to period. Clovis point near Cle Elum may indicate use of foothills or low elevation passes. **Recommend:** Samples from deeply stratified cultural deposits. Mazama tephra provides good 6,800 year temporal marker in places.
Rest-Rotation Foraging (ca. 9,000-6,000 B.P.)	Full onset of Hypsithermal. Lowland forest density decreases—ungulate habitat improves; upland forest density increases—ungulate habitat restricted.	Low population density, mobile foraging strategies emphasizing ungulate habitat in lowlands and Cascade foothills. Minimal use of Mount Rainier uplands.	Small residential and hunting camp sites in lowland and foothill settings. Negligible to very low site density on Mount Rainier.	**Extant:** Modest number of dated sites in foothill to moderate elevation settings. No documented sites on Mount Rainier. **Recommend:** As above, concerted effort to locate and sample deeply stratified cultural deposits.
Semisedentary Rest-Rotation Foraging (ca. 7,000-4,000 B.P.)	Hypsithermal climate cools near period end. Ungulate habitat degrades in lowlands, improves in uplands. Volcanic collapse of Mount Rainier summit, Paradise-Greenwater-Osceola lahars.	Slightly elevated population density. Short-term winter sedentism and storage. Other aspects of mobile foraging strategies continue. Punctuated increase in use of upland ungulate habitats.	Site density in lowlands increases with similar site types. Limited evidence of storage features. Site density on Mount Rainier rises sharply. Patterned distribution of base camps at upper forest ecotone, hunting locations in subalpine to alpine settings.	**Extant:** Modest number of dated sites in SWC, none firmly dated on Mount Rainier, though stratigraphy at FS 90-01 indicates use 4,500-2,300 years ago. **Recommend:** Near term data recovery at FS 90-01. Survey and test rock-shelter locations to gain assemblage, resource and temporal data. Survey and test subset of base camp and limited-task locations.
Semisedentary Collecting (ca. 5,000-1,500 B.P.)	Climate cools to near modern conditions. Limited glacial advance ca. 2400 B.P. Closed lowland forests, open uplands. Mount Rainier C eruptions rebuild summit to present height.	Elevated population, degrading ungulate habitat; unstable resource balance with forager system. Shift to river oriented logistic strategies. Use of fire to improve ungulate habitat. Extension of territorial claims to uplands; montane use continues with focus on habitat protection and use of alternative resources.	Increased site density in lowlands with punctuated increase in aggregated settlement on salmon rivers and streams. Site density remains stable on Mount Rainier reflecting decreased per capita use. Maintenance of base camps at upper forest ecotone, increased site variety. Decreased elk/deer use, increased use of alternatives.	**Extant:** Village complexes in lowlands. Stratigraphic, artifact and ^{14}C evidence for use of Mount Rainier upper forest to alpine habitats. **Recommend:** Site survey with subsurface tests to expand database and improve temporal representation. Test/data recovery at subset of sites stratified by type to improve view of temporal and site distribution issues.

Land-Use Period	Environment	Land-Use Expectations	Archaeological Expectations	Rainier-S. Wash. Cascades Data
Intensive Collecting (ca. 2,500-400 B.P.)	Early mountain rebuilding vulcanism. Cool climate continues, glacial advance-retreat ca. 900-500 B.P. Dense Maritime forests in lowlands, open subalpine associations in uplands.	Peak prehistoric regional population density. Collector systems fully established. Increasing use of fire. Territorial claims vigorously enforced. Extension of trade and other intergroup ties. Increased social complexity. Elevated intergroup conflict. Exploitation of lower return storable resources, increasing use of inland valleys and foothills; high elevation use continues, focusing on habitat protection and use of alternative resources.	Maximum lowland site density and dispersal into varied habitats. Largest aggregated settlements in marine and riverine context. Storage features and elevated artifact complexity. Higher fraction of ritual and status goods. Higher fraction of tools for capture of smaller bodied animals. Montane site density and type remains largely constant. Due to logistic difficulty, mass Mount Rainier huckleberry harvest for lowland storage not expected prior to introduction of the horse.	**Extant:** Highest regional site density with largest aggregated villages in lowland settings. General SWC site density increases sharply. Upland Mount Rainier use evident by ^{14}C, stratigraphic, and artifact remains. **Recommend:** Survey and test procedures as above. Efforts to identify and date huckleberry prosessing fea-tures. Pollen profiles for paleo-environmental reconstruction and ex-amination of carbon frequency-fire data.
Mixed Strategy Hunting & Gathering (ca. 400 B.P.-Present)	Essentially modern climatic conditions. "Little Ice Age" 400-100 B.P. Lowland and upland forest patterns near modern levels.	Rapid population loss to epidemic diseases. Abandonment of villages in marginal habitats with reaggregation as composite groups in optimal habitats. Increased intergroup variability in land-use systems. Equestrian transport and emergence of long distance overland collecting and trade, particularly on east slope. Increased mass huckleberry harvest on Mount Rainier. Partial integration into Euro-american economy ultimately breaks predominance of forager-collector land-use strategies.	Punctuated drop in site density overall. Continuing but decreasing number of large lowland villages. Possible short-term reemergence of small forager residential camps. Increased frac-tion of European trade goods and utensils. Mount Rainier use declines then increases with primary focus on mass huckle-berry harvest and supplemental hunting. Indigenous use of Mount Rainier for economic purposes declines in late 1800s/ early 1900s.	**Extant:** Decreased lowland site total. Some large maritime and riverine villages continue. The Dalles trade fairs. Mount Rainier huckle-berry/hunting use ethnographically documented. Early historical use suggested at several sites, but data ambiguous. No huckleberry processing features currently documented. **Recommend:** Survey efforts geared to expand and categorize sample of early historical remains. Survey test procedures to document huckleberry processing features. Test procedures at most probable traditional prehistoric-historic sites, esp. FS 74-01 and 95-10.

Chapter 6

MOUNT RAINIER ARCHAEOLOGY MANAGEMENT, RESEARCH & INTERPRETATION

Mount Rainier National Park embodies scenic and geological qualities that have made it one of the nation's best known and most heavily visited parks. Well before becoming a park and before its historical attraction to adventures, scientists, miners and the rest, the mountain played an important role in the lives of indigenous people residing in its vicinity. Known as *Tahoma* during early historical times, the mountain's subalpine and alpine habitats provided huckleberries, game and other plant resources to Indian groups east and west of the Cascades. As *Tahoma* and probably a host of other names, the mountain also was integrated into the lives of Northwest hunter-gatherers for up to 8,500 years into the prehistoric past. Beyond its scenic and perhaps spiritual grandeur, the mountain's value to these populations lay largely in the abundance of animal and plant resources that could be obtained from upper elevation settings during its brief summer season.

This project has been designed to develop a better understanding of Mount Rainier's role in the region's long-term prehistoric subsistence and settlement patterns by clarifying the character and interpretive potential of its archeological record. In pursuit of this general goal, the Mount Rainier archeological project undertook four specific obligations.

1. Conduct new archeological reconnaissance structured to provide a more complete view of Mount Rainier National Park's prehistoric archaeological record.
2. Prepare archaeological base maps and supporting site data for prehistoric localities documented within Park boundaries.
3. Prepare an archaeological overview and research document for Mount Rainier National Park, emphasizing relationships between the montane environment, prehistoric subsistence and settlement practices, and the nature of the Park's archeological record.
4. Building on overview and research results, develop management and research recommendations to protect the Park's archaeological record and further the interpretive effort begun here.

The archaeological reconnaissance was completed in late summer of 1995. Detailed site specific data are on file at Mount Rainier National Park, at the Washington Office of Archaeology and Historic Preservation, and are included in the separately bound *1995 Reconnaissance Data* companion volume (Burtchard and Hamilton 1998). Chapter 4 of the present volume describes reconnaissance procedures and results in summary fashion. Map Figure 4.2 in that chapter shows the Park-wide distribution of prehistoric remains documented during the reconnaissance and through earlier archeological efforts. Color fold-out map Figures 2.10 through 2.13 in Chapter 2 also show prehistoric site distribution in relation to environmental zones in four Park quadrants.

For the most part, the present volume is intended to meet the final two objectives. Its primary focus has been to use combined archaeological and environmental information, interpreted through a body of ecological and anthropological theory, to address Holocene subsistence and settlement processes relevant to Mount Rainier National Park and the southern Washington Cascades. Contents include environmental descriptions, archeological background discussions, current site data, and the Mount Rainier site distribution/site type and long-term land-use models. These have been organized to provide an interpretive overview of the Park's archaeological record in its broader regional and temporal context, and to establish a research context for its continuing refinement.

This concluding chapter summarizes basic aspects of Mount Rainier archaeology by returning to a series of questions posed earlier in the report. These summaries are then used as a platform to address continuing management, interpretation and research options for the Park's prehistoric archaeological resources.

MOUNT RAINIER PREHISTORIC SUMMARY

Chapter 2 concluded with a set of general questions about prehistoric use and the archaeological record on Mount Rainier. Those questions were posed to help clarify the relevance the report's ecological research focus and to anticipate long-term subsistence and settlement patterns contributing to development of the Park's archeological record. Here, we return to these questions to summarize land-use and archaeological issues discussed at greater length in the report. Accompanying each question category is a consideration of the current status of relevant Mount Rainier data and recommendations to improve our understanding of that aspect of the Park's archaeological record.

Why Did Hunter-Gatherers Use Mount Rainier?

In essence, the question calls for clarification of variables that would have attracted humans to Mount Rainier in sufficient numbers and over a long enough period of time to create its archaeological record. Indeed, this may be the most critical of the four sets of questions posed in that basic causes underlying human use of Mount Rainier strongly influence other montane land-use issues such as onset of earliest use, seasonality, landscapes selected for use and so on.

This report has relied on ecological and economic arguments, in concert with archaeological data, to suggest that the most important "attractors" to Mount Rainier were a limited suite of animals and plants critically important to forager and, to a lesser extent, collector economies. Foremost among these were elk, deer, goats and sheep, marmots and pika, bear, ptarmigan and grouse, and huckleberries. Importantly, all of these food resources tend to co-occur in greatest abundance in areas of reduced forest maturity; that is, in areas with grassy to brushy vegetation and only limited forest cover. On Mount Rainier and in the southern Washington Cascades the largest and most predicable places where these habitat requirements are met are in subalpine and alpine zones above 5,000 ft.

Because of extensive land mass above 5,000 to 6,000 ft, the southern Washington Cascades and particularly Mount Rainier, are capable of sustaining substantial populations of economically useful animals and plants during the brief mountain summer. The contrast is particularly sharp relative to generally resource poor qualities of mature Pacific maritime forests that dominate lower elevation landscapes. Because of these resource qualities, early to mid-Holocene foragers are expected to have been attracted to Mount Rainier's upper elevation landscapes as part of a normal mobile residential round. Later in the Holocene, in a context of elevated population density and resource competition, resource emphases shifted to salmon and other storable resources by collectors residing in larger, more nearly sedentary villages with more complex resource capture and distribution mechanisms. Use of the mountain is expected to have continued in order to protect remaining ungulate herds and to exploit alternative high return resources such as goats and (in the very late Holocene) huckleberries not readily available in lowlands settings.

Mount Rainier Data

Mount Rainier's extant archaeological record is strongly consistent with hunting-related use of subalpine and alpine settings on all sides of the mountain. Hunting is suggested by the suite of hafted biface, butchering tools and lithic debitage that make up the bulk of the current sample of observed and collected artifacts. Plant processing locations have yet to be documented in Mount Rainier. It is possible, however, that reported, but presently undocumented, peeled cedar locations may be associated with manufacture of huckleberry containers, though other uses are equally plausible.

Unfortunately, the current archaeological record tells us little about the suite of resources actually exploited at Mount Rainier, nor does it provide information on possible changes in exploitation patterns through time. The only controlled excavations conducted in the Park at the time of writing are low volume tests at Fryingpan and Berkeley Rockshelters (FS 63-01 and FS 86-02), and recent Park Service tests at Typsoo Lakes (FS 88-01). With the exception of tooth fragments from Fryingpan Rockshelter, faunal remains were too fragmented for identification. The teeth were either goat or sheep (Gustafson 1983:27-28). Presently the best set of faunal data from the southern Washington Cascades are from excavations at Layser Cave (45LE223) and Judd Peak (45LE222)—lava tube cave and rockshelter sites situated at 2,280 and 1,400 ft (Daugerty et al. 1987a and 1987b).[42] While these data would be useful for comparison, but because of the sites' lower elevation and riverine settings, Layser Cave and Judd Peak faunal patterns cannot serve as a proxy for samples from Mount Rainier. At present we have very little direct faunal or floral evidence from higher elevation settings within Park boundaries.

Recommendations

Current data limitations are the result of poor preservation conditions and the low number of controlled research excavation in the Park. In the maritime Pacific Northwest, unburned faunal remains deteriorate rapidly in the region's acidic sediments. Best preservation conditions in wet mountains are usually found in drier lava tube caves and rockshelters. Accordingly, I recommend 1) reconnaissance efforts to expand the count of culturally relevant rockshelter and lava tube caves in the Park; 2) subsurface testing to help establish cultural content and depth in these caves; and 3) controlled sample excavation at the most productive of these localities with the longest temporal record. If successful, results will assist in developing a more complete faunal resource and assemblage record, and should allow us to evaluate possible changes in land-use strategy through time.

Fryingpan and Berkeley Rockshelters (FS 63-01 and FS 86-02) are the only archaeologically tested overhanging rock sites in the Park (Rice 1965; Bergland 1988). At least initially, new site reconnaissance and test procedures (more appropriately subsurface reconnaissance techniques) need not be as invasive as more thorough test procedures. I suggest that presently documented but untested sites such as Mt. Pleasant Rockshelter shown in Figure 6.1 below as well as newly documented sites be examined with low volume test or auger units to establish presence of cultural remains, and to establish stratigraphic sequence and depth. Indeed, for some rockshelter sites, it may not be possible to

42 Faunal resources recovered from Layser Cave and Judd Peak Rockshelters include a wide species variety dominated by deer in all levels. Interestingly, early to mid-Holocene deposits at Layser Cave contain a small fraction of salmon remains. Anadromous fish are represented in substantially greater proportion in the late Holocene cultural deposits at Judd Peak Rockshelters (see Table 3.4 for radiocarbon data from these sites).

unambiguously establish prehistoric cultural presence without subsurface techniques. Once complete, these initial data can be used to develop more sophisticated test strategies for sites with the greatest potential to return meaningful resource, assemblage and temporal information.

Figure 6.1 Mt. Pleasant Rockshelter (FS 72-02). Northeast facing shelter overlooks Mist Park in Mount Rainier's NW quadrant.

In the short-term, it also may be useful to expand on existing rockshelter excavations, particularly at Fryingpan Rockshelter. Because this shelter is known to contain faunal remains and because original excavation controls and report contents were not rigorous by moderns standards, the shelter offers a relatively easy opportunity to refine excavation procedures and expand the existing database.

Efforts also should be made to document plant (especially huckleberry) processing features. If found, a sample should be examined to determine feature morphology, use and temporal range. Because carbonized remains are relatively impervious to chemical degradation, macrobotanical samples of charred remains potentially will help identify the plants processed and wood species used for drying fires.

Combined results should provide a better grasp of faunal and floral exploitation patterns. If suitably stratified and well preserved, these data also will allow us to address changing resource procurement patterns through time. If primary attractors to Mount Rainier were the suite of resources listed above, then they should be heavily represented in the archeological record. Furthermore, if as anticipated, primary faunal exploitation patterns shifted from elk and deer to goats and possibly marmots through time, the pattern should be reflected in changing frequencies in stratified remains. Huckleberry use is expected to be limited to very late prehistoric and historic times. In addition to resource data, test procedures will improve our understanding of temporal range, assemblage characteristics, and site distribution and use patterns on Mount Rainier—all useful for dealing with remaining questions below.

When Did Hunter-Gatherers Use the Mountain?

At the close of Chapter 2, I posed three sets of time related questions about 1) seasonality; 2) onset of earliest human activity; and 3) temporal variation in land-use strategies or intensity on Mount Rainier. Logically, at least, seasonality appears to be the easiest of the three questions to address. Mount Rainier's winter climate places severe constraints on human use. Aside from obvious (but solvable) problems of cold, wet weather and deep snowpack, are more serious winter resource-related issues. Subalpine to alpine habitats, where critical resources are most abundant, are virtually unusable from late fall through spring. Even with reliable winter access, there would be little to eat. Elk and deer overwinter in lower elevation foothill and valley settings. Marmots hibernate in high elevation dens. Pika burrow under subalpine snow. Goats move to upper forest habitats to shelter from wind and deep snow. At best, winter available food would be limited to goats, sheep and hibernating bears. Even these animals would have gotten thinner as winter progressed. Accordingly, there is little doubt that winter use of the mountain was very limited, or idiosyncratic and irregular. As intelligent predators, prehistoric hunter-gatherers can be expected to have followed their primary prey upslope during the summer, leaving with them in the autumn when snow returned and the upland resource base declined.

Earliest possible hunter-gatherer use of the Cascades must coincide with development of glacier free game habitat coincident with human presence in the region. In the vicinity of Mount Rainier, both criteria appear to be met at about 8,500 years ago. While human population density was undoubtedly low at this time, temporally coincident extinction of Pleistocene megafauna would have favored increased exploitation of medium-sized animals wherever they occurred—including Mount Rainier if suitable glacier-free habitat was available.

Despite early Holocene development of forested montane habitats, there is reason to expect that regular use of Mount Rainier's upland habitats would not have begun until Hypsithermal climatic conditions ameliorated. Paleoenvironmental data discussed in Chapter 2 suggest that the relatively warm, arid Hypsithermal climate contributed to maintenance of low maturity, open forests in the Puget lowlands and Cascade foothills from about 7,500 to 5,000 years ago. While comparably aged data are unavailable from Mount Rainier, hypsithermal snowpack repression should have had an effect on high elevation forests opposite that of the lowlands. All else being equal, the longer, somewhat warmer upland growing season should have permitted forest expansion into what now are subalpine and alpine zones. Accordingly, during the Hypsithermal Interval, ungulate forage should have been relatively abundant in lowland and foothill settings and limited in higher elevation montane settings. Given low population density and relatively abundant lowland resources, there is little reason to expect substantial use of higher elevation places at this time. In short, while earliest use of Mount Rainier may be expected by about 8,500 years ago, such use may have been limited and associated archaeological sites rare relative to foothill and valley settings. Use of Mount Rainier should have increased sharply about 6,000 to 5,000 years ago due to elevated population demands, expanding lowland forests and improving upland ungulate habitat; environmental features plausibly associated with onset of cooler, wetter conditions at the end of the Hypsithermal.

The third and most complex question deals with potential variation in the nature and intensity of Mount Rainier land-use over time. McClure (Chapter 3) and Benson and Lewarch (1989) have suggested a 1,000 to 2,000 year abandonment of the southern Washington Cascades, possibly due to increased late Holocene volcanic activity. Schalk (1988) suggests that use of montane uplands was an early Holocene phenomenon fit to foraging land-use patterns that was effectively terminated with the shift to lowland focused collector strategies about 4,000 years ago. It is also possible that other less dramatic land-use changes were associated with climatic oscillations shown on Table 2.3 and noted above.

In my opinion, there presently are neither empirical nor theoretical grounds sufficient to infer prolonged abandonment of Mount Rainier and the southern Washington Cascades during the Holocene. At the very least, there are compelling empirical grounds to dismiss importance of volcanic events as a likely cause. Citing pollen data from the southeastern flank of Mount Rainier, Dunwiddie (1986) notes that Holocene vulcanism had minimal impact on forest composition. If vegetation patterns were essentially unaffected by these events, then it is unlikely that and human use patterns were substantially influenced, and certainly not for a 1,000 years or more. While it is possible that post-Hypsithermal environmental changes had short-term impact on land-use patterns, it is unlikely that these changes were severe or lasted long enough to have a marked effect on regional population levels or broad-scale land-use practices. In the absence of other compelling environmental or theoretical grounds to anticipate a marked mid-to-late Holocene land-use hiatus, regional population processes should be considered continuous (i.e., generally increasing) throughout the Holocene. If so, changes in Mount Rainier land-use patterns, if any, would have to reflect the operation of processes other than temporary abandonment of the general area.

Schalk (1988) argued for a substantial shift in mid-Holocene upland use patterns without relying on external environmental mechanisms or a region-wide population hiatus. Rather, he suggested that use of montane uplands declined sharply due to logistic reorganization associated with adoption of lowland-based collector strategies. Schalk's ideas received substantial attention in the preceding chapter because, despite being theoretically well-grounded and perhaps applicable to the maritime context of the Olympic Peninsula, they are not consistent with existing Mount Rainier data; which indicate continuing use of subalpine habitats throughout the Holocene

Evidence for continuing use of montane uplands, despite apparently compelling theoretical reason to the contrary, can be explained by a change in land-use strategy rather than abandonment of montane habitats altogether. I suggest that about 4,000 years ago upland use declined on a *per capita* basis and shifted from rest-rotation foraging by residential groups to 1) use by remnant foragers coexisting on the margins of collector society; and/or 2) use by limited-task collector groups exploiting alternative high elevation resources while insuring that ungulate herds were not depleted by others. Pressures for extension of territorial boundaries and protection of subalpine "pasture lands" by limited-task groups tethered to lowland villages is expected to become acute after about 2,500 years ago.

In sum, theoretical arguments buttressed by limited, but not insignificant, environmental, geological and archeological data suggest summer season use of Mount Rainier subalpine and alpine habitats as early as 8,500 years ago, increasing sharply at the end of the Hypsithermal Interval circa 5,000 years ago. Assuming that the region was not abandoned and that post-Hypsithermal climatic oscillations were insufficient to cause significant land-use changes, seasonal use of subalpine habitats is expected to have continued throughout the Holocene. After about 4,000 years ago, and particularly after 2,500 years ago, uplands use may have shifted from primary dependence on large ungulates hunted by residentially mobile foragers to use of alternative resources by collectors whose primary task was to protect remaining herds from overuse by other groups.

Mount Rainier Data

Present Mount Rainier archaeological data tell us little about initial use of the Mountain or land use changes through time. Presently the only indications of very early use are style and hafting width attributes of projectile points found in surface context. Hamilton's analysis of these artifacts (see Table 4.7 and associated text in Chapter 4) suggests that use of the mountain began prior to 5,000 years ago and continued to at least 2,000 years ago. Temporal inferences based on stylistic attributes of individual artifacts, however, must be regarded as suspect *in lieu* of supporting stratigraphic or radiocarbon data.

The probability of recovering stronger chronometric data is good. Because of substantial land area with deeply buried older sediments, it is possible that very old subsurface cultural horizons are preserved in the Park. Unfortunately, deeply stratified cultural deposits have yet to be documented. Existing data do not allow us to extend the time line past the ca. 3,400 year old remains eroding from the Sunrise Ridge Borrow Pit site (FS 90-01). Radiocarbon dated remains from Berkeley Rockshelter (FS 86-02), archaeological materials atop 2,300 year old Mount Rainier-C tephra, and widely scattered arrow points suggest continuing use during the late Holocene as shown in Table 4.7. However, because these data are widely scattered and not tied to a controlled set of assemblage and resource data, they are not suited to address possible land-use changes through the time period represented.

Recommendations

Clearly, the nature of the questions posed are best met with old and/or well stratified cultural deposits. Paleoenvironmental data can also be useful for establishing earliest post-Pleistocene floral colonization of Mount Rainier. These data, usually derived from deep pollen core samples, also can be useful for refining our understanding of broader Holocene forest associations and environmental changes. To deal with temporally relevant issues addressed in this section I recommend 1) subsurface reconnaissance and erosion face survey to identify deeply stratified deposits; 2) sample excavation of a subset of what appear to be the best stratified deep sites; and 3) extraction of a set of paleoenvironmental core samples with palynological/archaeological interpretation of results. Of course, rockshelter research recommended above also may be useful in providing temporally sensitive data.

Our understanding of the onset of human use of Mount Rainier and changing patterns in that use can best be improved through sample excavation of one or more deeply stratified sites. Because of widely distributed Holocene volcanic deposits and reason to expect long-term human use of the mountain, it is likely that deep sites exist and ultimately will be found. Tephra rains that created well-stratified horizons, however, also buried them, making older deposits difficult to identify. The first goal, then, is to identify older subsurface cultural materials.

Perhaps the most practical means to identify buried site components is to a) routinely examine erosion faces for buried artifacts and features; and b) incorporate subsurface auger tests to new survey efforts, and reexamine presently identified sites and high site probability landforms. With minimal clearing, erosion scars provide ready-made stratigraphic profiles, some with substantial depth. Figure 6.2 below, for example, shows a an erosion exposed stratigraphic sequence on the east-central side of Grand Park. The dark, lowest stratum (base of the meter stick) is a paleosol predating the lighter (orangish) layer of circa 6,800 year old Mazama tephra. Other strata higher in the profile document repeated fire history on Grand Park as well as multiple volcanic episodes. Similar scars (with visible Mazama tephra) can be seen on the alpine landscape west of Frozen Lake (FS 86-01) and elsewhere in the Park. Even though such exposures are not systematic and cannot guarantee presence of cultural remains, they offer an easy means of building familiarity with the Park's sediment and environmental sequence. In some cases, they also may intercept features and artifacts similar to those in the borrow pit exposure at site FS 90-01 on Sunrise Ridge. Of course, profile faces must be repaired when complete to minimize acceleration of erosion processes.

Figure 6.2 Profiled Erosion Scar in Grand Park. The profile displays circa 6,000 years of stratified deposits (sediment core removed from center).

Systematic subsurface auger testing is probably the most effective way to identify buried archaeological components. Though time consuming relative to surface-only survey, deep testing may be the only way to locate older cultural remains at places like Mount Rainier where sediments have accumulated during the Holocene. Experience elsewhere in the Cascades has shown that very low volume test units, when systematically placed in sufficient number, can effectively identify even low to moderate density site components (Burtchard 1991; Werth et al. 1994; Burtchard and Miss 1998). Small volume auger or shovel test grids also have the advantage of minimizing damage to surface vegetation in the testing process.

To maximize deep site discovery potential, I suggest that auger test systems be employed at presently identified sites and isolated finds situated on landforms with relatively deep deposits as shown above.[43] In some cases, buried components will likely be found. Once a sample of these have been identified, a subset of the most productive or deepest sites should be examined further with larger excavation units to obtain more complete assemblage, temporal and resource data.

Deep sediment/pollen cores is the best data source for paleoenvironmental reconstruction research. These data are needed to refine the time line for development of, and change in, Holocene floral associations on Mount Rainier. Dunwiddie's (1986) paleoenvironmental work on the mountain's southeastern slope was useful in this regard, but its inferential scope was limited by the small number of cores and the 6,000 year old sediments from which his samples were taken. Where overlying older Holocene sediments, lake and marsh settings typically provide the best pollen capture and preservation qualities for expanding on earlier studies like Dunwiddie's.

Figure 6.3 shows Buck Lake, a particularly promising pollen trap in direct association with prehistoric site FS 71-01 in the Park's NE quadrant. I recommend that paleoenvironmental cores be extracted from this and similar settings on various sides of the mountain. Carefully structured studies conducted with combined palynological and archaeological expertise can provide a cost-effective means to improve our understanding of Holocene floral and environmental patterns with implications for human use of the mountain. Sediment/pollen cores also facilitate study of temporal variation in charcoal density. Charcoal patterns help to understand fire frequency and fire ecology, and may help clarify whether or not mid-Holocene populations used fire to improve ungulate habitat.

Where Did Montane Hunting and Gathering Activities Take Place?

The issue of where prehistoric groups focused their activities assumes that use was spatially patterned and repetitive over time. Assuming that use of Mount Rainier was geared primarily toward exploitation of economically useful plants and animals, then variables that affected their distribution would necessarily influence the distribution pattern of humans that came to get them. Threaded throughout this report is the notion that most of these resources are *highly patterned* in high montane environments. Over long stretches of time, the most valuable prehistoric resources on Mount Rainier tended to aggregate in highest density and with the greatest predictability in subalpine and alpine habitats over 5,000 ft. Accordingly, we can expect prehistoric use, as reflected by the archaeological record, to conform to this pattern as well.

There is no doubt that prehistoric site distribution patterns on Mount Rainier are biased toward subalpine and alpine habitats. In fact, ecological arguments, archaeological data and ethnographic accounts are so strongly consistent with patterned use of these settings, that "where" questions are really best directed toward understanding the *exceptions* rather than the rule. That is, where can we expect to find prehistoric remains in settings outside of subalpine or alpine habitats? Exceptions noted in this report include 1) residential base camps in upper forest/subalpine ecotone; 2) rockshelters wherever they occur; 3) cryptocrystalline lithic exposures; 4) cedar groves; 5) early succession burns; and 6) trails.

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[43] Because subsurface tests were not a part of the present project, I do not know how many of the presently documented Mount Rainier sites are located on deeper Holocene sediments. Cursory inspection of the distribution of Holocene tephra deposits suggests that deepest deposits are biased toward the eastern side of the Park (see Figure 2.3).

Figure 6.3. Buck Lake Site FS 71-01. Looking SE from the site, photo shows the lake and upper forest/subalpine ecotone.

Use of the upper forest ecotone is only a slight deviation from the subalpine pattern—one that I believe reflects a pragmatic adaptation to use of subalpine and alpine habitats given Mount Rainier's unstable weather patterns. Plausibly, use of the upper forest fringe reflects either a) use at times when forests were lower than present (e.g., during the Garda Stade glacial advance circa 750 years ago); or b) use for weather protected residential base camps. Because of the proximity to subalpine of documented sites such as FS 71-01 at Buck Lake (Figure 6.3 above), FS 90-01 on the side of Sunrise Ridge and FS 95-10 downslope from Indian Henry's Hunting Ground to the forest fringe it is hard to unequivocally dismiss the possibility that they were used at times when the subalpine zone was lower than present. However, surface visible remains exhibit greater lithic density and complexity relative to most higher elevation locations. Because of combined assemblage and location characteristics, these forest-subalpine ecotone sites are tentatively classified as base camps out of which hunter-gatherer groups operated while in residence on Mount Rainier. Data recovery research is recommended to provide firmer grounds to evaluate use of these potentially important prehistoric places.

Rockshelters offered a source of natural shelter with minimal modification. Since Mount Rainier weather can be severe at any time of year, such shelters would have been at a premium to populations lacking modern camping subsidies. Because of their value, sheltering rock overhangs may have been sought out some distance from actual foraging locations. Even so, all presently documented rockshelter sites occur in or on the fringes of the subalpine zone. While the pattern will likely hold true as sample size increases, surveyors should be aware of their relatively high correlation with prehistoric remains wherever they occur.

Cryptocrystalline silicate (chert) exposures are found at several places on Mount Rainier. Such outcrops provide useful tool materials, thereby minimizing the need to carry heavy biface blanks or cores to the mountain. These sources bear no necessary association with subalpine or alpine habitats; though proximity maximizes utility. To date, only one lithic quarry site has been documented (FS 90-04 on Tum Tum peak in the southwest quadrant). Present survey results suggest presence of alternative, but as yet unidentified sources in the vicinity of Mt. Fremont in the northeast quadrant, and Windy Gap and Mist Park in the northwest quadrant. It is likely that most chert outcrops will vary in use intensity as a function of distance to subalpine hunting locations.

In the Pacific Northwest, cedar provides a source of easily split, weather resistant planks for lowland long-house construction, and fibrous bark for clothing, cordage, bags and baskets. Alaska yellow cedar is present in well watered low to mid elevation settings on Mount Rainier. Red cedar is found in some of the low elevation river valleys. It is reasonable to expect prehistoric people to have taken advantage of available Alaska and red cedar as a fiber source to assist with foraging and packing needs.

Bark peeled cedars have been reported in several lower to moderate elevation places in the Park (see Chapter 4). Locations are keyed to wet forest cedar habitat. Under ideal conditions, cedars may live over 1,000 years (Franklin and Dyrness 1973:48). Accordingly, examination of these sites may help us understand the location of late prehistoric travel routes into the Park. Core sampling may provide information relevant to possible temporal patterns in their use. According to McClure (pers. com. 1996) peeled cedar sites also may be correlated with huckleberry processing areas (cedar bark used to make containers). If so, survey centered on bark scarred cedar locations may be useful in the search for huckleberry processing sites recommended above.

The final two categories of exceptions to the subalpine pattern— prehistoric burns and trails—are difficult, perhaps impossible, to establish for other than historic or very late prehistoric events. Burns can be important resource procurement areas because they temporarily lower forest maturity, improving ungulate and huckleberry habitat. The location of burns is not bound solely to upper elevation settings. Natural burns may have been used during early succession stages, or even intentionally fire-maintained to elevate productivity. If so, an archaeological record should accumulate in now-forested mid-slope settings. Even though current data do not indicate presence of low elevation sites, it is important that reconnaissance efforts continue to include low to mid-elevation forested landscapes. In forested settings, experience from elsewhere in the Cascades suggests a site pattern keyed to ridges, side slope benches, and elevated stream terraces (Burtchard and Keeler 1991).

Trails are patterned on the landscape, but cross a variety of environmental zones linking the uplands to lowland overwintering areas. Like burn areas and cedars, however, their impact on the landscape tends to be ephemeral, making them difficult to locate. Historical and ethnographic sources represent the best sources of information on the location of these routes. Though they cannot be tied unambiguously to early or middle Holocene use of the Park, they show plausible routes that can serve as examples and, in many cases, probably have greater antiquity.

Mount Rainier Data

Because of the large number of location-related issues, current archaeological information has been indicated in the body of the general discussion above. The most salient point is that the extant archaeological record strongly indicates use of subalpine and alpine zones on all sides of the mountain. Deviations from this pattern reflect selection of sheltered upper forest locations within easy reach of subalpine hunting areas for use as residential base camps, and places with particular qualities not linked to upper elevation habitats (chert quarries, bark peeled cedars, perhaps rockshelters). It is likely that mid-elevation forests were used at lower density, particularly in the vicinity of prehistoric burns. Present Mount Rainier site data, however, do not include sites in these contexts. Sections of at least one undocumented trail are known near site FS 90-01 on Sunset Ridge. Others are cited by Smith's (1964) Indian informants. Additional site types and locations such as stacked rock features are likely to exist in the Park as well, but as yet have not been documented.

Recommendations

The best way to improve our understanding of distribution patterns is to expand survey coverage. The present project was directed toward consolidating existing site reports with limited new reconnaissance. To expand this beginning effort further I recommend: 1) consolidation and field evaluation of remaining unverified site reports; 2) additional survey designed to sample the full range of Park landforms in all four quadrants; and 3) interviews with informed residents and local Tribal representatives to develop a more complete view of early historic land-use practices and travel routes. Survey procedures should include, or supplement, rockshelter reconnaissance and testing efforts recommended above and subsurface testing techniques to identify old site components.

Site data summarized in this volume pulls together all known site and isolate localities for which we were able to find credible information during the field effort. There is little doubt that additional localities are known to Park employees and informed persons that were not interviewed. This information, coupled with field evaluation, constitutes an effective, inexpensive means of expanding the prehistoric and historic site data base. Because these reports tend to come from all parts of the Park, resulting site data reflect "inspection" of a variety of habitats and landforms, despite the fact that they are not rigorously systematic in a sampling sense.

Additional formal survey would also be a useful addition to the present reconnaissance. Survey procedures should be structured to sample landforms and environmental zones widely on all sides of the Park. To the extent possible, low volume subsurface auger and/or shovel probe techniques should be used to search for buried components where surface remains are present, and on high site potential bench, terrace and ridge top settings. Resulting information can be added to similarly examined site data to develop sample excavation plans suited to a number of research options.

Allied with general site report interviews are discussions with representatives of Indian groups on all sides of the mountain. To my knowledge, the only systematic attempt to solicit land-use information about Mount Rainier from Tribal members was Allan Smith's (1964) work for his *Ethnography of Mount Rainier*. In addition to improving interpersonal and intergovernmental relations by involving neighboring tribes and Indian Nations with studies of concern to their history, living tribal members may yet offer useful information on traditional use patterns and travel routes to and from the mountain. Such information may be particularly useful for clarifying and expanding on such issues as reported use of Sunrise Ridge for "late summer fairs" (Morrison pers. com. 1995), travel routes and use of places like "Indian Henry's Hunting Ground"(Bjarke 1949; Smith 1964), and early historic period huckleberrying, hunting and travel patterns generally.

How Did Regional Settlement Systems and Montane Environments Affect Site Distribution Patterns?

Issues related to integration of Mount Rainier resources and landscapes into broader Northwest subsistence and settlement systems have been addressed throughout the report and formally modeled in Chapter 5. In essence, these models suggest that Mount Rainier—particularly its upper forest ecotone, subalpine and alpine habitats—has been used as a summer hunting and gathering area throughout much of the Holocene. Use may have begun as early as 8,500 years ago, or when the first essentially modern post-Pleistocene plant and animal communities successfully colonized Mount Rainier. Foraging is expected to have increased markedly about 5,000 years ago as the climate cooled from the post-glacial Hypsithermal rebound, expanding the size of alpine and subalpine habitats on Mount Rainier. During this time, Mount Rainier's subalpine zones would not have been remote places, but essentially "summer neighborhoods" where small, politically autonomous forager groups maintained residence while the weather was warm and resources plentiful; moving downslope when winter drove game to foothill and valley settings. Human distribution patterns should have been fluid, shifting from place to place as dictated by the abundance and distribution of exploitable plants and animals.

During the middle Holocene, subsistence and settlement systems—while still keyed to a basic hunting and gathering economy—changed perceptibly, perhaps dramatically. A mobile foraging system can only work while human population density is low relative to critical animal and plant populations. Wild, unmanaged resources have finite limits that cannot be exploited indefinitely if population density continues to increase. Primarily because of population/predation pressures—probably exacerbated by post-Hypsithermal environmental changes—forager strategies became incapable of reliably sustaining Northwest hunter-gatherers. Since prehistoric agriculture is a practical impossibility across the region, successful groups developed techniques to exploit available resources more intensively—to "squeeze" more food out of increasingly limited available space. In practice, this meant adopting winter-sedentary land-use strategies centered on productive salmon rivers or other areas with resources that could be mass harvested and stored, and instituting more complex, labor intensive, logistic resource acquisition and distribution mechanisms. Mobile foragers became semisedentary collectors.

These intensification processes now appear to taken place across the Pacific Northwest about 4,000 years ago. They become more pervasive through time until catastrophic diseases decimated indigenous populations between 400 to 150 years ago. It is only after development of semisedentary lowland-based economies that Mount Rainier may have become viewed a *remote* place, if indeed it was at all. The mountain's upland habitats and summer resources— now insufficient to support regional populations—lay some distance from village centers and conflicted with warm season collecting and storage obligations in the lowlands. At least two of the most important hunted species—elk and deer—after all, would return to the lowlands of their own accord in the winter and be hunted when need was greatest. Accordingly, reasons for journeying to Mount Rainier and similar montane uplands could very well have been less compelling than before, resulting in diminished use overall as suggested by Schalk (1988) for the Olympic Mountains.

Even so, use of Mount Rainier did not stop during the later Holocene. To accommodate this apparent paradox, the model suggests that primary upland use shifted from summer residence by autonomous forager groups (though limited use by marginalized foragers may have continued), to use by sub-groups dispatched from larger collector societies to hunt as necessary for self support while seeing that upland resources were not overused by others. Because of logistical difficulties inherent in foot transport, collection of stored commodities for return to lowland villages is not expected to have been a primary concern of these limited-task groups. It is plausible, however, that lighter and/or particularly valuable commodities unavailable in the lowlands (e.g., goat wool) were carried out at season's end. Mass use of huckleberries is expected to have become particularly important after introduction of the horse enhanced transportation options about 300 years ago.

Much of the scenario outlined above and considered in detail in Chapter 5 is deduced from a body of ecological and evolutionary theory. Available regional data are consistent with basic tenets of the forager to collector shift. Data relevant to finer details, such as late Holocene extension of protective territorial boundaries to the uplands, remain scant. The model is intended to provide an interpretive framework for developing research questions and for evaluating results which, if implemented, will facilitate progressive refinement of our understanding of the past. If the present model approximates past reality, several predictions should hold for Mount Rainier's archaeological record. The following list includes some of the more obvious. Readers are encouraged to generate others.

1) Earliest cultural remains on Mount Rainier should date to $\leq$ 8,500 B.P.
2) Site density should exhibit punctuated increase circa 5,000 B.P.
3) Early Holocene forager sites should be dominated by full residential assemblages in close spatial association with hunting and lithic procurement localities.
4) Faunal profiles associated with forager sites should be dominated by, or contain relatively high fraction of, larger ungulates, principally elk and deer.
5) Due to high residential mobility and uncertain return to same-site locations (limiting effectiveness of implement caching), early Holocene tool kits should be relatively simple and dominated by multi-functional implements fit to killing and butchering large animals.
6) Early Holocene forager sites should lack mass harvest and storage features.
7) Mount Rainier's broader archaeological record should span the entire Holocene time frame after initial settlement.
8) Late Holocene collector sites should exhibit increased intersite variability relative to early Holocene forager sites. Residential base camps should remain to accommodate prolonged stay.
9) The late Holocene faunal record should show increased fraction of smaller body sized game relative to elk and (perhaps) deer.[44]
10) Late Holocene site locations should tend to be reused resulting in greater accumulations of material remains.
11) Late Holocene increased task variability, site reuse and enhanced effectiveness of equipment caches should be expressed as increased variability in artifact and material types, and artifact density.
12) Possible late Holocene evidence for mass harvest of high value, low bulk commodities such as goats (for wool) and marmots (for fat).
13) Mass huckleberry drying features should date to late prehistoric or historical times.

[44] More rapid recovery rate and ability of deer to exploit smaller, more widespread and hidden forage patches relative to elk, may have facilitated longer reliance on this animal.

Mount Rainier Data

Extant information can touch on only a few of the issues that potentially could be addressed with archaeological research at Mount Rainier. The least ambiguous of these is the very clear indication of continuing use of subalpine and alpine habitats throughout the latter part of the Holocene. Existing data also indicate surprising intersite variability; including residential base camps at the forest/subalpine ecotone (see Figure 6.3), plus limited task butchering, lithic procurement and reduction, and field hunting camps and locations as discussed in the first section of Chapter 5. Analyzed lithic assemblages also indicate intersite diversity in lithic technology, density and material types (see Tables 4.3 and 4.8). Site distribution patterns suggest use by people on all sides of the mountain

Recommendations

The capacity to address the range of research possibilities noted above requires long-term commitment to a coordinated research effort, directed by persons familiar with the processual approach to prehistoric research and well versed in montane archaeology. Though useful in an a cumulative sense, independently conducted, uncoordinated testing and salvage efforts operating with project-specific goals seldom are capable of addressing broader subsistence and settlement oriented research issues. Summary research recommendations in the following *Management* section are intended to begin that process by focusing on specific, staged research objectives. Recommendations specifically designed to address complex land-use issues summarized above rely primarily on 1) better defining the temporal record; 2) developing a site and temporally sensitive faunal and floral record; 3) completing assemblage comparisons reflecting the range of temporal and site type diversity on Mount Rainier; and 4) consolidating existing test and data recovery data from the southern Washington Cascades (and beyond) into a format suited to intersite comparisons with Mount Rainier data. It also is important to incorporate historic period remains—at least into survey procedures—if the Park wishes to pursue a truly broad-based approach to its archaeological record.

Options that address most of the four recommended research areas above have been outlined in earlier *Why, When* and *How* discussions. Perhaps the area most worthy of further comment is the notion of gaining more complete, excavated samples from sites representing a broad temporal and functional range. I suggest that test/data recovery efforts focus on comparison of deposits at one or more each of the currently recorded site types as defined in Chapter 5 and listed in Table 5.1. Recognizing practical time and budget constraints, initial efforts should try to maximize return by emphasizing sites with the greatest potential for providing data classes sought. Initially it is recommended that research efforts be directed toward 1) possible residential base camp site FS 90-01 on Sunrise Ridge; 2) expansion of earlier work done at Fryingpan Rockshelter site FS 63-01; 3) excavation at open sites FS 95-04 on Sunrise Ridge and/or FS 95-05 in Spray Park; and 4) sample excavation at Frozen Lake site FS 86-01.

The recommended sample is based on present information only and should be changed if new data (e.g., deep sites located by auger or erosion face profile work) suggest that work could more profitably be directed elsewhere. If implemented as recommended, however, the sample would include sites presently classified as residential base camps, rockshelter and open hunting camps, and a butchering location. Work at the Sunrise Ridge Borrow Pit site (FS 90-01) seems particularly pressing because of extensive damage and continuing site erosion resulting from mechanical removal of fill for road construction and other Park purposes. Fryingpan Rockshelter (FS 63-01) was chosen because of established content, though Vernal Park and Mt. Pleasant Rockshelters noted below are tempting alternatives. Sites FS 95-04 and FS 95-05 have a moderate density and variety of remains in an as yet uninvestigated site type. Site FS 95-04 offers the advantage of proximity to several day trails leading from the Sunrise Ridge Visitor's Center. Excavation here could be integrated into an interpretive program certain to attract substantial public interest. Spray Park site FS 95-05 broadens the sample away from the northeast quadrant, and would recover information in a setting that is being denuded and eroded by use. Finally, site FS -01 at Frozen Lake offers our best opportunity to examine what appears to be both a lithic reduction and butchering locality. It also is one of the few sites in true alpine context. The site has been disturbed to an unknown extent by artifact collecting and frost heaving. Sample excavation would recover remnant information, examine cryoturbation impacts and improve the quantitative base for its functional interpretation. As with FS 95-04, excavation at Frozen Lake site would stimulate substantial public interest, offering unique interpretive opportunities for the Park Service.

Sample excavation of additional localities and site type classes, could only improve our understanding of Mount Rainier's prehistoric land-use practices. I hope that other important sites such as FS 71-01 at Buck Lake, FS 95-10 below Indian Henry's Hunting Ground, Vernal Park and Mt. Pleasant Rockshelters (FS 74-01 and FS 72-01), limited use locations such as FS 95-08 and FS 90-03 near Windy Gap, and others can be added as research needs and budget realities dictate. In all cases, care should be taken to structure excavation and analytical procedures and evaluate results in a fashion that can meaningfully address research issues such as those introduced here.

MANAGEMENT, RESEARCH IMPLEMENTATION AND INTERPRETATION

Because of National Park status, cultural remains on Mount Rainier have been relatively free of logging and development related damage compared to many sites elsewhere in the Cascades. Primary sources of deterioration stem from road and Park facilities construction and artifact collection by visitors. At least two known prehistoric sites have been damaged by construction activities: site FS 90-01 on the south slope of Sunrise Ridge from earth removal, and site FS 88-01 from parking lot construction at Tipsoo Lakes. Both sites recently has been tested to assess damage and to establish remnant site boundaries and content (Sullivan pers. com. 1996; Liddle pers. com. 1997). Results were unavailable for inclusion here. A third find—an isolated ovate *Cascade* style point (IF 01-63)—was exposed in a cutbank for the Highway 706 turnout at Bench Lake. No additional remains were found at the time (Rice and Nelson n.d.), but it is not known how much of the site was lost in the construction process.

It is possible, perhaps probable, that additional prehistoric remains have been lost in construction of facilities at Longmire, Ohanapecosh, Paradise, Sunrise Ridge, various campground locations, and so on. Given site density patterns noted here, losses at higher elevation places like Paradise and Sunrise Ridge are likely to have been most severe. As with IF 01-63, however, these construction events are well in the past. With the exception of Sunrise Ridge Borrow Pit (FS 90-01) and perhaps IF 01-63, chances of meaningfully evaluating the extent of past losses are minimal.

Past cultural resource losses, while regrettable, do not significantly impact our ability to learn from and interpret Mount Rainier's prehistoric cultural heritage. Now that the Park has an archaeological staff, protection of prehistoric and historic period remains should be more systematic and effective.

Rather than dwelling on strictly cultural resource management/site preservation issues, the remainder of report deals with the link between research and interpretation of the prehistoric record. The first section below recommends staged research options developed above and in the body of the report. The second section offers interpretive suggestions. Research and interpretive options are considered in serial order because of the important role archaeological research plays in developing a meaningful prehistoric interpretive program. It is the primary means for building an understanding of the past beyond the memory of ethnographic sources, and is our only means to examine empirically the validity of the interpretations offered.

Research Implementation

Research options believed to be particularly well suited to Mount Rainier's archaeological record appear at various points in the body of the report. Specific recommendations were offered above. Here, prehistoric research options are pulled together in tabular form and grouped in terms of recommended implementation stages (Table 6.1). The approach is intended to provide a research strategy that will maximize information return in a context of pragmatic budget and personnel constraints. It is important to note that *Stage One* recommendations are not necessarily more important than those in "lower" numerical order. These options simply are those that I believe offer the best near-term opportunities to 1) more thoroughly evaluate the existing archaeological record; 2) refine approaches to subsequent research efforts; and/or 3) recover information from sites that are being damaged by natural and Park-use causes. It is important to emphasize, too, that recommendations should not be considered fixed, but subject to constant revision as more information becomes available. Equally important, however, is the need to maintain a general research design to impose order on the work done and to help keep results focused on the primary goal—a better, theoretically and empirically based understanding of processes of long-term human use of the montane landscapes that now constitute Mount Rainier National Park.

Table 6.1 Research Implementation Summary Recommendations

Stage	Recommendation	Purpose
1	Consolidate and field evaluate remaining reported but undocumented sites and isolates based on interviews with Park employees and informed individuals.	Cost effective means to expand existing site database.
1	Test and data recovery salvage excavation at Sunrise Ridge Borrow Pit (FS 90-01).	Obtain remnant archaeological information from damaged and eroding site. Provide data from possible residential base camp in forest ecotone setting. Site retains known deposits in stratigraphic context.
1	Expand existing test excavation at Fryingpan Rockshelter (FS 63-01).	Improve on poorly controlled initial excavation in a site with established faunal and assemblage content (but relatively young age). Excavation will provide an opportunity to expand assemblage and faunal database and to refine strategies for excavation elsewhere.
1	Incorporate historical archaeological remains into a unified program with prehistoric resources.	Provide a coordinated systems for documenting and interpreting all archaeological remains in the Park.
1	Discuss cultural resource issues with Tribal representatives. If possible, develop informant information on historical land-use practices, travel routes and known site locations.	Improve understanding of historical land-use practices. Increase list of potential site locations. Improve interaction with Indian groups in the cultural resource process.
1	Publish and distribute as appropriate Smith's *Ethnographic Guide to the Archaeology of Mount Rainier.*	Best available compilation of ethnographic information relevant to historical indigenous use of Mount Rainier.

Stage	Recommendation	Purpose
2	Increase representation of rockshelter sites through directed reconnaissance and low-volume subsurface testing.	Increase rockshelter sample size. Assess assemblage characteristics, stratigraphic context, and approximate age of cultural remains. Results to provide a foundation developing larger volume test excavation strategies.
2	Conduct low-volume subsurface auger test strategy at selected currently identified surface sites and isolates.	Maximize probability of identifying early Holocene cultural deposits. Improve understanding of the relationship between surface visible and subsurface remains.
2	Profile and test as necessary visible deep erosion scars in varied Park contexts.	Refine understanding of natural stratigraphy across the Park and attempt to identify early Holocene cultural deposits.
2	Paleoenvironmental reconstruction with archaeological implications drawn from set of deep pollen core profiles.	Establish time of initial floral colonization of Mount Rainier and monitor changing Holocene vegetation patterns. Refine understanding of environmental-cultural feedback mechanisms. Improve understanding of Mount Rainier fire history.
3	New surface survey (subsurface testing as possible) stratified by landform, resource zone and Park quadrant.	Examine validity of the proposed subalpine-alpine site density pattern. Identify alternative site types such as scarred trees, plant processing sites and stacked rock features.
3	Sample excavation of a subset of identified rockshelter sites, emphasizing those with most deeply stratified cultural content and faunal and assemblage data.	Develop a stratigraphically controlled sample of cultural remains and resources from sites that maximize probability of gaining meaningful resource, assemblage and temporal data.
3	Sample excavation of a subset of deeply stratified sites identified in auger and erosion face tests.	Improve understanding of earliest use of Mount Rainier. Monitor changes in assemblage variation through time. Improve quantitative bases for land-use inferences. Refine temporal data relevant to land-use processes. Address possible population hiatus in southern Washington Cascades.
3	Survey and excavation procedures to locate and examine huckleberry processing features.	Determine morphology of plant processing features and examine inferred late adoption of mass huckleberry processing practices.
4	Controlled excavation at varied site locations—initially suggest Upper White River Trail (FS 95-04), Mist Park (FS 95-05), and Frozen Lake (FS 86-01).	Improve intersite comparative base. Refine functional and temporal inferences. (Actual site selection should be flexible enough to accommodate new information from earlier stage procedures.)
4	Expand survey coverage and tested site sample sites as indicated by accumulating results.	Refine and expand on a broad range of cultural resource inferences.
5	Renew overview and research design for Mount Rainier National Park.	Pull together the expanded information base to review and improve on Mount Rainier settlement and subsistence models. Review the Park's cultural resource program with recommendations as appropriate.

Interpreting Mount Rainier's Prehistoric Past

Archaeological research efforts, no matter how well planned and conducted, are of little value if they are not relayed to a broader professional and lay audience. Mount Rainier National Park, with its high visitor base and established interpretive program, is well positioned to offer high-quality public presentations on its extensive prehistoric past. Interpretive specialists are best suited to gauge the relative value of different approaches. Here, I offer suggestions in three basic categories: 1) museum displays, interpretive signs, brochures and books; 2) public outreach talks and displays; and 3) archaeological excavation with public interpretation. Hopefully, these brief discussions will serve to stimulate additional, more sophisticated ideas to increase public awareness and involvement in Mount Rainier's prehistoric and historic archaeological record.

At the outset, I wish to underscore the importance of public interpretive efforts and maintenance of research integrity in the process. Archaeology is the only science oriented to study of long-term human organizational processes that extend far beyond living memory or the written record. As such, it is uniquely suited to help us better understand how humans, through their cultural systems, have used and changed the earth, and have themselves changed in the process. In this light, Mount Rainier's cultural resources constitute a record of our shared human past as expressed in this place. The story of that past has a natural constituency in the indigenous people that still reside in the area and in the broader population who can learn, not only about the prehistory of a particular place, but about land-use processes that transcend racial, ethnic and national boundaries. Maintenance of regular feedback between ongoing archaeological research and cultural resource interpretation is emphasized because it is the only means at our disposal to evaluate and improve the accuracy of the prehistoric story we relate.

Museum Displays and Interpretive Literature

Passive displays and literature are an effective means of providing information to a large number of Park visitors. There are numerous ways in which museum displays could be developed to emphasize various aspects of Mount Rainier's prehistory. Displays that emphasize life scenes, rather than only artifacts, can provide a reasonably complete understanding about how the mountain has been used in the past. For example, hunting dioramas focused on subalpine or alpine settings and animals hunted could be used as a spring-board for discussing seasonality, environmental zones, resources sought and the forager lifestyle generally. Rockshelter dioramas could stress the importance of this type of natural shelter in the face of Mount Rainier's unstable weather. Other possibilities include butchering scenes, huckleberry processing, and residential settings. Tool use involved in these scenes could set the stage for artifact presentations if desired. In my opinion, however, simple artifact displays tend to elevate the importance of the material remains of past life ways rather than the life ways themselves. However, if linked to more general scenes, the importance of the archaeological record to understanding the past could be emphasized in a manner that promotes preserving (rather than stealing) the archeological record.

The simplest forms of interpretive literature are short brochures and trail side interpretive signs. Brochures with appropriate descriptions of Mount Rainier archaeology, and subsistence and settlement patterns, compliment information offered in museum dioramas. Indeed the brochure may be used as explanatory material for the museum displays themselves. Perhaps most useful, however, brochures could be used to promote Mount Rainier's cultural resource program, emphasize the importance of fragile archaeological remains to our ability to interpret the past, and offer a condensed Holocene history of human use of the Park.

Trail side interpretive signs may be an effective way to promote an understanding of past land-use practices even in places, like Mount Rainier, where physical archaeological remains are difficult to see. Interpretive signs located at places like the multiple trail junction near Frozen Lake can draw attention to the importance of the alpine landscape for goat, marmot and perhaps elk hunting; discuss the time ranges and land-use practices involved; and draw attention to the hunting/butchering site in the vicinity (without drawing attention to the specific place). Existing information already is adequate to support comparable interpretive signs in several well traveled backcountry settings such as Windy Gap and Spray Park/Mist Park in the northwest quadrant, and Indian Henry's Hunting Ground in the southwest quadrant. Interpretive signs could also be productively placed at Typsoo lakes (northeast quadrant) and at varied campground locations throughout the Park.

Finally, I suggest that prehistoric interpretive information be added to existing trail literature. Again, interpretive comments should emphasize landscapes, plant and animal communities, and subsistence and settlement patterns. In this, as in other field interpretive displays, people need not actually see archaeological remains to appreciate the context in which significant prehistoric events took place.

Public Outreach Presentations

Public presentations involve in-Park programs, increased involvement with surrounding Indian Tribes and Nations, and various other talks and mobile displays. As with museum and other passive interpretive displays, I suggest that presentations use artifact displays as necessary to generate interest, but place primary emphasis on long-term land-use and environmental processes. Campfire and visitor center talks or short tours are obvious in-Park options. Slide and print photographic documentation was made for all sites and isolates recorded during the present project. Landform and general environmental photographs were taken as well. If desired, this slide record can be made available to the Park Service to serve as a starting point for various kinds of interpretive talks.

In my opinion, it is important for the Park to continue to develop and sustain effective working and information exchange relationships with nearby Tribal organizations that hold an historical interest in Mount Rainier. In recent years, Indian interest in and concern with their prehistory has grown. Relations with government agencies and archaeological research programs have run the gamut from strong support to equally strong opposition to archaeological resource policies and procedures. We must recognize that it is reasonable for indigenous people anywhere to have an interest in the archaeological record that links them to a past that they view as their own. It also is reasonable for them to wish to participate, if not in the decision making process *per se*, at least in information exchange on cultural resource plans and results. Recognizing these concerns, the Park has developed formal relationships with Muckleshoot, Nisqually, Puyallup and Yakama Tribal governments.

In my experience, once these kinds of relationships develop to a level of mutual trust, they can be rewarding to all involved. The professional archaeological community and administrative agencies gain a level of insight and cultural sensitivity that often is otherwise absent. Indian communities can gain a new understanding of the more distant past and benefit indirectly from a growing appreciation for past life ways that, in an ecological perspective can be seen as reasonable, intelligent responses to a environmental circumstance operative through time in the Pacific Northwest.

Public outreach presentations, of course, should be directed toward Indian and other nearby communities. Presentations need not be complex but should focus on what is being learned about long-term use of Mount Rainier and about the close association between use and montane environmental patterns. Cultural resource presentations directed toward local schools, libraries and other civic organizations can help build goodwill and appreciation for Mount Rainier's human past. The Park also may wish to consider developing a mobile display that can be loaned temporarily to libraries and schools to extend information to local residents who may seldom visit in-Park museum displays. Such displays can be durable and attractive, and serve as a format for presenting additional information through pamphlets and brochures.

Interpretive Archaeological Excavations

Public interest in archaeology, and particularly in archeological field excavation, has been high for some time. Field excavations are particularly interesting to people because they show the science in action and provide visual stimulation even when cultural remains and features are limited or subtle. Because of the level of public interest and active research environment in the Park, ongoing excavations provide an opportunity to extend a learning experience difficult to match with passive displays or talks alone. Risks of damage or theft of archaeological remains are negligible if visitation is controlled carefully.

Two of the sites recommended for near-term test or data recovery research are located in high visibility, high use areas by visitors to Sunrise Ridge. The Upper White River Trail site (FS 95-04)—a moderate density lithic scatter presently classified as a hunting camp—is located immediately adjacent to the Emmons Overlook trail at its junction with the trail to White River Campground. Visitation and interest was high even during the few hours spent documenting the site during the present project. Because of its proximity to the Visitor's Center, the site provides an unusual opportunity to simultaneously investigate a potentially important archeological location, promote a better understanding of Mount Rainier archaeology, and develop interest in the research process. If the area is cordoned off, and tours are conducted on a scheduled basis, interference with the excavation process should be minor and damage to the site negligible.

Site FS 86-01 near Frozen Lake is also situated in a visible, heavily visited location. As with the White River Trail site, interest was high during the documentation process. Unlike the former site, surface exposed artifact density is high. Unfortunately, formed tool artifacts have already been lost to artifact collectors (see Burtchard and Hamilton 1998). Excavation at Frozen Lake is recommended to recover information from a site continually exposed to damage, and to investigate what appears to be Mount Rainier's only known butchering locality and one of only two documented sites in alpine context. Even though the site is further from the Sunrise Ridge Visitor's Center than FS 95-05, excavation at Frozen Lake presents an excellent opportunity to conduct meaningful archaeological research and present methods related to that research in the setting in which the past events being studied actually took place.

A third site—FS 90-01 or the Sunrise Ridge Borrow Pit Site—is recommended for near term study due to past damage and ongoing erosion. While more distant from the interpretive center, excavation at this site also offers good interpretive possibilities. The site is one of the few documented in the forest-subalpine ecotone setting. It also is located near what is reputed to be the Yakama trail to Sunrise Ridge. Auto or walking tours beginning at the Visitor's Center could employ an interpretive scheme including both historical use focussing on implications of the trail, and prehistoric use emphasizing excavations at FS 90-01. If the trail could be traced from its presently reported location near the borrow pit to the crest of Sunrise Ridge, a particularly effective approach would be to walk that portion of the route to the site. Interpretive opportunities abound; including discussions about the flora and fauna en route, implications of the Yakama trail for early historical use of Sunrise Ridge, importance of the ecotone and, of course, prehistoric land-use practices and the archaeological record.

Clearly, excavation/interpretation efforts could extend beyond the three cited here. These sites are recommended particularly because they offer the dual advantage of providing useful archaeological data in the near-term, and being easily accessed from one of the Park's major Visitor's Centers. The bias toward Sunrise Ridge reflects the extensive subalpine habitat and relatively high site density common to the Park's northeast quadrant. Tours, of course, could be promoted at other centers. At present, however, no prehistoric sites have been documented near enough to them to warrant combined excavation-interpretation efforts at other than Sunrise Ridge.

Interpretive and research possibilities outlined here represent a sample of the many ways in which the emerging picture of prehistoric use of Mount Rainier may be presented to the public. The salient issue is to recognize that the Park's archaeological remains preserve an important record of long standing human use of the mountain and its surrounding landscapes. The existing record suggests that *Tahoma* has been used by people from all sides of the mountain for at least 3,400 years. With additional archeological research, it is likely that the record eventually will be extended perhaps to 8,500 years into the prehistoric past. Archaeological data, ethnographic accounts and ecological-anthropological theory converge to suggest that the mountain's subalpine and alpine habitats have long provided valuable animal and plant resources during its brief summer season. We now have ample reason to believe that for thousands of years these landscapes were not remote, uninhabited places, but routinely supported foraging then collecting groups living between its forested slopes and alpine snow. Our task now is to present that story as effectively and accurately as possible, and to take the steps required to genuinely improve our understanding of these long-term land-use processes. I hope that this volume has served to stimulate thought in this regard and made a useful contribution toward this greater goal.

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Appendix A:

SITE AND ISOLATE REPORTS IN MOUNT RAINIER NATIONAL PARK

The following table brings together various artifact and site reports directly involving Mount Rainier National Park. Sources include internal Park memoranda, museum catalog records on file at Park headquarters in Longmire, personal communications by various Park employees, and formal archaeological surveys. Dates provided refer to the time that the artifact or site report was filed (when known). Multiple entries indicate multiple reports. Dates and names are listed, and the sources described further, under *Site Report Sources* following the table. Catalog numbers are those entered on "Department of the Interior, National Park Service, Museum Catalog Record Worksheet - Cultural Resources" forms housed with museum collections in Longmire. Map numbers refer to locations included on map Figures 3.1 through 3.3. All numbered sites (prefix FS) and isolates (prefix IF) are documented in summary fashion in Chapter 3, and in detail in the *1995 Reconnaissance Data* companion volume (Burtchard and Hamilton 1998). The table's *Comments* field provides brief location and supplemental reference information.

The table is intended to reduce confusion in Mount Rainier cultural resource reports and collections that is inherent in the presence of multiple, uncoordinated finds that span a long period of time. Please note that the list is a preliminary document that should be improved and expanded as more information becomes available. Collections added after completion of 1995 fieldwork are not included. Note too that with the exception of three localities, the table focuses entirely on prehistoric cultural remains. Mount Rainier National Park also preserves an unknown number of potentially significant historic period archaeological sites. Efforts should also be made to systematically document these localities.

Table A-1 Prehistoric Sites and Isolated Find Reports in Mount Rainier National Park through 1995

Type of Find	Date	Reported by	Cat #	Map #[1]	Site or Isolate No.	Comment
Projectile point	1920	Schmoe, Floyd		1	None, unverified	Obsidian point found near Lane Peak in Tatoosh Range; cited in Schmoe (1967)
Unspecified lithic remains	1925	Schmoe, Floyd		2	None, unverified	Van Trump Park remains cited by Schmoe (1925 in Smith 1964:207-208).
Biface tip isolate	1930	Richards, L.G.	59	3	None, unverified	Possible knife tip reported found by Schmoe near Pinnacle peak. Probably really the "white quartz" find in Spray Park by Richards (1930 in Smith 1964:208).
Rockshelter	1963	Daugherty, Richard (Terry Patton)	Pend.	8	FS 63-01 (45PI43)	Fryingpan Rockshelter tested by Rice (1965) and reevaluated in 1995 (*see this volume*).
Dart point isolate	1963	Rice, David & Charles Nelson		9	IF 01-63	Bench Lake isolate reported in Daugherty (1963) (*also see this volume*).
Lithic Isolate	1968 1978	Bell, Frank Dalle-Molle, John	8304 8305	10	IF 01-68	Bee Flat/Yellowstone Cliffs area (*this volume*).
Two projectile point isolates	1970	Henderson, Jan	8306 8307	11	IF 01-70	Success Cleaver isolates (*this volume).*
Lithic scatter	1971 1978 1995	Dalle-Molle, John Dalle-Molle, John Fabiani, Carl & Denise	8317 8318	12	FS 71-01(45PI438)	Buck Lake Site documented in 1995 (*this volume*). This site also is referred to as "Fawn Ridge" in 1971 memo by JD-M; and as Buck Lake in 1978 JD-M memo. Cari Kreshak (R. McClure project) searched unsuccessfully in 1990. D. & C. Fabiani (pers. com.) drew attention to the site again in 1995.
Rockshelter	1971 1978	Dalle-Molle, John Dalle-Molle, John	4631 - 4700	13	FS 86-02 (45PI303)	Berkeley Rockshelter tested in 1987 by E. Bergland (1988) (also see Bergland 1986 and *this volume*)
Lithic isolates	1972	Dalle-Molle, John	8311 8312	14	IF 01-72	Sunrise Creek isolate (*this volume*).
Isolated flake	1978	Dale-Molle, John		15	IF 01-77	Deadwood Lakes Pass isolate location examined in 1995 (*this volume*).
Isolated small point	1978	Dalle-Molle, Lois		16	None; verification attempted	Broken small point, upper Huckleberry Park, SW section. Area surveyed by Burtchard and Hamilton in 1995, no cultural materials identified.

Type of Find	Date	Reported by	Cat #	Map #[1]	Site or Isolate No.	Comment
Rockshelter	1978	Dalle-Molle, John	8313 8314	17	FS 74-01 (45PI437)	Vernal Park Rockshelter documented in 1995 (*this volume*).
Lithic scatters	1978 1995	Dalle-Molle, John Fabiani, Carl & Denise		18 33 39 40	In graveled trail west of S. tarn lake FS 90-03 (45PI410) FS 95-07 (45PI434) FS 95-08 (45PI430)	Various lithic scatters in the general Windy Gap / Spunkwush Creek headwater area. FS 90-03 documented 1990 by R. McClure; others in 1995 (*this volume*)
Flake in rockshelter	1978	Dalle-Molle, John		19	None; unverified	Large flake from rock overhang (cave) on Boulder Creek.
Rockshelter	1978 1995	Dalle-Molle, John Fabiani, Carl	8310	20	FS 72-02 (45PI433)	Mt. Pleasant Rockshelter in Spray Park documented in 1995 (*this volume*).
Lithic scatter	1978 1986	Dalle-Molle, J. & L. Thompson, Mark	4737 4738 4739 8309	21	FS 86-01 (45PI407)	Frozen Lake Site documented 1995 (see Bergland 1986 and *this volume*).
Isolated flake	1978	Dalle-Molle, John		22 35 36 48 49	Unspecified place FS 95-03 (45PI436) FS 95-04 (45PI435) IF 06-95 IF 07-95	JD-M reported flake probably is associated with one of these places documented in 1995 in the general Yakama Park section of Sunrise Ridge (*this volume*).
Isolated flake	1978	Dalle-Molle, John		23	None; verification attempted	Single flake in basin ENE of Dege Peak. Upper bench area surveyed in 1990 by Janet Liddle (1990). No cultural remains identified.
Lithic scatter	1978	Dalle-Molle, Lois		Not mapped	None; unverified	Numerous chips (flakes) in log skid road W of White River and S of Anger Creek airstrip, Snoqualmie N.F. Not in Park.
Possible flake scraper	1981	Teague, George		Not mapped	None	Found during survey for the Paradise waste treatment facility. No site recognized and construction was completed.
Arrow point isolate	1984	Burman, Wendy	8308	24	IF 01-84	Upper Palisades Lake isolate (*this volume*).
Dry wall masonry	1986	Carney, Mike		Not mapped	None, unverified	In the vicinity of Cataract Creek; may be historical (in Bergland 1986).

Type of Find	Date	Reported by	Cat #	Map #[1]	Site or Isolate No.	Comment
Lithic scatter	1986	Carney, Mike		25	None, unverified	In the vicinity of Indian Bar, Ohana [pecosh River..?] (In Bergland 1986).
Lithic scatter	1986	Thompson, Peter		26	None, unverified	Lake James Trail (in Bergland 1986).
Lithic isolate	1987	Jensen, Chris	8315	27	IF 01-87	Tokaloo Trail isolate (*this volume*).
Possible quarry	1988	Dalle-Molle, John		28	None, unverified	Reddish jasper chunks and fragments on the NW flank of Mt. Fremont in the upper basin above Forest Lake. Map included with memo note to Regional Archaeologist, Jim Thomson.
Lithic scatter	1988	Jensen Chris & Steve Freitas	Pend.	29	FS 88-01 (45PI406)	Original Tipsoo Lakes Site recorded by R. McClure in 1988 (*also see this volume*).
Lithic scatter	1989	Forrest, James		30	FS 95-01(45PI426)	Site originally located by Forrest, relocated by G. Sullivan and documented in the 1995 reconnaissance (*this volume*).
Lithic isolate	1989	Forrest, James		Not mapped	MORA 89-01	Found near Hwy. 410 in the White river floodplain. Flakes may be road fill. Because of fill and known White River flood patter, *cultural association is considered unlikely.*
Lithic quarry	1990	Drie-Miller, Joe		34	FS 90-04 (45PI411)	Tum Tum Peak Quarry Site recorded by Janet Liddle in 1990 during the R. McClure inventory project (see *this volume*).
Lithic scatter	1990	McClure, Rick		33	FS 90-03 (45PI410)	Lithic Scatter on Windy Gap documented 1990 (*this volume)*.
Lithic scatter	1990	McClure, Rick		32	FS 90-02 (45PI409)	Sarvant Glaciers Site documented in 1990 (*this volume*).
Lithic scatter	1990	Osterhaus, Luke	Pend.	31	FS 90-01(45PI408)	Sunrise Ridge Borrow Pit Site recorded by R. McClure in 1990 (*this volume*).
Eleven reconnaissance documented sites	1995	Burtchard, Greg & Steve Hamilton		30 Historic 35 36 37 38 39 40 Historic 41 42	FS 95-01 (45PI426) FS 95-02 (45PI427) FS 95-03 (45PI436) FS 95-04 (45PI435) FS 95-05 (45PI432) FS 95-06 (45PI431) FS 95-07 (45PI443) FS 95-08 (45PI430) FS 95-09 (45PI428) FS 95-10 (45PI429) FS 95-11 (45PI439)	All newly documented during the 1995 cultural reconnaissance project (*this volume*). Some of these numbers appear elsewhere in this table with other reported sites. Note that two—FS 95-02 and FS 95-09—are historic period sites. Other previously reported sites, documented in 1995, are noted elsewhere in the table as appropriate.

Type of Find	Date	Reported by	Cat #	Map #[1]	Site or Isolate No.	Comment
Eleven reconnaissance isolated finds	1995	Burtchard, Greg & Steve Hamilton		43 44 45 46 47 48 49 50 51 52 53	IF 01-95 IF 02-95 IF 03-95 IF 04-95 IF 05-95 IF 06-95 IF 07-95 IF 08-95 IF 09-95 IF 10-95 IF 11-95	Newly documented during the 1995 cultural reconnaissance project (*this volume*). Some numbers appear elsewhere in this table with other reported finds. Other previously reported finds, documented in 1995, also are noted in the table.
Lithic isolate	1995	Cox, Pam	Pend.	54	None, unverified	Upper Crystal Lakes isolate.
Jasper projectile point	1995	Carl & Denise Fabiani		55	None, unverified	In social trail ca. 100 ft west of maintained trail atop of ridge approaching Tolmie Peak Lookout.
Jasper projectile point	1995	Carl & Denise Fabiani		56	None, unverified	On Howard Peak
Projectile Point	1995	Carl & Denise Fabiani		57	None, unverified	In trail near west end of Eunice Lake. Geologist Bailey Willis reported finding Indian baskets near Eunice Lake in early 1880s.
Point & lithic debitage	1995	Carl & Denise Fabiani		58	None, unverified	In bulldozed fire trail on ridge top south of Mowich River near the Park boundary.
Lithic scatter	1995	Carl & Denise Fabiani		59	None, unverified	On ridge between Tyee Peak and Windy Gap.
"Couple" of flakes	1995	Carl & Denise Fabiani		60	None, unverified	In trail east of Golden Lakes Ranger Station.
Two flakes	1995	Carl & Denise Fabiani		61	None, unverified	In trail to Sunrise Lake along top of Sunrise Ridge east Sunrise Point.
Trail Segment	1995	Carl Fabiani & Jack Morrison 1995, Roger Drake 1996		62	None, undocumented	Portion of trail ostensibly providing access to Sunrise Ridge from the east. Reported to have been used by the Yakama during the early historic period.
Chert biface	UK	UK	57	None	None, unverified	Artifact in MORA museum in Longmire without provenience.
Ground ax head	UK	UK	58	None	None, unverified	Artifact in MORA museum in Longmire without provenience.
Biface preform	UK	UK	130	4	None, unverified	Artifact from Moraine Park, in MORA museum in Longmire. No map found.

Type of Find	Date	Reported by	Cat #	Map #[1]	Site or Isolate No.	Comment
Arrow point	UK	UK	131	5	None, unverified	Artifact near Glacier Vista Trail in MORA museum in Longmire. No map.
Dart point	UK	UK	132	6	None, unverified	Found within sight of east side of Burroughs Mtn., artifact in MORA museum in Longmire. No map location.
Arrow point	UK	UK	133	7	None, unverified	Found within sight of Klapatche Park, artifact in MORA museum in Longmire. No map.
Ground stone maul	UK	UK	8319	None	None, unverified	Unknown location, artifact in MORA museum in Longmire.
Ground stone maul	UK	UK	8320	None	None, unverified	Unknown location, artifact in MORA museum in Longmire.

[1]Map locations refer only to *prehistoric* sites and isolates within Park boundaries. Refer to Figures 3.1 through 3.3.

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Appendix B:

MOUNT RAINIER LITHIC ASSEMBLAGE INVENTORY METHODOLOGY

by
Stephen C. Hamilton

A lithic assemblage inventory was applied to sites and isolates investigated during the 1995 reconnaissance project in order to quantitatively assess site diversity. We hope that the method represents an improvement over general descriptions, which often overlook subtle differences in assemblage characteristics. Although subjective aspects remain, the categories are intended to maximize replicability by adherence to fixed attribute definitions. There are, of course, nagging problems of biases introduced by depositional variation, ground visibility, small sample size and collection by artifact hunters. Nevertheless, we feel that the present inventory has proven to be a useful means to more clearly describe site characteristics and build a stronger inferential foundation for technological organization and site function.

The basic procedure for the Mount Rainier project involved flagging individual artifacts and then walking from flag to flag tallying artifact by type (defined below) within basic raw material categories. When deemed appropriate, comments on specific artifacts, assemblage character, visibility and other variables were noted.

All artifacts were classed within raw material types. These include various cryptocrystalline silicates (CCS), volcanic basalts, volcanic metasediment and obsidian. CCS material is subdivided into jasper (red and tan), various color phases of chert (opaque) and chalcedony (translucent). All raw material types except obsidian are available at primary sources on the mountain and alluvial gravels associated with the mountain's watershed system. Artifact definitions and discussion follow below.

Debitage

Debitage is the waste material from manufacturing tools that shows no subsequent shaping or use as a tool. Debitage is subdivided into categories that represent general stages of manufacture. The description and rational for these categories are discussed below.

Cortical flake (CF)
A flake with cortex on its dorsal face. This category does not include cortical platform flakes. [Result of initial nodule reduction].

Secondary, Interior flake (IF)
Flakes without cortex that are greater than 5 mm thick. [Result of initial nodule reduction, core shaping (preparation), amorphous core reduction and early stage tool shaping].

Tertiary Interior flake (TIF)

Flakes without cortex that are less than 5 mm thick. [Result of flake production from prepared cores and mid stage tool shaping (i.e., edging process)].

Biface flake (BF and BTF)

Flakes with a biface edge platform or with multiple dorsal flake scars, often with longitudinal flake scar ridges. They are usually curvilinear. They include mostly percussion flakes, but also some larger pressure flakes. [Result of mid and late stage biface shaping and thinning].

Retouch flake (RF)

Small flakes, usually pressure flakes. [Result of biface finishing and maintenance of bifaces and flake tool edges (i.e., resharpening)].

Shatter

Blocky debris that is less than 5 cm with no distinguishable ventral surface that would define it as a flake and no flake scars that would define it as a core. [Result of early stage, core reduction].

Raw Material

A piece of potential parent material for making tools that is larger than 5 cm but has no apparent cultural modification such as flaking, battering or grinding. [Result of natural source or manuport into a site].

Debitage Discussion

The above debitage definitions are designed to categorize flakes rather quickly in the field while maintaining their integrity as representing basic stages of manufacture in a reduction sequence. Cortical Flakes (CF) are early-stage reduction flakes. These flakes are produced primarily during initial nodule reduction, including core shaping. Secondary, Interior Flakes (IF) are also early-stage reduction flakes produced during early core reduction and flake production using amorphous cores. They may also include flakes from early tool manufacture such as initial shaping of a uniface or biface. Tertiary Interior Flakes (TIF) are the result of late stage core reduction, usually of prepared cores (rather than amorphous cores), and, like IF, possibly early stage tool manufacture. In general, the higher the frequency of TIF flakes in an assemblage, the more emphasis on late stage reduction is represented. This can be the result of flake production from at least minimally prepared cores (cores with developed platforms) and mid-stage biface shaping. By contrast, high proportions of CF and IF flakes indicate earlier stages of reduction as a result of primary nodule reduction and initial core shaping and, to a lesser degree, initial tool shaping. We expect high frequencies of CF and IF flakes at procurement sites as compared to, for example, residential sites or butcher sites.

Biface flakes are produced during biface edging, shaping, and thinning (mid to late stage biface manufacture). They may also be produced from standardized biface cores. However, most identifiable biface flakes are the result of the later stages of biface shaping and thinning (mid to late stage). While biface flakes result from primarily percussion and early stage pressure biface shaping, retouch flakes are usually the result of biface finishing and tool maintenance. However, biface production can be highly variable. For example, arrow point production, in which pressure is applied to a flake blank during all stages of manufacture, will result in a relatively high frequency of retouch flakes as compared to a dart point in which percussion and pressure techniques are used in the shaping and thinning process. In addition to biface finishing, retouch flakes are produced during tool edge resharpening. In general, there should be a higher frequency of biface manufacture debitage at residential sites, while special task sites or short term hunting camps should have higher frequencies of retouch debitage from tool maintenance.

Cores

Cores were defined by shape and standardization. The morphological categories are as follows:

Polyhedral (amorphous)
Flake scars (or platforms) occur on two or more faces on a blocky piece of raw material.

Single platform
Flake scars originate from a single platform (nodule face). The parent nodule may be blocky.

Tabular
A flat nodule or large flake that was flaked on one or two faces but the edge is not contiguous- early stage biface.

Biface
A flat core flaked on both faces. The flaked edge is contiguous- mid stage biface.

Standardized core
A core was described as standardized if it is well formed with regularized flake scars and a well prepared platform. These usually include blade cores and biface cores.

Expedient core
Most other cores are expedient. These include polyhedral cores and tabular and single platform cores with few flake scars and minimal platform preparation.

Tools and Preforms

At the most general level, tools and preforms are classified as biface, flake tool, cobble tool, and ground stone. A *biface* is substantially flaked on two faces. A *flake tool* is either minimally shaped such as retouch along one margin (uniface) or a flake that shows use-wear (used flake- patterned microflaking and/or polish). *Ground stone* artifacts show abrasion smoothing and polish from use and/or manufacture. Ground stone typically includes milling stones for plant processing such as metates, mortars, hand stones (manos), and pestle-mauls. *Cobble tools*, on the other hand, exhibit flaking, crushing, and/or battering from shaping and use. Cobble tools include edge battered cobbles, choppers, other flaked slab tools and various hammerstones. The functional definitions of cobble tools and ground stone are conventional and therefore not specified here.

For this project, fine-grained flaked tools included primarily projectile points, miscellaneous bifaces, unifaces, and used flakes. For the sake of analysis replication, some of these are worth defining.

Projectile point
Finished bifaces with a hafting element or other biface fragments with impact fractures. These include three functional types: arrow points with a neck width of less than 7 mm; dart points with a neck width of 7 - 15 mm; and lance points with a neck width of greater than 15 mm. When possible, the Great Basin Type was noted. All projectile points were also sketched.

Uniface

A flake tool with substantial unifacial retouch on at least one margin. Retouch is identified as patterned flaking with flake scars 3 mm or greater. Unifaces include scrapers (edge angle 60 - 90 degrees), shavers (edge angle 20 - 60 degrees), and cutters (edge angle <20 degrees). Edge angles were estimated, not measured.

Used flake

A flake with patterned microflaking (less than 3 mm flake scars) and/or polish.

Preform

Preforms that were identified in the field are usually bifaces. These were defined according to general stages of manufacture. Early stage preforms are in the edging process and therefore not flaked completely around their circumference (Callahan 1979- Stage 2). Mid stage bifaces have been completely edged, but have not been thinned (Callahan 1979- Stage 3). Late stage bifaces are edged and almost completely thinned but need final shaping. They have irregular margins without the completion of finishing retouch (Callahan 1979- Stage 4).

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Appendix C:

ECOLOGICAL SUCCESSION; IMPLICATIONS FOR PLANT AND ANIMAL ABUNDANCE, AND ARCHAEOLOGICAL SITE DISTRIBUTION PATTERNS

Author's note: The following text is reprinted from Greg C. Burtchard and Robert W. Keeler; 1991; *Mt. Hood Cultural Resource Reevaluation Project: A Consideration of Prehistoric and Historic Land Use and Cultural Resource Survey Design Reevaluation, Mt. Hood National Forest, Oregon*; report to USDA Forest Service, Gresham, Oregon; Laboratory of Archaeology and Anthropology; Portland State University; Portland, Oregon; pages 40-42. The section reproduced below provides ecological and theoretical background underlying statements regarding seral-stage productivity (phrased as relative forest maturity or ecosystem maturity) and archaeological site distribution patterns discussed in the body of this report. Bracketed [] comments have been added for this printing.

FOLKS HAVE TO EAT: RESOURCE DISTRIBUTION AND PREHISTORIC LAND-USE IN THE NORTHERN OREGON CASCADES

Throughout this chapter [Chapter 2 in Burtchard and Keeler 1991], we have implied that patterned distribution in the availability of resources, principally food resources, is of central importance to understanding patterned site distribution in the mountains. The modern structure of the Northwest Maritime Forest tends to limit food resource abundance overall, placing particular importance on locations within the forest that are less constrained by such limitations. These are places where weather, rainfall, soils and forest clearings combine to allow generation of diverse plant and animal communities. Such communities exist at present in high elevation parklands, weather and fire maintained open forests, and perennially wet meadows. Pollen from both [eastern and western] Cascade slopes suggest that such communities existed, and periodically expanded, during the period of human tenure in the central Cascades. Given the seasonal availability of resources needed to support human populations, it should not be surprising that Forest archaeologists are finding an increasing number of prehistoric localities in the montane uplands. The mountains were simply good places for people to be during the late summer and autumn months when critical exploitable food resources were most abundant. Below, we support this point and clarify basic causes underlying the resource pattern…

The Terrestrial Environment: Forest Maturity, and Plant and Animal Abundance

The availability of terrestrial resources is linked to seral succession and ecosystem maturity. Even though biomass increases during succession, the ratio of primary production to total biomass drops as ecosystems approach maturity. During succession, there is an increase in the proportion of inert or even dead matter with a low respiratory rate, such as wood, shells, and so on (Margalef 1968:31). In a forest, this means that, as maturity increases, the fraction of plant tissue available to support animal life decreases. Accordingly, the highest ratio of animal biomass to plant biomass is not found in the forest proper, but in grasslands or parklands in which vegetation is kept at a lower state of maturity [i.e., an early seral-stage] (Margalef 1968:44). In his discussion of mule deer habitat, Geist (1981:159) emphasizes the point: "Immature ecosystems, compared with climax ones, produce a greater amount of young, exploitable plant tissue per unit area." Because of this variation, deer tend to forage in open areas and/or take advantage of herbaceous growth along streambeds and marshes. He states the same premise even more directly in his discussion of elk ecology. "The greatest concentration of food is found where an animal has access to the entire food-producing (photosynthetic) layer of vegetation. For elk, this is in grasslands" (Geist 1982:227).[45] The point is clear for deer, elk and a variety of animals (including humans) that exploit forest habitats: terrestrial ecosystems with low to moderate maturity provide a higher fraction of edible plant (and animal) tissues than do mature forests.

In the Northwest Maritime Forest, this edible productivity/maturity association poses particular problems for resident human populations. Due to moisture and climate moderating effects of Pacific westerlies, the Maritime Forest naturally is able to achieve high maturity [relatively late-stage seral succession]. In a natural state, old-growth forests would have been common, but *would not* have been the best places to find food. The very presence of extensive Northwest Maritime Forest cover established a context that selectively favored more intensive, repeated human use of certain low maturity [early seral-stage] places within the forested landscape; and less intensive, less frequent use of closed forest, high maturity [late seral-stage] areas. These low maturity places are parklands, meadows, recent burns and any other area where a combination of solar exposure, weather and soils facilitate vigorous low-lying vegetation. These are the places that permit relatively high primary productivity and contain the greatest abundance and diversity of food items. Included within this diversity were arguably the most critical of the upland resources –elk and deer, and perhaps huckleberries and bear. By directing their attention to low maturity areas in the Maritime Forest, prehistoric humans could not only reasonably expect to acquire such high return commodities, but maximize their opportunity to acquire supplemental or buffering resources (game birds, roots and berries) as well. Assuming that food acquisition is a prime reason for using the upland terrain, an understanding of the factors conditioning variable maturity in the northern Oregon Cascades is of key importance to understanding broad-scale patterns in human land-use and patterns in the relative density of their archaeologically preserved remains.

Low maturity areas are not uniformly or randomly distributed in the forest. In a natural state, they are maintained by circumstances that reduce stability of the maritime environment to an extent that represses tree cover but permits growth of a faster reproducing ground cover species. Such places are 1) frequently water saturated ground (wet meadows, swamps and marshes); 2) areas subject to unstable weather conditions [and heavy, late-melting snow loads] (subalpine parklands [and alpine tundra]); 3) solar exposure and/or shallow soils contributing to periodic desiccation (southern and western exposures on high slopes and ridgelines); 4) mesic areas contributing to periodic burning (above plus eastern slope pine forests); 5) tree blowdowns (primarily exposed ridges); and 6) mass sediment wasting (steep slopes). While wet meadows and mass wasting can occur at any elevation, most of the lower maturity areas tend to be situated at higher elevations and perhaps on the pine forested eastern slope. Over long stretches of time, these are places that should have supported the highest density and diversity of plants and animals, and consequently should have been the focus of repeated human hunting and gathering activity. From mid-summer through autumn, upland productivity was at its highest relative to the drier lowlands. Given relative resource abundance in these places at those times,

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[45] Note that mule deer and elk share variant but overlapping habitats. Deer eat a variety of herbaceous shrubs and grasses, but can thrive on the former. They are well adapted to forest fringes and to stream channels where deciduous young growth penetrates the forest cover. While they tend to migrate upslope with seasonal warming, individuals and small groups can remain near and browse in minor forest openings so long as forage is adequate. Elk can use similar habitats, but thrive on more extensive grasslands that can support their large body size and more gregarious habit. Both species use forest cover for shelter and predator protection, but again because of size and number, elk can successfully risk venturing further and longer into open countryside. For thorough consideration of elk, mule deer and black-tailed mule deer ecology see Thomas and Toweill (1982) and Walmo (1981).

it should not surprise us to find archaeological evidence of human occupation on or near these same upland places. Ridgelines, high elevation parklands, wet meadows were simply among the most productive places for human foragers to earn a living.

It should be noted that natural (non-human related) processes are not the only means by which low maturity states can be achieved and maintained. Humans are quite capable of meddling in such processes. The arguments above suggest that it is unreasonable to expect intelligent, foraging experts not to have recognized and availed themselves of the relative resource abundance of low maturity areas within the generally resource poor Northwest Maritime Forest. It is also unreasonable to expect them not to recognize that they could personally intervene to lower forest maturity in a manner that enhanced its exploitable productivity. Forest burning can maintain or expand grassland and parkland habitats thus improving its elk, deer and ultimately human carrying capacity. Given increasing population demands on available resources through time, we must assume that humans increasingly turned to enhancing resource potential through burning forest cover. The ability of humans to intentionally set fires coupled with the possibility of extensive (if infrequent) natural fires introduces a degree of chaos into the emerging pattern of low maturity and land-use in the Maritime Forest. Even so, it is reasonable to expect intentional burning to be differentially directed to 1) those areas that were already productive habitats (rather than attempting to create new habitat out of mature forest, and 2) to drier areas that could be burned most effectively. If so, the basic low maturity pattern noted above should generally hold as outlined. The most dramatic effect of human induced burning should have been to enlarge the naturally occurring boundaries.

In short, because exploitable resources have a patterned distribution in the northern Oregon Cascades [and in the Cascades generally], the archaeological remains of humans dependent upon those resources should be [spatially] patterned as well. An understanding of the impact of forest maturity on resource productivity provides an important element in understanding basic [site location] patterns in human use of the environment. Arguing solely from a maturity based perspective, we anticipate a relatively high density of prehistoric archaeological sites near 1) presently predictable places such as wet meadows, and on upper elevation ridges and [subalpine] parklands; and 2) functionally similar, but less predictable, places such as once dry meadows, ephemeral burns and artificially maintained low-maturity areas that are now obscured by regenerated successional forest cover. …

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