DESCHUTES COUNTY PREHISTORIC CONTEXT STATEMENT

Deschutes County
Preservation Planning Department

HPF 9516

SEPTEMBER 1996

A PREHISTORIC OVERVIEW OF DESCHUTES, COUNTY

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PREPARED FOR
DESCHUTES COUNTY, THE CITIES OF BEND, REDMOND AND SISTERS AND THE STATE HISTORIC PRESERVATION OFFICE

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INTRODUCTION

Deschutes County has over 1400 known archaeological sites. To date, little has been done to protect these sites from the massive growth within the County, let alone to create a methodology to address these resources under Statewide Planning Goal 5 and ORS 358. US census data showing Deschutes County as the fastest growing County in the State since 1980 along with recent building permit trends suggest a study like this is imperative and that the threat to prehistoric resources is imminent. Census data indicates County population grew 18.4 percent from 75,600 people in1990 to 89,500 in 1994. Portland State University's Center for Population Research and Census estimates that population will increased in the County by another 18.1% from 1990 to 2000. By the year 2010 the population of the County is expected to be 128,868 people, a 32.6% growth rate from todays population. Recent estimates indicate that archaeological site density within the County may be as great as five to six sites per square mile.

In response to these trends the Deschutes County Community Development Department has completed a prehistoric context statement discussing the current archaeological sites in the County and made recommendations on how to manage known and unknown sites. The following document will serve as a planning document for future decisions related to compliance with Statewide Planning Goal 5 and ORS 358.

As part of its stewardship role for the cultural resources of Deschutes County, the Deschutes County Community Development Department, Historic and Cultural Resources Office is required by State and County law to inventory and oversee prehistoric and historic resources located within the County. In the form of prehistoric sites, traces of the human presence on the landscape are often very difficult to locate and fragile to manage once found. Recognizing this difficulty, the Deschutes County Community Development Department has written the following Prehistoric Context Statement, in conjunction with Federal, State and private agencies, to locate, evaluate and manage prehistoric sites in the County.

The Deschutes County Historic and Cultural Resource Planner served as the lead coordinator on this project, responsible for research, document preparation and coordination with an Advisory Committee. The Advisory Committee was composed of individuals from: the US Forest Service (Deschutes National Forest), the Bureau of Land Management (Prineville District), and the Confederated Tribes of Warm Springs. Representative professionals in their respective fields, the Advisory Committee provided direction, consultation and editing for this project. Richard Pettigrew was hired on a consulting basis to provide a synopsis of current archaeological research in Central Oregon and to pose some research questions to guide further study of archaeology in the region. The following are their findings.

ENVIRONMENT

In order to understand the prehistory of Deschutes County and its past inhabitants, it is first necessary to understand their relationship to the physical environment and how it changes over time. This study will describe Deschutes County's current setting of flora (plants), fauna (animals), geology, soils, and hydrology, as well as, attempt to interpret the past Paleo-environment. A description of the current distribution of land forms, floral and faunal types will help model the past economic and political lifeways of human ecology for prehistoric people living within the County. Because County boundaries were set at the time of incorporation in 1916, a regional approach to the features defining the natural environment is more appropriate for study purposes.

Setting / Spatial Boundaries

Deschutes County lies on the east side of the Cascade Mountain range in Central Oregon almost directly in the middle of the State (see Figure 1). Most of the County is situated on the High Lava Plains Physiographic Province between the basin and range country to the south, the Columbia Plateau region to the north and the Blue Mountains to the east (Baldwin 1981). The area is characterized by gently sloping terrain and contains numerous lava flows, lava butte cinder cones and tubes or caverns. Volcanic features are abundant, many of which are comparatively recent in origin. The 500 square mile Newberry volcano dominates much of the south central portion of the County and contains at least 20 obsidian flows within the caldera and on its flanks (Skinner 1983:37). Many of these areas were used by prehistoric people for the manufacture of chipped stone tools. The elevation in Deschutes County ranges from a low of 2,700 feet above sea level near Redmond to a high of over 10,000 feet in the Three Sisters Wilderness Area. Land ownership in the County is composed of approximately 60% U.S. Forest Service land, 30% Bureau of Land Management land and 10% private land (Scott 1984).

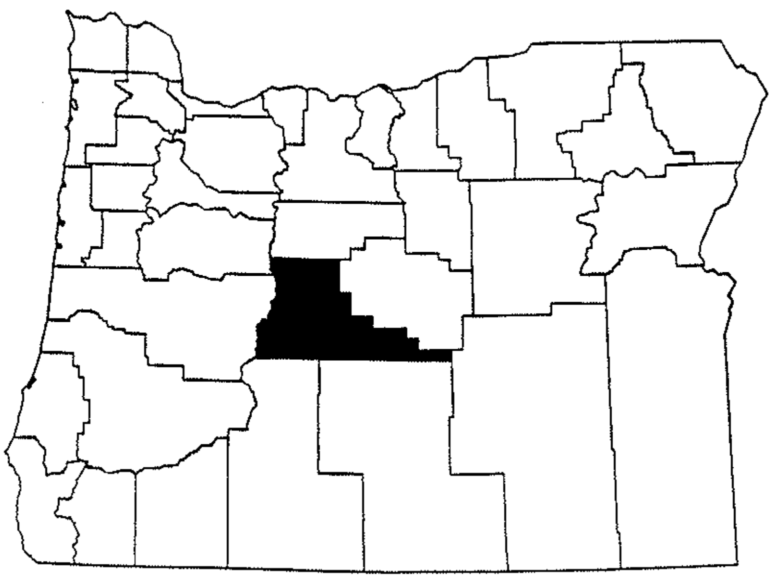


Figure 1. State of Oregon Map showing the geographic location of Deschutes County.

Geology and Soils

Deschutes County contains geological features such as fault systems, cinder cones, lava flows, lava tubes and ash deposits where extinct and dormant volcanoes are abundant. Of great significance to human populations was the presence of numerous obsidian flows associated with past volcanic activities. Among the more important toolstone resources are: Obsidian Cliffs, Newberry Volcano (including McKay Butte), Glass Buttes, Quartz Mountain, Cougar Mountain, Sycan Marsh and Spodue Mountain. Among these is Newberry Volcano, the primary source of obsidian raw materials for the region. Lava tubes were also important to prehistoric populations in Deschutes County, providing shelter and access to water usually in the form of perennial ice or springs. Most of the lava tubes within the County are part of the Horse Ridge or Arnold systems. These regional geologic structures have determined, to a great extent, the soil composition, altitude, microclimate pattern, water sources, vegetation zones, and wildlife habitat over the last 12,000 years

Changes in the geologic environment, required subsequent changes to human settlement patterns. The most devastating geologic events were volcanic eruptions of Mt. Mazama in 6700 BP (Before Present), Newberry Crater in 6700, 3500 and 1400 BP and Lava Butte at 6150 BP (Infotec 1990).

Just north of the Deschutes County boundary, is the major geological division separating the Deschutes-Umatilla Plateau and the High Lava Plains Physiographic Provinces the Crooked River (Baldwin 1981). In its lower reaches the Crooked River channel follows part of the John Day fault system, marking the southern edge of the Clarno Formation (Infotec 1990). The Clarno Formation of the Deschutes-Umatilla Plateau is made up of diverse cryptocrystalline silicates, andesite, rhyolite, basalt flows, breccia, and multicolored tuffs, and a variety of water-laid sedimentary rock (Baldwin 1981:96).

The High Lava Plains, in which most of the County is situated, are composed of middle-and late- Cenozoic volcanic uplands which maintain a moderate topographic relief with an elevation range between 3,000 and 8,000 feet (see Figure 2). These High Lava Plains are marked structurally by the Brothers Fault Zone which trends west to northwest for the length of the province (Lyman 1983:5). This *en echelon* normal fault zone acts as a fundamental structural boundary between the Blue Mountains and the Great Basin's north-south faulted volcanic terrain. These uplands are overlaid by the Deschutes Formation, which is different in structure from the Clarno Formation on the other side of the Crooked River. The Deschutes Formation is composed of tuffaceous sedimentary rock throughout the upper-and middle-Deschutes Valleys (Infotec 1990:2-39). It has been best described by Ewart Baldwin in his book Geology of Oregon as:

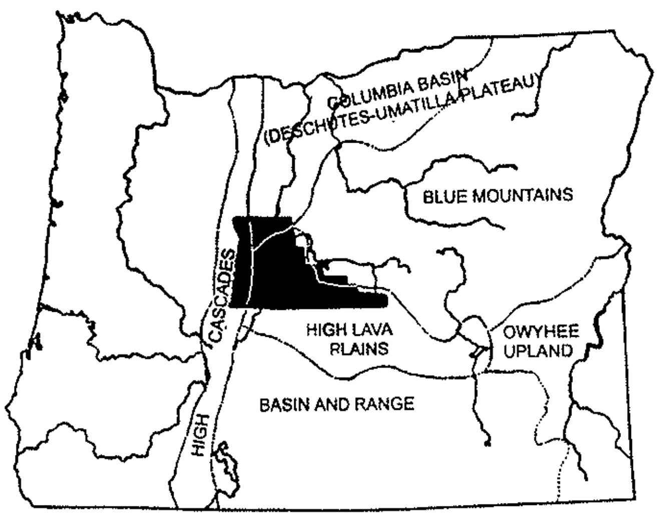


Figure 2. Physical and Geological Provinces of the State of Oregon. Deschutes County is in shaded area.

> "overlain by a thin but widespread rimrock-forming olivine basalt which also fills shallow channels at the top of the Deschutes... volcanic cones such as Round Butte formed on top of the olivine basalt. Then the lowering base level caused the rivers to cut valleys in the soft Deschutes sediments. The rimrock was undercut and portions of it slid. During the Pleistocene, lava flowed down both the Deschutes and Crooked Rivers filling the valleys nearly to the top"(Scott1984).

Erosion carved the canyons of the Crooked River and Deschutes River Gorges. Contributing further to the geology of the Central Oregon Region were volcanic eruptions from the Newberry Volcano which deposited basalt flows across the entire western portions of the County.

Soil tests conducted for Deschutes County in the past several decades have numerous inconsistent references to soil types and distribution patterns (Lyman 1983:9). For further study of soil type distribution see: Leighty 1958; Loy et. al. 1976:126; Mayko and Smith 1966; Oregon Water Resources Board 1969: Map 7-5-18841-5; USDA-SCS 1947, 1973; and USDI-BLM 1980 (Lyman 1983:9). Generally however, soils within the County belong to the Metolius, Houstake, Laidlaw, and Statz series: all sandy loams of similar composition. Soils in the northern part of the County are predominately of the Houstake and Statz series. The former series is a loamy sand formed in alluvium of ash materials eroded from lava, and typically is found in depressions on lava plains with slopes from 0 to 5 percent (Infotec 1990:2-43). These soils are taxonomically classified as course-loamy, mixed, mesic and aridic. The Statz series is composed of shallow, well-drained sandy loam soils located on lava plains with 1 to 15 percent slopes (Infotec 1990:2-43). Its taxonomy is very similar to the Houstake series. From Terrebonne to LaPine, post-glacial erosion in the small local valleys has created sediments consisting primarily of:

> "Stratified diatomaceous silts, sands, and fine gravel's derived from the erosion of nearby basalt shield volcanoes of the Pliocene and Pleistocene age, as well as volcanic air fall deposits of basaltic to rhyolite composition....lacustrine and fluvial sediments of the Late Pleistocene age in the area of LaPine, occupy a basin between the axis of the Cascade Range and Newberry Volcano to the east" (Chitwood 1985:1).

For more information on the geology and soils of the region see: PGT-PG&E Pipeline Expansion Study, and Cultural Resource Reconnaissance in the Redmond Training Area.

Flora

Numerous floral species occur throughout Deschutes County. Their distribution and productivity is variable and dependent upon elevation, precipitation, soil type, slope, aspect, seasonality and geographical location. Significant plant habitats to prehistoric peoples and the flora associated with them are mention in Leo Hitchcock's 1973 Flora of the Pacific Northwest as:

> "lithosolic patches (roots such as lomatiums, bitterroot, onions, and brodiaeas), dry fields (seeds such as sunflowers and mustards, and lilly bulbs), stream banks (currants, ryeseeds, cowparsnip), wet meadows (camas, yampa), woods (pine nuts), and mountains (huckleberries)."

The flora of the County is generally characteristic of zones from the Northern Great Basin, the Columbia Plateau and the Cascade Range. These major vegetation zones include: (1) the low and mid-elevation *Pinus ponderosa zone*; (2) the *Juniper Occidentalis zone* located between the forest and shrub-steppe and (3) the *Shrub-Steppe zone* marked by big sagebrush. Areas on the west side of the County, mainly in the Cascade Range are part of the *Pinus ponderosa zone*. This forested zone also occurs both south of Bend and in the foothills of the Paulina Mountains below Newberry Crater. Areas east of Sisters, Bend and the Newberry Crater include vegetation characteristic of the *Juniper Occidentalis zone* and the *Shrub-Steppe zone*.

Loy describes the *Pinus ponderosa zone* as "Under story cover [that] varies from dense to open mats of Bitter brush (*Purshia tridentata*) and Ceanothus (*Ceanothus velutinu*)... in association are other the following tree species: Lodgepole pine (*Pinus contorta*), Ponderosa pine (*Pinus ponderosa*), Mountain hemlock (*Tsuga mertensiana*), and mixed conifer species" (Loy 1976:144). Species occurring in other plant community associations include: Engleman spruce (*Picea engelmannii*), Aspen (*Populas tremuloides*), Subalpine fir (*Abies lasiocarpa*), Western Juniper (*Juniperus occidentalis*), Low sagebrush (*Artemisia arbuscula*), and Rabbit brush (*Chrysothamnus spp.*) (Goddard 1979:7; Cheatham 1992:4).

Vegetation within the river basin of the Deschutes River is of two main zones: the *Juniper Occidentalis zone* and the *Shrub-Steppe zone*. Here you will find wildrose (*Rosa spp.*), snowbrush (*Ceanothus velutinus*), serviceberry (*Amelanchier alnifolia*) and choke cherry (*Prunus demissa*) (Scott 1986:1) On the bench land above the canyon bottom, in the *Shrub-Steppe zone* where vegetation is homogeneous, you will find exclusively juniper (*Juniper occidentalis*), rabbit brush (*Chrysothamus sp.*), bitterbrush (*Purshia tridentata*), sage brush (*Artemisia tridentata*), Basin big sage (*A. Tridentata*), and a few species of grass including Idaho fescue, wheat bunchgrass and cheatgrass (Scott 1986:3; Stuemke 1987:9).

Clearly, many more floral species thrive in Deschutes County than are mentioned here. For a more comprehensive listing and discussion of current area flora see PGT-PG&E Pipeline Expansion Study, and Cultural Resource Reconnaissance in the Redmond Training Area. It is noteworthy, however, to mention that contemporary, or post-historic perspectives of Deschutes County flora do not fully represent the flora distribution during aboriginal times. While a few authoritative sources exist which document prior vegetative conditions; it appears that land-modifying activity (i.e. volcanism, grazing, and logging) in the County has had a dramatic effect on floral communities and their associations.

Fauna

Like floral resources, faunal resources played a significant role in the past human land-use patterns of Deschutes County. Although hunting is thought to have contributed to the diet much less than fishing and gathering, animal resources were very important to the lifeway of Native American peoples. Numerous animal species found throughout the County provided clothing, shelter, ornamentation, medicine, and trade items to prehistoric people.

The occurrence and prevalence of fauna is also linked inextricably to available wildlife habitat, especially flora (Goddard 1979:6). As a result, it is likely that a contemporary counting of faunal resources, like the area's vegetation, does not represent an accurate picture of the prehistoric era. Nevertheless, while contemporary faunal distributions may vary from earlier times, it is probable that many of the species now present in Deschutes County were also present during earlier times.

In reconstructing the prehistory of the County the following animal resources may have played a significant role: mammals such as ungulates (grass eaters), and rodents; numerous species of birds including grouse, and waterfowl; fish like salmon, eels, and suckers; herps (reptiles and amphibians); as well as various species of invertebrates (Hunn 1990: 138-169).

Hydrology

In Deschutes County most of the surface water runs in perennial rivers that originate from various springs high in the Cascade Range. Most rivers are slow moving, with mild gradients. The thick aeolian pumice deposits, with their underlying permeable basalt formations, have created an unusual hydrological system where underground water exchange has developed a very stable natural flow regime in the upper Deschutes River Basin (Infotec 1990:2-42).

The main waterway in Deschutes County is the Deschutes River, which originates high in the lava lakes of the Cascade Mountains. Flowing north through the County and eventually spilling into the Columbia River, the Deschutes River is the main supply of water for fish and wildlife habitat. The upper Deschutes River and a majority of its first order tributaries drain the east slopes of the Cascade Mountains. Among the first order tributaries are the Little Deschutes, Fall and Spring Rivers, and Paulina Creek. Only Paulina Creek, originating in the Newberry Caldera, begins to the east of the upper Deschutes River (see figure 3).

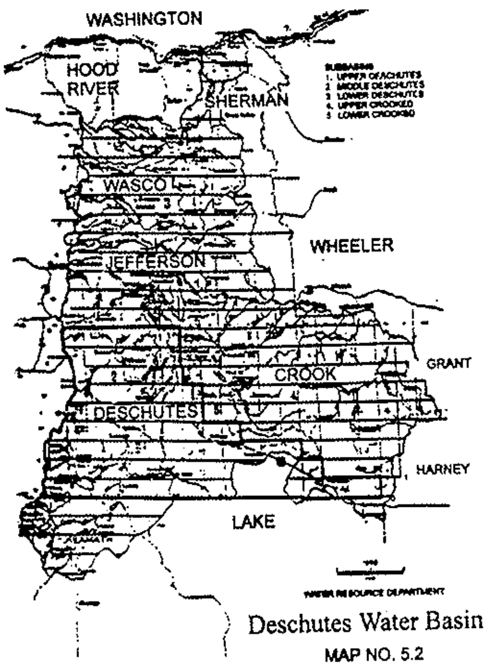


Figure 3. The Deschutes River Basin Encompasses 95% of Deschutes County.

Much of Deschutes County lies in the rain shadow of the Cascade Mountain Range, which effectively blocks out most of the precipitation from the Pacific Ocean. Weather patterns in Bend can be considered typical for the region. Average yearly rainfall in Bend is a mere 12.0 inches. Monthly rainfall varies from a low of 0.42 inches per month in September to a high of 1.82 inches per month in January (U.S. Weather Bureau 1965). Most of this precipitation is a result of convection showers or thunderstorms in the early to mid-summer months. It is because of this scant precipitation and porous bedrock that secondary streams above the confluence of the Deschutes and Crooked Rivers are seasonal. The winters are usually cold with little precipitation at lower elevations. Most of the precipitation in the winter months occurs high in the Cascade Mountain Range on the western side of the County. The summer months are typically dry and sunny with low humidity and cool nights. The average annual temperature for the County is 46.3 degrees Fahrenheit, varying from an average low of 30.2 degrees in January to an average high of 63.7 degrees in July (U.S. Weather Bureau 1965). The extreme maximum temperature ever recorded in Bend is 115 degrees Fahrenheit. It is not uncommon within the County to observe a 50 degree diurnal temperature range on any given night (Stuemke 1987:9).

This lack of water within Deschutes County, in the form of precipitation and ground surface water, has had a dramatic effect on prehistoric peoples. Out of necessity, prehistoric peoples relied on areas that provided permanent or seasonal water resources; such as springs, lava flows margins, lava tubes, rivers, lakes, streams and marshes. These sites were significant not only for their direct access to water but for the abundance of floral and faunal resources often associated with them.

Paleo-Environment

Scholars only know the broad regional characteristics of the Paleo-environment: local ecosystem patterns and wildlife habitats of Central Oregon during the Late Pleistocene period are not well understood. Only four known fauna genera (*Equus, Mammuthus, Bootherium, Camalops*) have been reported and verified from the Late Pleistocene period to date. At present there is no reported or undisputed association of people with any genus of large mammal that became extinct at the end of the Pleistocene period, although potential for such an association certainly exists (Lyman 1983). The predominant scientific view holds that these Pleistocene "mega" fauna were the focus of hunters during the Paleo-Indian Period. However, additional research may reveal that floral resources played a significant role in their diet and economy as well.

Hansen (1942, 1947, 1947) provides some data that should be noted on ancient plant communities. He reports that a pollen profile gathered near Bend indicated that forests have been sustained at lower elevations in the past. He concluded that this was due to the cooler and less arid climatic conditions that existed in earlier post-glacial times. He continues, saying that "during the Altithermal [period], area floral communities may have followed a general trend toward greater chenopod and composite populations" (Hansen 1942). Regardless of his conclusions, it is generally believed that the recency of volcanic depositions forced effects on area paleovegetational community compositions and successions (Lyman: 1983:23).

Reconstructing Paleoclimatic conditions is as difficult as reconstructing ancient plant communities. The post-glacial epoch for the region is generally divided by scholars into three Paleoclimatic periods: the Anathermal, the Altithermal, and the Medithermal. Each period is described as follows: the Anathermal Period (10000 BP to 7500 BP) is marked by cooler and moister conditions; the Altithermal Period (7500 BP to 4000 BP) is characterized by warmer and more arid conditions. The Medithermal Period (4000 BP to present), the last paleoclimatic period, is characterized by a return to cooler and moister conditions in which "modern" plant communities emerged; conditions in which we see today.

These broad Paleoclimatic periods have been derived from archaeological studies over the past decade. The possibility of localized micro-environmental fluctuations that affected flora, fauna and climate conditions does exist. Future research needs to be focused on the collection of Palynolgical data from selected sites within Central Oregon. This will allow for the development of sequences relevant to settlement and subsistence patterns of the region. For example, a site occupied throughout the Anathermal to Metathermal periods may have been used for different purposes even though it is in the same location.

CULTURE AREAS

Documentation of past lifeways are often based on anthropological and historical accounts of Native American people. Commonly, these accounts are derived from the journals of explorers, missionaries, trappers, traders, and trained ethnographers. This method of interpreting archaeological data is referred to as ethnographic analogy. In the early twentieth century, anthropologists tried to reconstruct the distribution of aboriginal ethnic groups and their boundaries in the Pacific Northwest. The result has been unclear and incomplete information. Systematic ethnographic research has never been attempted in Central Oregon, and therefore reconstruction's of ethnographic and ethnohistorical patterns about cultural groups residing within Deschutes County boundaries are inconclusive.

Many of these ethnographic and historic accounts are also subjective in nature and were often written shortly before or after Native American peoples had been placed on reservations and were undergoing rapid cultural change. Thus, ethnographic analogy may not present a wholly accurate perspective of prehistoric aboriginal life in Deschutes County. Further, culture area boundaries were fluid and fluctuated over time so that the historic Native American inhabitant locations may not be representative of earlier prehistoric group locations. Any attempt to delineate precise territorial boundaries is difficult if not impossible. With these shortcomings in mind, ethnographic analogy of culture areas does provide some general insight into the lifeways of prehistoric people who once lived in what is today Deschutes County.

Within the geographic region of Deschutes County three culture areas are hypothesized. They are as follows: the Northern Great Basin, the Southern Columbia Plateau and the Cascade Range (see Figure 4). Five historically known Native American groups occupied areas within these culture areas: the Northern Paiute, the Tenino/Tygh, the Molalla, the Klamath, and the Modoc. The exact geographic relationships between these groups have been disputed among anthropologists for over 50 years. The following is a brief description of the culture areas and lifeways of those groups.

The Northern Great Basin

The Great Basin culture area is found in the intermontane region between the Cascades and the Rocky Mountains, extending from Central Oregon through Nevada and Utah. This area, like the Columbia Plateau Region can be described as a semi-arid environment on a high desert plateau. The basin area, as its name indicates, has interior drainage and a few large watercourses. The native people who lived in this area followed a hunting-gathering lifeway. Generally the Great Basin people had a very low population density, lived in small camps, wintered in willow frame houses, and traveled mostly on foot until horses were introduced in the mid-1800s. The group most associated with the Great Basin in Central Oregon are the Northern Paiute. The following is a brief description of their culture area and lifeway.

The Northern Paiute

Concise descriptions of the Northern Paiute lifeway have been recently written (Fowler and Liljeblad 1986; Aikens and Couture 1991). The Northern Paiute, who in some early historical accounts are called the "Snakes", the "Bannocks", and the "Diggers", occupied the entire southeastern portion of Oregon at the time of white contact in the early 1800s. Although their territory fluctuated, prior to the 1850s they occupied approximately one-third of the State (Loy 1976). Most of that territory did encompass Deschutes County (see Figure 5).

There were a number of Northern Paiute groups or bands located in Nevada and Idaho as well as in southeastern Oregon, each speaking different dialects of a single language. This language when grouped with others from the Great Basin make up the Numic branch of the Uto-Aztecan language family (see Table 1). Linguistic evidence suggests that the Northern Paiutes spread northward into the Northern Great Basin region within the last 1,000 years (Lamb 1958). Although there is general agreement among archaeologists that the Northern Paiute groups moved into Central Oregon from the southeast in the late- prehistoric or early- historic period replacing Sahaptin-speakers (such as the Tenino/Tygh), the exact details and timing of the population movement continue to be examined. According to Berreman (1937:44-45), the Molala probably occupied the middle Deschutes River territory until 1750 when they were displaced westward by the Northern Paiutes migrating north. Blythe (1938), Whiting (1950), Beckman (1976) and Suphan (1974) assigned the territory on both sides of the Deschutes River near Bend to the Northern Paiute, while Stewart (1939) and Flower and Liljebald (1986) assigned them strictly to the territory east of the river (Infotec 1993).

The Northern Paiute economic strategy included hunting of both large and small game as well as the gathering of a wide variety of wild plant foods. This was in large part due to the environmental conditions and geographic location of the Paiute. On the High Lava Plains, a harsh desert environment, the Paiute had limited food resources where vegetation was scant and small game were sparse, thus the Pauite were forced to seek a wide variety of resources. They did however, maintain specific political and economic territories from which their basic food and subsistence resources were derived. Following the seasons of the year, they hunted and gathered in the foothills, mountain ranges, basins and valleys which characterize the Great Basin. Wide ranging seasonal "rounds" were followed by the Northern Paiute people in their quest for food and the necessities of life. For example, a specific resource was exploited, such as camas root, until the people moved on to another area where other resources were located. Because the availability of plant and animal resources were variable and limited, careful resource scheduling was important. Many wild plant foods were stored and dried for the winter season. During the warmer months of the year the Northern Paiute were quite nomadic. In the winter months, bands were generally stationary, camping near springs or rivers. According to Suphan (1974:64), the "Deer-eater" band wintered at camps along the middle Deschutes River near Bend and along the nearby Metolious River. The Northern Paiute made the most of the sparse resources, intensively exploiting a wide variety of vegetal and animal foods. These included seeds, roots, berries, mountain sheep, deer, antelope, rabbits, squirrels, minnows, salmon, trout, and a wide range of insects (Goddard 1979:62).

Linguistic Background

- 1. Penutian (Phylum)
    - A. Sahaptian (Family)
        - 1. Sahaptin (Language)
            - A. Tenino / Warm Springs (Dialect)
            - B. Tygh (Dialect)
    - B. Lutuamian (Family)
        - 1. Klamath (Language)
            - A. Klamath (Dialect)
            - B. Modoc (Dialect)
    - C. Molalla (Language Isolate)
- 2. Aztec-Tanoan (Phylum)
    - A. Uto-Aztecan (Family)
        - 1. Numic (Language)
            - A. Northern Paiute (Dialect)

Table 1. Linguistic background of Native American groups in the Deschutes County Region.

Although the Northern Paiute consumed a great variety of foods, each band tended to concentrate somewhat upon a particular food resource which was especially abundant and predictable in their geographic region. It is from these core areas of subsistence that the names of the individual bands are often derived. For example, the band which wintered near Bend in the Metolius River Basin were called the "Juniper-Deer-Eaters" (Blyth 1938). Stewart (1939) reported that the group occupying the territory to the east of the Deschutes River near Bend was the *Hunipui*, a term meaning "eaters of *Lomatium* sp. roots," probably *Lomatium macrocarpium*, or biscuit root (Whiting 1950:17; Flower and Liljeblad 1986:463). Though the possession of certain springs, gathering and hunting spots were acknowledged by certain bands, other bands were allowed to use these areas (Scott 1984:6). Because of the general scarcity of food resources in the high desert, it is thought that the pre-contact Paiute population did not exceed an average density of one person per 10 to 20 square miles (Minor 1987). These small family band or social groups, generally consisted of 3-7 extended families. To date twenty-one separate bands have been identified that inhabited the vast territory of the Great Basin (Steward 1939).

Winter villages were usually composed of 3-10 households, comprised of about 15-40 persons. Here the Paiute had no strict rules of social or political organization. The bands did, however, tend to have leaders who had little overall authority but were chosen to lead by consent of band members. Selected individuals also organized and led various communal activities such as rabbit drives and antelope hunts (Infotec 1993). Ritual and religious practices played a minor role in Northern Paiute society (Lyman 1983: 41).

Shelter for the Northern Paiute consisted of circular dome shaped wickiups during the winter (and summer) months. These structures were made of conical wood frames, eight to fourteen feet in diameter. Summer shelters consisted of crude windbreaks or sunshades made out of brush.

The Southern Columbia Plateau

The Columbia Plateau includes Central Washington, Eastern Idaho and Northern Oregon (see Figure 4). It is generally a semi-arid region cut with deep river valleys. The economy of the people living here was based on the collection of roots, fishing, and the hunting of game. Many different groups or tribes lived within the Columbia Plateau sharing the basic characteristics of Plateau culture. These groups or tribes however had individual traits and practices. The main tribal group that lived on the fringes of Deschutes County in the Southern Columbia Plateau are the Tenino/Tygh. The following is a description of their lifeway.

The Tenino/Tygh

The Tenino/Tygh spoke several dialects of Sahaptin (Penutian language phylum) (Lyman 1983:39). Four subgroups of the Tenino/Tygh have been identified by Murdock (1938:396-397; 1958:299-300) and Rigsby (1965:52-62) along the south fork of the Columbia River: (1) the Tenino proper, located east of The Dalles and along Fifteen Mile Creek; (2) the Wyam or Lower Deschutes at Celilo Falls and on the bank of the Deschutes River just above its junction with the Columbia; (3) the John Day group near Quinton, Oregon, east of the mouth of the John Day River; and (4) the Tenino/Tygh or Upper Deschutes group in the Tygh and Deschutes River valleys. Here in Deschutes County we are mostly concerned with the later group, the Tenino/Tygh (see Table 1).

It is generally believed that the Tenino/Tygh traditionally occupied lands adjacent to the Columbia River and subsequently moved south into the eastern slopes of the Cascades just prior to 1855, when they were placed on the Warm Springs Reservation (Goddard 1979:61). The southern boundary for these people is thought to have extended to areas around Eight Mile Creek, near the Dalles and the Deschutes and John Day Rivers (Murdock 1958:299). Others have claimed that the Tenino ranged as far south as the Klamath tribal country during their hunting forays (Lyman 1983:41; Stuemke 1987:77).

Unlike the Northern Paiute who had wide ranging seasonal rounds based on winter and summer villages, the Tenino/Tygh were semi-sedentary people who followed annual subsistence rounds based on winter villages. Most winter villages were located inland a few miles along tributaries; in the Tygh Valley and along the Columbia River at the confluence of the Deschutes and John Day Rivers (Murdock 1938, 1958; Aikens 1984:89). Here they fished, hunted and made tools and equipment. In the winter villages, each extended family maintained two house structures-- an oval-shaped semi-subterranean earth lodge used for sleeping and storage, and a rectangular-shaped structure used for cooking and day time activities (Murdock 1958). Summer villages were located along shores of the Columbia River near prominent fishing places such as The Dalles, Celilo Falls and Sherar's Falls (Murdock 1938, 1958). Summer shelters consisted of rectangular sheds of poles and mats which served as living quarters and a drying area for salmon. When away from the summer camps in search of berries or nuts in the mountains, temporary camps of mat-covered tipi-like structures were used.

The Tenino/Tygh's primary food source was salmon but other species of fish such as suckers, chubs, whitefish, and trout were also taken (Scott 1984: 7). The fish were trapped, speared, caught on hooks, netted in seines, or caught with the aid of dams or weirs (Goddard 1979:63). In the Plateau culture, fish and plant foods made up approximately 90% of the diet (Hunn 1990:118). Hunting of deer, elk, antelope, bear, goat, mountain sheep, rabbits and other small mammals contributed only approximately 10% of the diet (Hunn 1990:118). To aid in hunting the Tenino/Tygh sometimes used hunting blinds. These are natural or man made walls of stone or wood to block the hunter from the view of the animal. Vegetal foods most important to the Tenino/Tygh included berries, pine nuts, acorns, camas, kouse, and lupine (Goddard 1979:63).

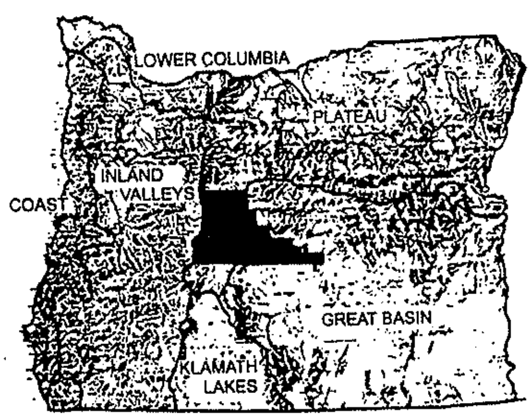


Figure 4. The Culture Areas of the State of Oregon. Three areas effect Deschutes County: The Northern Great Basin, the Southern Columbia Plateau, and the Cascade Range.

As part of the right of passage from child to adulthood, Tenino/Tygh children of both sexes conducted vision quests. In this practice, a parent would send the child into the night wilderness to seek a guardian spirit. During the quest the children were taught to build rock piles (cairns) in order to stay awake while waiting for the guardian spirit. Deschutes County has five known rock carins.

The Tenino/Tygh tended to trade and coexist peacefully with most other Plateau groups, but were in regular conflict with the Northern Paiute with whom they traded only sporadically. Communities varied in size from several hundred people down to 50 people. Social distinctions between a chiefly class, commoners, and slaves within the tribes were recognized. Due to a ban on marriage between blood relatives, people sought mates from distant localities, thus resulting in an extension of kinship networks over broad regions (Aiken 1984:90).

The Cascade Range

The Cascade Range includes a chain of mountains running north and south through Washington and Oregon. This high mountain region has peaks reaching over 10,000 feet. Notable mountains in or adjacent to Deschutes County include: Mt. Washington, 7,794 ft.; North Sister, 10,085 ft.; Middle Sister, 10,047 ft.; South Sister, 10,385 ft.; Broken Top, 9,152 ft; and Mt. Bachelor at 9,065 ft. The economy of the people living here was based on hunting small game, fishing, and the collection of roots. Many different groups or tribes lived in the Cascade Range both on the east and west slopes, each with individual traits and practices. The tribal groups that lived on the fringes of Deschutes County and may have utilized its resources are the Tenino/Tygh (as previously discussed), the Molalla, the Modoc and the Klamath (see Figure 5). The following is a description of their lifeways.

The Molalla

Little is known about this group of Native Americans but they are believed by most archaeologists and anthropologists to have occupied a territory west of the Northern Paiute in the Central Cascade Range. They may have ranged north and south along the eastern slopes of the Cascades to the western banks of the Deschutes River (Murdock 1938). George Murdock (1938) hypothesized that the Molalla were driven westward and southward into areas as far south as Crane Prairie and La Pine, eventually being pushed over the Cascades by the Tenino people. While Thomas Garth (1964) suggests that the Molalla were driven westward by the Pauites.

There is little concrete information available about the Molalla's lifeway. The Molalla are considered a language isolate (Rigsby 1966,1969), within the Penutian Phylum (See Table 1). Like other tribes, their residential and subsistence patterns were seasonal. During the winter they tended to stay at low-elevation streams, ascending the mountains during the summer to hunt deer, elk, and bear, as well as to pick berries (Goddard 1979:63). Although they are believed to have lived mainly on the west slopes of the Cascades, recent evidence indicates they most likely ventured to the eastern Cascades into areas of modern Deschutes County for hunting and berry picking (Goddard 1979:61). The Molalla frequently intermarried and traded with other groups in territories adjacent to their own, including their Chinookan, Sahaptian, Klamath, and Kalapuyan neighbors. These ties served to facilitate passage into or through each others' territories on trading and/or subsistence-related expeditions. Relationships with the Northern Paiute, in contrast, were hardly amicable and more often than not took the form of slave-capturing raids (Murdock 1938:397).

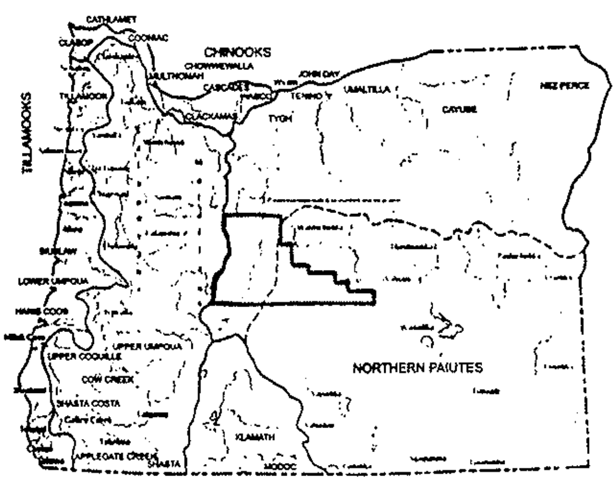


Figure 5. Tribes and Bands of Traditional Oregon, 1750-1850.

Molalla family groups tended to winter at lower elevations, probably living in large semi-subterranean earth lodges (Rigsby 1969). The family unit, basic to the Molalla social organization, remained together with other groups in winter villages and dispersed in more temporary locations during the rest of the year (Synder 1987:14). Tribal or village organization was apparently lacking. Leadership was task-oriented, based on personal reputation and ability rather than wealth (Synder 1987:14).

The Klamath

The Klamath Indians, speaking a language assigned to the Penutian phylum, occupied the Upper Klamath Basin and surrounding uplands (see Figure 5 and Table 1). Up to six tribelets (i.e., localized territorial groups not distinguished by either language or culture) centered around the major lakes and the lower stretches of rivers in semi-permanent villages (Spier 1930; Stern 1966). The largest tribelet, called *a'ukckni*, occupied the Klamath Marsh and the Williamson River above the confluence of the Sprague River. This tribelet is described to by Spier (1930) and subsequently described further by Stern (1966:19). Other Klamath peoples lived west and south, around Klamath Agency and Klamath Lakes (Zucker 1983:11).

Klamath subsistence activities focused primarily on the plant and animal resources found in marsh, river and lake environments. Principal dietary staples included: freshwater mussels, anadromous and resident fish, migratory and residential birds, small and large mammals, and numerous plant species. These river and marsh resource areas were also prime areas for residential locations as well as seasonal gathering spots for those who lived elsewhere. Due to these prime resource areas, other ethnic groups often joined the Klamath, exploiting fish runs in the spring and fall (Stern 1966).

Klamath dwellings for winter villages were large, round, semi-subterranean lodges with wood superstructures covered with matting and earth (Spier 1930:197-203). Summer dwellings were similarly shaped, but lighter structures of mat-covered framing resting on the ground. Other structures used included: cook houses, sweat lodges and menstrual huts. Families usually dismantled the winter houses in the spring to move to better locations for resource collecting (Stern 1966:11). This sedentary lifeway permitted the Klamath to develop an extensive inventory of tools and utensils of flaked and ground stone, bone, horn, antler, wood, and plant materials. Canoes, rafts, baskets and other containers allowed the Klamath to transport and store food for winter.

Klamath social organization is believed to have been flexible. The positions of war chief, shaman, and/or leader were assigned by the basis of wealth (Ray 1963). Contact with neighboring groups was extensive, and came typically in the form of trade, warfare, and/or slave-raiding parties. Religious practices included: construction of rock cairns in prominent locations during vision quest retreats, and the retreat to certain caves and rocks with supernatural properties. Shamans, who were both men and women, were influential and historically had the largest houses due to their wealth. Because of this their homes were used as places of celebration (Spier 1930:107-127).

The Modoc

The Modoc, closely related to the Klamath in language and culture, lived principally in northern California around the Lower Klamath Basin lakes and rivers. It is believed that their territory extended into parts of south central Oregon and as far north as the Lost River (see Figure 5 and Table 1). The principal differences between the Modoc and the Klamath were subsistence practices and settlement patterns (Ray 1963). Although the Modoc centered around lake and water resources, they relied more upon hunting than the Klamath. Elevations above 4,000 ft. were used more by the Modoc than the Klamath, possibly for winter as well as summer residences. Winter subterranean houses were constructed deeper in the ground than those of the Klamath (Stern 1966:7). This was to combat the cooler temperatures of higher elevations and giving the shelters more insulation .

SUMMARY

The groups briefly described above inhabited or at least seasonally used the lower and upper Deschutes region. The area of what is now Deschutes County was not so much "occupied" as it was "utilized" by the various Native American people. Given the settlement and subsistence patterns of these groups, the land of Deschutes County was probably visited seasonally for purposes of hunting animals and gathering plant foods by all previously listed groups.

The distribution of Native American groups is difficult to map for several reasons: long term shifts of population, their disbursement after white contact, the multi-lungualism of individuals and groups, settlement patterns, cyclical shifts of places of residence, and sketchy ethnographic data.

PREHISTORY (Richard M. Pettigrew, Ph.D.)

Human beings have occupied Deschutes County for at least the past 12,000 years, but only recently has systematic research begun to reveal the rich patterns of changing human life recorded in the archaeological data found on and below the surface of the ground. Because of its geographic position, the prehistory of Deschutes County can be understood only in the context of the archaeological information gathered from the larger Central Oregon region of which it is a part. The modern boundaries of the county bear little relation to the territories of aboriginal peoples and the resources that they gathered or to the intersocietal relations that influenced cultural patterns in time and space. To create a meaningful perspective, then, this discussion of Deschutes County prehistory will examine the broader region as it pertains to the county.

Lebow et al. (1990:51-73), who summarized the state of knowledge in 1990, completed the most recent overview of regional prehistory that covered Central Oregon in detail. The review offered here, then, will draw upon that document and update the summary and interpretations on the basis of research reported since that time. Following the lead of Lebow et al. (1990), the method here will be to examine time periods and lifeways, particularly as they relate to modes of human adaptation. Reported information is considered pertinent to the extent that it addresses the primary question posed by Lebow et al. (1990:51): "What evidence for human occupation exists for a given period, and what does it tell us about resources and areas exploited, the adaptive strategy and settlement patterns used, and the archaeological manifestations we might expect to find?" Such an organizing guideline exposes important gaps in knowledge about prehistory and prepares the way naturally for consideration of research design, site evaluation, and proper management of cultural resources.

To facilitate comparisons of regions and to illustrate patterns of changing human adaptations, this summary is organized by arbitrary cultural periods (following Lebow et al. 1990:51): (1) Paleo-Indian (prior to about 10,500 B.P.), marked by fluted projectile points; (2) Early Archaic (10,500-7,000 B.P.), when projectile points tended to be willow-leaf-shaped or large, stemmed lanceolate forms; (3) Middle Archaic (7,000-2,000 B.P.), represented generally by broad-necked, notched, triangular points; and (4) Late Archaic (2,000 B.P.-contact), when the arrival of the bow-and-arrow caused a shift to smaller notched points. These periods are not considered cultural significant divisions, because they are not based on known episodes of cultural change but instead on stylistic or technological change in projectile point forms and the Mt. Mazama eruption near 7,000 B.P. Also, the temporal scale for these periods is based on radiometric (^{14}C) ages, because most reports use this scale in reporting the ages of strata, features, and sites.

It should be recognized, however, that radiometric ages deviate significantly from actual (calibrated) ages for ages greater than about 2,000 years. This becomes problematic particularly in areas, such as Central Oregon, where obsidian hydration, which can be interpreted correctly only in terms of calibrated ages, is a common chronological technique.

Table A lists those reports considered to provide important new information relating to Central Oregon since the Lebow et al. (1990) overview. This is not an exhaustive list of reports for the region, but rather the primary reports drawn upon for this discussion. They are listed in Table A according to the geographic regions used for this summary: the Columbia River, the Deschutes River drainage (not including the Crooked River), the John Day River drainage, the Crooked River drainage, and the Great Basin. Unless otherwise specified, information summarized below is drawn from Lebow et al. (1990).

Paleo-Indian (prior to 10,500 B.P.)

Human occupation of Central Oregon in Paleo-Indian times is not directly evidenced, but finds of fluted projectile points from the northern Great Basin and possibly the Columbia River, as well as other parts of Oregon (Connolly 1994; Minor 1985) and North America, strongly suggest that a human population inhabited the region at this time, derived from immediate predecessors who had crossed the Bering Land Bridge from Asia. (Although radiometric dates earlier than 10,500 B.P. have been obtained from caves in the Fort Rock Valley, only 15 miles south of the Deschutes County line, none are associated with fluted points, and the earliest dates of 13,200 and 11,950 B.P., which are not confidently associated with human activity, may not pertain to human occupation [Aikens and Jenkins 1994:7; Bedwell 1973].) Most archaeologists believe that Paleo-Indian peoples were mobile foragers, following herds of large mammals, many species of which, such as the mammoth, are now extinct. If this model is correct, people at that time were organized at the family level of sociocultural integration, and possessed a sophisticated level of specialized knowledge about their prey animals and generalized knowledge about the availability of other key plant, animal, and mineral resources. This hypothesized lifeway involved frequent residential movement of small family bands, low population density, and the use of large bifaces, both as cutting and scraping tools and as cores from which flakes were struck to make other tools. The archaeological signature of such groups would be small (often single-episode) lithic debris concentrations dominated by flakes driven mostly from bifacial cores. Fluted projectile points (usually basal fragments from retooling) and flute flakes should be the primary stylistic indicators of formed bifaces. Evidence of typically temporary dwelling features should be hard to find, so hearths may be nearly the only feature types discernible.

Although such sites have yet to be found in Central Oregon, the most likely places to find them are those places where forage probably was most plentiful for large herding prey mammals, particularly near grasslands and forest margins. Although paleoenvironmental information for the area is scanty, likely places for grasslands would include the flats east of Bend and surrounding Redmond and Madras, the modern wheatlands north and east of Shaniko, and the High Desert south of the Maury Mountains. Before it was clothed in coniferous forest, the Cascade Range might have contained productive grassland (Barnosky 1985). Forest margins might have existed on the east slope of the Cascade Range and on the flanks of the Ochoco Mountains and the Paulina Mountains. Finding such sites may be particularly difficult south of

Bend, where Mazama ash blankets the landscape, obscuring the early Holocene surface. Ironically, this same ash may protect some Paleo-Indian sites from disturbance by both natural and modern artificial causes. Elsewhere, exposed ancient surfaces may present the opportunity to find Paleo-Indian artifacts, which should be quite rare, through pedestrian reconnaissance.

Early Archaic (10,500-7,000 B.P.)

Knowledge of what was a poorly understood chapter in the human prehistory of Central Oregon, the Early Archaic Period immediately preceding the Mt. Mazama eruption of 6,845 ^{14}C B.P. (Bacon 1983), has been dramatically augmented recently by evidence gathered by the Pipeline Expansion Project (Atwell, Bailey, et al. 1995; Atwell, Hildebrandt, et al. 1995; Lebow et al. 1991; Moratto et al. 1991; Moratto et al. 1994; Price et al. 1993; Speulda et al. 1993), highway-related projects in Newberry Caldera (Connolly 1993, 1995; Connolly and Musil 1994), and test excavations at Odell Lake (Jaehnig 1994). The Pipeline Expansion Project (PEP), which traversed the states of Idaho, Washington, Oregon, and California, has been especially productive of new data and new interpretations of prehistoric human land use. Within Oregon, along a narrow corridor extending through the Deschutes-Umatilla Plateau, Central Oregon, and the Klamath Basin, the PEP recorded 149 prehistoric sites, conducted test excavation at 119, and undertook data-recovery excavations at 19. As measures of the vast database generated by the PEP, from Oregon prehistoric sites alone, most of which are concentrated in the area between the John Day River and LaPine, 121 radiocarbon dates were obtained and 6,184 artifacts were selected for obsidian studies (x-ray fluorescence for sourcing and hydration rim measurement for chronology). Nearly 600 projectile points were collected between Umatilla and Crook counties alone. Assimilation and interpretation of this new data set is a process only just begun and may take years for Oregon archaeologists to complete.

The Early Archaic is the first clearly documented period of human occupation in Central Oregon. According to the analysis of PEP data by Schalk et al. (1995), much of eastern Oregon at this time had limited population density and human groups participated in a much more diversified economy (i.e., much less focused on large herding mammals and more dependent on a broad spectrum of animal and plant resources) than their Paleo-Indian ancestors, although residential mobility was still quite high compared to post-Mazama times. Sites tend to be directly associated with surface water features and are small, reflecting brief occupational periods, and differ relatively little in their artifact assemblages from one to the next. A wide variety of game was hunted, ground stone tools (especially those clearly related to food processing) are infrequent, and food storage is not strongly evidenced.

It now seems clear that pre-Mazama components are generally widespread but more frequent in some areas than in others (Pettigrew and Hodges 1995b). In particular, the upper Deschutes River drainage south of Bend yielded the highest pre-Mazama site density of the entire PEP. These sites are concentrated where the PEP corridor intersects the margins of the Little Deschutes River and Paulina Creek floodplains, which may have been much more productive wetlands at that time, before they were blanketed by Mazama pumice. Two well described examples are 35DS263 (Bailey 1995) and 35DS557 (Atwell and Hodges 1995).

Only about 10 miles east of the intersection of the PEP corridor with Paulina Creek, Connolly (1993, 1995) reports the excavation of a pre-Mazama cultural deposit at the Paulina Lake Site

(35DS34), which straddles Paulina Creek at the outlet of Paulina Lake. Dated radiometrically between 9920 and 6540 B.P., this deposit is divided into three components, of which Component 2, dated between 9060 and 7930 B.P., is characterized by what is described as a domestic structure, in the center of which was found a hearth. Changes in assemblage composition from Component 1 to Component 3 are interpreted to signify a functional shift from stable residential use to a more logistically focused and less permanent base camp. Whether or not these interpretations are valid, the Paulina Lake Site appears to match the profile for Early Archaic sites described above, including its waterside location.

This pattern for Early Archaic sites in the upper Deschutes River drainage was presaged many years ago by sub-Mazama discoveries at Wikiup Damsite No. 1 (Cressman 1937) on the Deschutes River and at the Odell Lake Site (Cressman 1948; Stuemke 1986) near the Cascade Crest. More recently, Jaehnig (1994) describes additional excavations at the Odell Lake Site and two other sites on the shores of Odell Lake and summarizes earlier work by others, documenting more evidence of pre-Mazama occupation there. Of eight sites recorded around the margins of Odell Lake, six have been subjected to subsurface probes sufficient to demonstrate the presence of cultural debris in the pre-Mazama paleosoil. Evidence suggests that pre-Mazama occupation there may have been even more intense than later occupation.

Two pre-Mazama sites recorded by the PEP in the middle Deschutes River drainage area of Jefferson County, 35JE49 and 35JE51B, deserve mention because of the volume of information they have yielded about the Early Archaic period. Site 35JE49 (Horne 1995), located 9 miles east-southeast of Madras alongside Mud Springs Creek, contains a large rockshelter with stratified cultural deposits both below and above Mazama ash. The rockshelter is considered to represent a residential base camp throughout its long occupation span, measured by radiocarbon ages from 9,980 to 1,140 B.P. An emphasis on early-stage biface reduction argues for greater residential mobility in the Early Archaic, but the diversity of the tool assemblage does not suggest that the occupants were strictly foragers. Differences between pre-Mazama and post-Mazama cultural debris were not as great as expected, possibly because of an inherent analytical difficulty in distinguishing debris of a residential site occupied by highly mobile family groups from debris deposited by occupants of a logistical base camp.

Site 35JE51B, the Johnson Site, is located 16 miles north-northwest of Madras in the low-elevation valley of Trout Creek, a principal tributary of the nearby Deschutes River. Based on obsidian hydration dating, the site is thought to reflect occupation over about 10,000 years, although radiocarbon estimates range from 7,035 to 380 B.P. The oldest of three defined components, Analytic Unit 3, lies below Mazama ash. All components are considered to represent residential site use, but the Early Archaic lifeway suggested by site evidence was more residentially mobile, involving a smaller population, heavy dependence on animal food resources, and very limited use of obsidian, for which raw material was extracted through direct procurement from the distant sources.

The abundant new evidence on human lifeways in the Early Archaic of Central Oregon, combined with what was already known, generally supports the scenario described by Lebow et al. (1990:59), which can be summarized as follows. By the time the large herding animals that were the focus of Paleo-Indian adaptation disappeared from the landscape by 10,500 B.P., the foraging strategy changed to one reliant upon more local and less mobile resources. The economic emphasis still was on animal foods, particularly large mammals where they were abundant, although a wide variety of animals were taken, including smaller mammals and waterfowl. Foraging territories became smaller, requiring less travel by complete family units. Population densities rose markedly in some areas, limited primarily by the availability of fresh winter foods, because little reliance as yet was placed on food storage. Society was still integrated at the family level. Seasonal residential sites were located mostly alongside bodies of water, where the widest diversity of animal and plant foods existed. Coincidentally, lakes, marshes, and major rivers also tend to lie at the lowest elevations of particular basins, where winter temperatures are mildest and fresh winter foods are most available.

This model may help to account for the known distribution of Early Archaic sites in the Fort Rock Basin just south of Deschutes County. Here, the greatest intensity of Early Archaic occupation seems to be in the well-watered southwestern quadrant, in association with Silver Lake and Paulina Marsh (Aikens and Jenkins 1994:7-8). Unfortunately for the purposes of site discoverability, the Early Archaic land surface in the Paulina Marsh area, where human occupation at this time by the present hypothesis should have been focused, was covered by a thick layer of Mazama ash. As a result, the full extent of Early Archaic settlement in that basin may not yet be apparent.

In Central Oregon, the greatest concentration of rivers, lakes, and marshes is in the upper Deschutes River drainage. Prior to the Mazama ashfall, this region may have been significantly more biotically productive that at present, and both the theory discussed above and the growing body of archaeological evidence suggest that it was a magnet for Early Archaic human populations. Furthermore, paleoenvironmental evidence is beginning to suggest that the pre-Mazama climate was warmer than present. Pollen data from the Sunset Cove Site (35KL884) on Odell Lake (Chatters 1994) indicate that ponderosa pine dominated in the area during much of pre-Mazama time, but was replaced by juniper woodland beginning just before the ashfall. Presently, the forest is composed of subalpine fir and grand fir, adapted to cooler, moister conditions than apparently prevailed for much of the Early Archaic. Additionally, an archaeoclimatological model created by Bryson and Bryson (1996) argues that annual precipitation in the upper Deschutes River drainage prior to the Mt. Mazama eruption, while still higher than most other parts of eastern Oregon, was significantly lower than the average since then. The potential exists, then, that the regional climate there during the Early Archaic was generally milder that it is at present. If this is so, then the region probably would have been more attractive to a resident foraging human population than it may appear to be at present.

Because of the flood of new data, the Early Archaic in Central Oregon has been raised to a new level of archaeological interest. Its potential now seems to be excellent as a source for key information about a critically important but poorly understood episode of human cultural evolution in western North America.

Middle Archaic (7,000-2,000 B.P.)

According to Lebow et al. (1990), the Middle Archaic witnessed the most dramatic cultural changes evident in the archaeological record, associated with the greatest increase in the visibility of human occupation. This development is explained as the result of a shift to a logistical economic system connected with intensive use of storable food resources (including roots, seeds, and salmon), central home bases with permanent houses, and a dramatic increase in the human population. Human populations not only grew to an unprecedented size, but expanded in areas that formerly were marginal to the centers of foraging peoples because of seasonal scarcity. A logistical extractive system permitted, even encouraged, such a spread because, with the logistical modifications and increased labor input, seasonal abundance of storable foods permitted winter settlement for relatively large populations in places where winter scarcity earlier kept populations low or absent altogether.

One of the principal goals of the PEP was to test propositions of this kind against systematically gathered data along a corridor transect covering parts of four Western states. This effort was largely successful in highlighting the overall patterns of prehistoric culture change in a large part of eastern Oregon, including Central Oregon. Substantial differences were found in the patterns of changing land use intensity between the upper Deschutes River drainage area and the middle Deschutes River and John Day River areas to the north (Pettigrew and Hodges 1995b). In particular, land use intensity in the upper Deschutes River drainage south of Bend apparently declined dramatically immediately following the Mazama ashfall of 6,845 ^{14}C B.P. (Bacon 1983), without much doubt because of the devastating effects of the thick pumice mantle on the local ecosystem. A slow increase in human use there in the centuries that followed may mark a slow rebound in biotic productivity. By 4,000 B.P., human use of the area had returned to the general magnitude of pre-Mazama levels, and land use intensity peaked between 3,000 and 1,500 B.P. In contrast, at the Willowdale locality in the Trout Creek-Willow Creek Valley 15 miles north of Madras, where only two pre-Mazama components were recorded, 15 components were tallied for the period between the Mazama ashfall and 4,000 B.P., the largest number for any prehistoric period there. Land use intensity at Willowdale apparently peaked at this time, then dropped to a lower but still substantial level in the following millennia. Elsewhere in north-central Oregon, including the John Day Canyon, the Shaniko Surface, and the area between the Madras vicinity and Bend, archaeological indicators of land use intensity increase after the Mazama ashfall, but do not peak until after 4,000 B.P. In the John Day Canyon, as with the upper Deschutes River drainage south of Bend, peak land use occurs between 3,000 and 1,500 B.P. However, on the Shaniko Surface and in the interval between the Madras vicinity and the Crooked River, peak land use apparently occurred between about 4,000 and 3,000 B.P. (Pettigrew and Hodges 1995b).

A critically important discovery of the PEP was a very early pithouse at the Johnson Site (35JE51B), dated radiometrically between 5,000 and 5,960 B.P. (Pettigrew and Hodges 1995a). This house is thought to represent an early manifestation of a lifeway involving reduced residential mobility and increased dependence on stored foods. Its location at Willowdale matches the settlement evidence there for an early peak in land use intensity between the Mazama ashfall and about 4,000 B.P.

Schalk et al. (1995) interpret the PEP archaeological record for the Middle Archaic of central and north-central Oregon to reflect both post-Mazama population growth (with at least one brief interruption) to a peak in the latter half of the period, and changes in land use strategy designed to accommodate that growth. Population peaked first in the Willowdale locality because, of all the places traversed by the PEP corridor, it possessed the best variety of plant and animal resources, among them some well suited to storage. This earliest of relatively well settled populations (ca. 6000-4,500 B.P.), represented by the early house at the Johnson Site, possessed a relatively unfocused economy, based on a wide variety of plant and animal resources, but including storable roots. Game resources no longer were sufficient by themselves to dependably support residential groups over the winter. Collection of roots, available locally, in combination with other food resources, made possible at this place a lifeway of low residential mobility without, as yet, a strongly logistical resource collection strategy. This strategy appears to have bridged the gap between foraging and semisedentary adaptations. Residential sites are characterized by pithouses, milling stones (for the first time in large numbers suggesting their regular use in food preparation), substantial amounts of fire-altered rock (presumably used in food preparation), a wide diversity of faunal remains including large numbers of rabbit-sized mammals, and minimal evidence for fishing. Hunting and gathering probably took place largely within a day's foraging radius (the local catchment area), and residential moves probably occurred from time to time when local plants and animals became overharvested, or scarce for other reasons. Settlement diversity was still low, because a system of specialized resource-extraction camps had not yet been established.

A curious but potentially very significant interruption or low ebb in land use in the area between the Willowdale locality and Bend is apparent in both radiometric and obsidian hydration data gathered by the PEP for the period between about 3,900 and 4,500 B.P. (about 4,400 and 5,000 calibrated years, or actual years, B.P.) (Pettigrew and Hodges 1995b). This gap matches similar and roughly contemporaneous gaps in the occupational record on the lower Snake River, the upper Columbia River, and northeastern California (Schalk et al. 1995:9-7 - 9-8). A similar discontinuity in the radiocarbon record occurs in the Fort Rock Basin (Mehringer and Cannon 1994:324). Whether this phenomenon truly represents a widespread depopulation, and what may have caused it, are not yet clear. Possible causal factors may be (1) local abandonment (caused by environmental decline?) and population relocation to more favorable locales, (2) a failure of the non-logistical system to support settled populations at times of temporary local resource scarcity, or (3) sampling error.

Whatever the cause of the gap, population growth apparently resumed in the region after 3,900 B.P., and populations rose to their highest prehistoric levels in most areas between that time and about 2,000 B.P. Pithouse sites become very numerous in the record, especially after 3,000 B.P., and tend to be small clusters of one to six surface depressions, spread throughout the main and tributary canyons of the John Day and Deschutes rivers. PEP data suggest that these sites tend to be located at the lowest elevations, where winter temperatures are mildest (Pettigrew and Hodges 1995b). In the Deschutes River drainage such sites are found as far south as Jefferson County, but so far none are recorded in Deschutes County. These sites apparently were situated to take advantage of a wide variety of resources, including terrestrial mammals (such as deer, sheep, and elk), anadromous fish (particularly steelhead that arrived in the late winter), and roots (especially lomatium and bitterroot) that were available in large quantities in the extensive lithosols in the hills and extending between canyons.

The Shaniko Surface, between the Deschutes and John Day rivers, is particularly productive of edible roots (Pettigrew, Hildebrandt, et al. 1995). Faunal data suggest a narrowing of focus toward larger, higher-valued game, food storage pits are common, and specialized hunting and gathering camps become widespread. These data argue that a shift occurred toward a logistical, semisedentary, collection strategy. This strategy was accompanied by dramatically increased use of areas of low resource diversity but narrowly focused resource abundance, including the

Shaniko Surface (primarily for root gathering) and the upper Deschutes River drainage (primarily for hunting).

Although pithouse sites have not been found in the upper Deschutes River drainage, including Deschutes County, the presence of a resident population in the Middle Archaic seems possible or even likely. If the area south of the Crooked River were used primarily by people from pithouse sites to the north, one might expect the lithic debris to be dominated by cryptocrystalline silica (CCS), which is locally available and dominant in the middle Deschutes River drainage. Instead, the lithic assemblages south of the Crooked River are composed primarily of obsidian, largely from the Newberry Caldera area (Lebow and Atwell 1995). Furthermore, the distance between the middle Deschutes River drainage pithouse sites and the forested zone south of Bend, where the PEP documented concentrations of hunting-related sites, is approximately 50 miles, much farther from the pithouse sites than the hunting grounds afforded by the forested slopes of the Cascade Range or the Ochoco Mountains. Nevertheless, the location of winter residential sites, if they exist, in Central Oregon remains as much a mystery today as it was when the question was first posed 14 years ago (Pettigrew 1982:65).

One well investigated post-Mazama site that exhibits some evidence for residential use is the Lava Butte Site (35DS33) 10 miles south of Bend. This large site was used intensely between 3,500 and 1,000 B.P. and yielded a diverse tool assemblage including large numbers of food grinding implements, but neither house features nor a dependable water source have been found (Bailey et al. 1995; Davis and Scott 1991; Ice 1962). For these reasons, and because the winter climate is considered too severe for winter habitation (Bailey et al. 1995:16-71), residential use of the site is thought to have been seasonal, primarily devoted to harvesting large herds of migrating deer as they passed through narrow gaps in the local lava flows. Evidence for such an interpretation, however, is not conclusive, because traces of structures in the loose pumice soil may be difficult to find and water may have been available in the local volcanic fissures and lava tubes.

Other recent research, outside of the PEP studies, has contributed significant new information on Middle Archaic lifeways in Central Oregon and nearby areas. Specifically, this work includes Connolly's (1993, 1995) summary of studies within Newberry Caldera, excavations at the Bon Site (Byram, personal communication 1996; Cheatham 1992) in the city of Bend, and continuing field research in the Fort Rock Valley by the University of Oregon (Aikens and Jenkins [eds.] 1994).

Middle Archaic use of the Newberry Caldera has been shown by Connolly (1995) to differ dramatically from that evident for the Early Archaic. Whereas Early Archaic occupation at Paulina Lake clearly emphasized broad-spectrum food gathering and seasonal residence, post-Mazama occupation, which is not seen until about 4,000 B.P., apparently was focused nearly exclusively on obsidian extraction and processing. Ecological devastation wrought by the Mazama ashfall is thought to have rendered the locality quite unattractive for food gathering, but a series of eruptions within the caldera shortly after the Mazama event created the Newberry obsidian flow, the source (referred to as the "Newberry Volcano" source) for much of the obsidian used by prehistoric peoples of central and north-central Oregon for the remaining prehistoric millennia. Post-Mazama sites within the caldera are interpreted as temporary camps devoted to obsidian mining and reduction, and typically contain huge quantities of reduction waste along with large bifaces and biface fragments. Quarrying of Newberry Volcano obsidian is thought to have been most intense between 4,000 and 1,000 B.P. (As suggested below under "Research Design," the potential exchange of obsidian bifaces for stored food reserves, if it took place to a significant degree, would have had a profound effect on the economy and carrying capacity of the upper Deschutes River drainage.)

The Bon Site (35DS608) is a Middle Archaic hunting camp thought, on the basis of projectile points (largely the large side-notched variety), obsidian hydration measurements, and one radiometric date, to have two components (the earlier of which is the more prominent) that fall some time between 6,500 and 3,100 B.P. (Byram, personal communication 1996; Cheatham 1992). Faunal remains are considered possibly to reflect the opportunistic hunting of small mammals and the processing of bone to render the fat, but the number of grinding implements suggests that the site was used largely for plant processing. The place of this site in the local settlement-subsistence system of the time cannot be established on the basis of evidence from the Bend area, because comparable sites have not been examined. However, if the PEP model is accurate, the site represents either a short-term residential foraging camp or a day-use camp used by people who resided nearby, at a time comparable to that represented by the early (6,000-5,000 B.P.) house at the Johnson Site (35JE51B). Whether or not people in the Bend area at that time, like those at Willowdale, had begun to adopt a more settled lifeway is not clear.

In the Fort Rock Basin, just south of Deschutes County, rather little evidence for human occupation between 7,000 and 5,000 B.P. has been found (Aikens and Jenkins 1994), but substantial evidence of occupation between 5,000 and 3,500 B.P. now comes from a series of residential and gathering sites associated with now-dry channels connecting Silver Lake Valley with Fort Rock and Christmas valleys to the north. House structures are evidenced at the Big M Site and the Bowling Dune Site, in association with grinding slabs, fish (tui chub) bones, and storage pits (the latter at least at the Bowling Dune Site). Fishing tools (bone gorges and tabular net weights) have been found at the Big M Site. Population growth during this time is quite evident in the numbers of sites belonging to the period. Over-wintering was made possible by processing and storage of fish, small seeds, and possibly roots from the nearby uplands. Jenkins (1994:613) argues that the settlement system was semi-sedentary and fully logistical. This emphasis on lowland resources was made possible by a relatively moist climatic period (the "Neopluvial"), during which Silver Lake overflowed into the Fort Rock Valley-Christmas Valley lowlands. According to Jenkins (1994:614), drier conditions after 3,000 B.P. caused abandonment of these lowland sites except during brief moist periods. In response to this climatic instability, the population shifted its economic emphasis to the more reliable upland root resources. It is interesting to note in this connection that the gap in the radiocarbon record (4,500-3,900 B.P.) in north-central Oregon, discussed above, is a period with only one radiocarbon date reported for the Fort Rock Basin (Mehringer and Cannon 1994).

Another site just south of Deschutes County is 35KL810, at the foot of the Cascade Range on the divide between the Deschutes and Klamath rivers (Atwell et al. 1994). Investigated in connection with the PEP, the site is associated with a spring in a region where such water sources are rare because of the extreme depth of the coarse Mazama cinders that blanket the landscape. The site is interpreted as a post-Mazama residential base camp occupied in the warm season by task groups hunting game, probably mostly deer. Obsidian sourcing indicates that the occupants came from the Klamath Basin. Although the site was used throughout the post-Mazama period, greatest intensity of use apparently occurred prior to 3,500 B.P., at a time when residential mobility seems to have been high relative to later times. That is, according to this interpretation, site use became increasingly specialized as time progressed, reflecting an increasingly logistical settlement system. Unfortunately, the interpretive value of the site is limited because it was not analyzed in the context of the broader PEP database.

The archaeological record from Deschutes County and surrounding areas now is much fuller than it was six years ago. As noted by Lebow et al. (1990), the Middle Archaic witnessed the greatest cultural changes of any prehistoric period, including an apparently marked population increase to the highest recorded levels. Reduced occupational intensity caused by the Mazama ashfall about 7,000 radiocarbon years ago seems clear only for areas with the thickest pumice deposits, especially the upper Deschutes River drainage south of Bend. Peak occupational intensity occurred between 4,000 and 2,000 B.P. in most areas, although an earlier peak, between the ashfall and 4,000 B.P., seems indicated for the Willowdale area, associated with the earliest pithouse structure so far recorded in the Pacific Northwest.

Data reported over the past several years have offered insights not only into the patterns of prehistoric change during the Middle Archaic, but also the potential causes and mechanisms for that change. Although consensus has not been reached on these issues, the new data, especially from the PEP, support the idea that population increase stimulated important changes in land use, away from settlement mobility with an orientation toward freshly gathered foods and in the direction of more sedentary settlement and growing reliance on storable foods, particularly roots. (The degree to which climatic change, especially changes between more arid and more moist periods, was involved in this cultural evolution is as yet unclear, and will remain so until better and more regionally specific paleoclimatic data become available.)

The success of this altered land use system promoted further population increase and a continuing feedback relationship between population growth and intensified resource use. As a consequence, areas that were formerly distant from population centers, such as the middle Deschutes and John Day river drainages, became settlement magnets because of their abundant and storable roots and salmon. In these areas, stable settlements with permanent houses became established. These settlements became the foci of a land use system largely involving resource collection by task groups using temporary camps in key resource areas at a distance from the home base. Archaeologically, this is expressed in part as a dramatic site frequency increase in upland resource areas and the appearance of pithouse dwelling sites in many lowland valleys.

Curiously, such lowland habitation sites have not been recorded in Deschutes County, although their presence may be suspected. In this area, it still is not clear that there were sufficient quantities of intensifiable food resources to promote a semisedentary settlement system. Such resources may have existed in the form of edible roots (such as *Lomatium*), anadromous fish (salmon and steelhead), and migrating deer herds (suggested by Lebow et al. 1990:70).

Late Archaic (2,000 B.P.-Contact)

As suggested by Lebow et al. (1990:72-73), prehistoric cultural change in central and north-central Oregon since 2,000 B.P. does not appear to have been as marked as in the Middle Archaic. Continuity in land use patterns in general seems to characterized the period. However, new data highlight adaptive changes, more pronounced in some regions than in others, that can be interpreted in terms of the intensification model discussed above.

For eastern Oregon in general, PEP data indicate a clear decline in the frequency of occupied sites after 1,500 B.P. (Pettigrew and Hodges 1995b). An occupational decline at this time also is evident in individual regions, including the John Day Canyon, the Shaniko Surface, the region between Madras and Bend, and the upper Deschutes River drainage south of Bend. A similar decline apparently took place in the Willowdale area after 800 B.P. Declines in land use intensity in these areas may have been associated with the growth of nucleated settlements on the Columbia River, in a process of further intensification involving salmon, an ethnographic hallmark of Plateau Culture (Schalk 1987; Schalk et al. 1995:9-33). According to this hypothesis, continued population increase caused a movement toward large settlements along the arid stretches of the Columbia River, where a major investment in salmon fishing, combined with seasonal exploitation of root grounds and other resources, could support elevation population levels. Alternatively, Connolly (1995) suggests that the Late Archaic population aggregation on the Columbia River could have been caused by intergroup hostility, environmental factors such as climate change, or an increasing economic importance of salmon. Whatever the cause, one result may have been a reduced residential population in central and north-central Oregon to the south.

Recent compilation of data from the Pine Creek Basin, a part of the middle John Day River drainage by Endzweig (1994), shows that by 2,500 B.P. small pithouse sites were common, and that a sudden decline took place after 300 B.P. A similar depopulation may be evidenced in PEP data as well (Schalk et al. 1995:9-32), although the degree of temporal resolution is problematic. Clearly, though, the archaeological pattern of dispersed small hamlets evident in north-central Oregon is not matched by ethnographic information, which emphasizes larger riverside villages dependent on salmon. Sudden and large-scale depopulation within the last 500 years may have resulted from the introduction of European diseases, even well before direct inter-cultural contact (Campbell 1990).

South of the Pine Creek Basin, in the Ochoco Mountains region of the upper John Day River drainage, Connolly et al. (1993) reported on data recovery excavations at Mitchell Cave, tested earlier by Jenkins (1988). New data from the site indicate two main periods of occupation, the first between 1,500 and 1,300 B.P. and the second much more recent, within the last 300 years. Summarized regional radiocarbon data in the site report are presented for the upper John Day and upper Crooked River drainages as a measure of occupational intensity, which apparently had two peaks during the Late Archaic, the periods 1,500 to 1,250 B.P. and 750 to 400 B.P., separated and followed by periods of much more limited occupation.

Somewhat farther south, at Big Summit Prairie in the Ochoco Mountains portion of the upper Crooked River drainage, Zancanella (1996) reports test excavations in one surface depression (out of many observed) at each of two sites, and concludes that these are house features, dated radiometrically to 850 and 1350 B.P., respectively. Earlier occupation of the site is also indicated by projectile points and stratigraphic evidence. Grinding slabs and macrobotanical samples indicate that root collecting and processing were important activities. Both camas and lomatium are common on the prairie and were identified among the macrobotanical samples. The presence of domestic structures, involving considerable labor investment, at the high elevation (4,400 ft.) is remarkable, and suggests the intensification of upland roots at this locality. Such intensification is predictable in view of the land use model discussed above, which posits continued population expansion and consequent intensification of suitable food resources.

Excavations at the Paquet Gulch Bridge Site (Jenkins and Connolly 1994), a substantial pithouse village site on a small tributary of the Deschutes River between Tygh Valley and Warm Springs, reveal that occupation began there at least by 2,290 B.P., peaked between 1,600 and 1,300 B.P., and terminated between 300 and 400 B.P. The site appears to be one of many habitation sites in the middle and lower drainages of the Deschutes and John Day rivers located in tributary valleys near intensifiable resources, in this case roots. It seems to be yet another example of the intensification process as it reached its apogee in the Late Archaic.

Recent discoveries at Davis Lake, high in the upper Deschutes River drainage in Deschutes and Klamath counties, appear to suggest Late Archaic harvesting of the seeds of the giant pond lily, also known as wokas (*Nymphaea polysepala)*. Hickerson (1993, 1995) reports that three dugout canoes have been discovered preserved in mud at the lake's margins. These canoes match descriptions of canoes used ethnographically by Klamath women at Upper Klamath Lake and Klamath Marsh to gather wokas seeds (Barrett 1910; Spier 1930), a principal staple of the Klamath diet. Wokas is fairly abundant in places along the shores of Davis Lake (Leslie Hickerson, personal communication 1996). One of the canoe sites (the "North Davis canoe") contained boulder metates potentially used for wokas seed processing, as well as associated mud flats exhibiting numerous wokas tubers. Another canoe (the "Lava Flow canoe") was associated with cultural debris including a worn slab milling stone, a portable basalt mortar, and a bedrock mortar. A radiocarbon date of 220 B.P. on the North Davis canoe indicates very late prehistoric or early historic manufacture. It is conceivable that a resident population in the upper Deschutes River drainage conducted intensive harvesting of wokas seeds as part of the overwintering strategy, but many questions remain, such as the present and past abundance and distribution of wokas in the lakes and marshes of the region and its potential association with polished grinding slabs suitable for seed grinding.

Elsewhere in the upper Deschutes River drainage south of Bend, analysis of Late Archaic land use patterns in Newberry Caldera (Connolly 1995) suggests a late decline in mining and processing of Newberry Volcano obsidian that may reflect reduced demand. Reduced use of Newberry Volcano obsidian after 1,000 B.P. is explained as possibly a consequence of reduced demand brought about by population shifts (especially an aggregation of population in large Columbia River villages at the expense of small hamlets on the John Day and Deschutes rivers and in their tributary canyons) and reduced exchange spheres among the settled people of north-central Oregon. Other possible explanations offered are ecological changes in the caldera resulting from the Big Obsidian Flow eruption of 1,300 B.P. or other environmental or economic changes. A possibility not suggested, but which seems possible, is that population density among consumers of Newberry Volcano obsidian actually declined for some reason. Another alternative explanation is a technological shift, with the arrival of the bow-and-arrow and its increasing use, toward smaller projectile points. Curiously, however, PEP data from Central and north-central Oregon appear to show no corresponding decline in the frequency of Newberry Caldera obsidian (Lebow 1995). Analysis of spatiotemporal patterns for obsidian weight rather than simple frequency may be needed to address this issue more clearly, because obsidian item frequencies may have remained constant while item size, and the overall mass of obsidian shipped north, may have declined significantly.

The last 2,000 years of archaeological record in the Fort Rock Basin apparently also has yielded remarkable evidence of the intensification process. Jenkins and Brashear (1994) report on excavations at four habitation sites in the uplands east of Silver Lake. The largest site, Boulder Village, at an elevation of about 5,250 ft., contains 122 stone-ringed house structures and at least 48 cache pits, in association with a perennial lake and an extensive root ground very productive of lomatium and other edible roots. Three smaller but similar sites were investigated nearby. Radiometric dates from cultural deposits indicate three phases of occupation: 1,500-900 B.P., when the largest and most spatially concentrated houses were occupied; 600-500 B.P., when houses were somewhat smaller and more scattered over the area; and the contact period, when houses were distinctly smaller and shallower and population was dispersed as in the previous period.

Aikens and Jenkins (1994) interpret this evidence as indicating a shift in the local land use strategy away from lowland resources near marshes and lakes and toward more reliable upland root crops. The Carlon Village Site on the shore of Silver Lake, the location of eight large stone ring houses, was occupied between 2,000 and 1,500, and produced faunal and floral remains of wetlands resources. According to Aikens and Jenkins (1994), the human population continued to expand during this period, but lowland waterside resources became less dependable owing to climatic fluctuations. As a result, a residential shift was made, despite the harsher winter climate, to upland locations near the more dependable root grounds, which had always been used but now became the staple food source. Jenkins (1994:616-617) believes that drought and epidemic disease caused an ultimate population reduction after 400 B.P.

As new data on the Late Archaic accumulate, a more detailed picture of land use fluctuations comes into view. For the most part, the changes that occurred in each region of Central Oregon and surrounding areas are explainable as responses to the consumptive demands of expanding populations in the form of intensification of key food resources. In the north, roots continued to be critically important, but storable salmon may have become the final step in the intensification process, attracting a large segment of the human population to large riverside villages. In the south, including the Fort Rock Basin and possibly the upper Crooked River drainage near Big Summit Prairie, salmon were not available, but more intensive use of upland roots may have become the solution to the problem of population pressure. These examples as yet have no clear counterparts in Deschutes County, where so far Late Archaic shifts in resource or land use, other than an apparent reduction in the use of Newberry Volcano obsidian after 1,000 B.P., are not clearly apparent in the archaeological record. Possibly, no sufficiently abundant resources existed there that could be further intensified, and the human population fluctuated in step with the area's carrying capacity. However, new discoveries, or reanalyses of existing data, might reveal details of changing land use that so far have eluded us. One interesting possibility of this kind is that intensive harvesting of wokas seeds in the lakes and marshes of the upper Deschutes River drainage, suggested by the Davis Lake canoes, made possible a degree of sedentism heretofore considered unlikely for that region.

Historic Period (post Euro-American contact, 1805 to present)

For the purposes of this report the Historic Period is considered to begin in about 1805. This date coincides with the arrival of the first Euro-Americans in Central Oregon, Merriweather Lewis and William Clark. This period was established for use in the data base of historic and prehistoric sites established concurrently with this study. For further discussion on the Historic Period see A Cultural Resource Overview for the 1990s, BLM Prineville District, Oregon. This particular study does not focus on the historic period.

Table 2. Key Reports Since 1990 Relating to the Prehistory of Deschutes County.

DESCHUTES RIVER DRAINAGE:	GREAT BASIN:
Atwell et al. 1994	Aikens and Jenkins (ed.) 1994
Cheatham 1992	
Connolly 1993, 1995	MULTIREGIONAL:
Connolly and Musil 1994	
Jaehnig 1994	Pipeline Expansion Project (PEP) reports:
Jenkins and Connolly 1994	Atwell, Bailey, et al. 1995
	Atwell, Hildebrandt, et al. 1995
JOHN DAY RIVER DRAINAGE:	Lebow et al. 1991
	Moratto et al. 1991
Connolly et al. 1993	Moratto et al. 1994
Endzweig 1994	Price et al. 1993
	Speulda et al. 1993
CROOKED RIVER DRAINAGE:	
Zancanella 1996	

RESEARCH DESIGN (Richard M. Pettigrew, Ph.D.)

Proper management of prehistoric sites in Deschutes County and surrounding areas requires a systematized approach for inventory and evaluation. Until now, most recordation and management of prehistoric sites have been conducted by the Deschutes National Forest and the Bureau of Land Management, Prineville District, whose lands together encompass most of the County. With the present effort, the County enters into a partnership with the two federal agencies to adopt an integrated program for managing prehistoric sites within their respective jurisdictions. As part of the necessary coordination, it is appropriate to consider what research orientation and organizing principles to follow in the management process.

A research orientation is critical to cultural resource management in large part because of the need to make decisions about the disposition of historic properties potentially threatened by planned development. For example, whether a cultural resource site is to be protected from the disturbing effects of construction depends on its value. That value is usually measured in terms of its potential as a source of information about past human activities. For federally entailed projects, such as those on federal lands, Section 106 of the National Historic Preservation Act of 1966 requires federal agencies to determine whether an undertaking may affect properties that are "significant," that is, eligible for listing in the National Register of Historic Places (NRHP).

Most commonly, prehistoric sites considered significant are those meeting NRHP Criterion "D," meaning "That they have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR 60.4). Similarly, Oregon state law (ORS 358.905) protects sites "of archaeological significance," including sites on or eligible for the NHRP. Assessing research value, then, is essential to evaluating prehistoric sites for management purposes.

Moreover, some measure of ongoing research is part of cultural resource management, and is necessary for making incremental improvements in the management process. Inventorying and evaluating prehistoric sites generate new data about prehistory, thereby expanding the context within which sites are evaluated. To the extent that new data are gathered systematically and with a view toward improving the context, decisions about site disposition will be made ever more intelligently. A research design constructed to guide this process, then, is a highly valuable tool for management purposes. Even more, the same research design can help guide the conduct of archaeological studies initiated to recover data from threatened sites and those under investigation for other reasons. Thus, a research program coordinated through a research design is valuable to all participants for a variety of reasons.

Guiding Principles

The best research design is one that is guided by a widely accepted theoretical theme that is easily connected to research issues that one may study through readily prescribable data collection and analysis. As a point of departure in this effort, we shall begin with the ideas offered by Schalk and Atwell (1994) for the research design prepared for the recent Pipeline Expansion Project (PEP) that transected Deschutes County and yielded the largest data set of any Central Oregon research project to date.

Among the goals of the PEP research design were some that are considered goals here as well. Two are especially applicable: (1) "providing a theoretical framework sufficiently general to provide some basic expectations for the widest possible range of archaeological sites encountered in the Project area," and (2) "establishing priorities for what can realistically be accomplished and providing a 'common denominator' for analyses applied to recovered archaeological collections" (Schalk and Atwell 1994:5-2). Deciding upon a theoretical framework is much the same as deciding what kinds of questions, out of the limitless array of possible questions, we should ask of the data. When the issue is couched in these terms, a course of action is easier to plot. Ultimately, the most valuable kinds of questions to ask are those with **universal applicability**, that is, questions that can be asked of data from many regions of the world. Such questions, when answered for Central Oregon, can contribute to understanding the dynamic processes of human cultural adaptation in general. Understanding cultural processes is widely regarded in this country as the ultimate goal of archaeology (Thomas 1989:142). At the same time, we clearly should ask questions that we can reasonably expect to answer. Much of our curiosity about the past will never be satisfied because the data do not or cannot exist to answer some kinds of questions, especially those of a particularistic nature, such as the names, belief systems, and, for the most part, languages and cultural identities of people who lived thousands of years ago. Questions that we can answer are those whose hypothesized answers are testable, or even better put, **falsifiable**. A falsifiable proposition is one for which we can devise data collection and analytical methods to disprove. Falsifiable hypotheses are a hallmark of the scientific method.

Central Theme: Land Use

In the 1990s, three research designs have been proposed for areas encompassing Central Oregon. The first was a major component of the cultural resource overview prepared for the BLM by Lebow et al. (1990:149-171). In this effort, the central themes were (1) social, political, and economic complexity, measures for which have been offered by Price and Brown (1985:10-13), and (2) a model for regional cultural evolution proposing that cultural change followed a path describable in terms of a series of adaptive modes. These themes were adopted as the basis for the synoptic research design constructed for the PEP Historic Properties Treatment Plan (Moratto et al. 1991:2.10-2:21). This first PEP research design focused on the theme of cultural adaptation, proposing a version of the model of cultural development advanced shortly before by Lebow et al. (1990), but modified to suit the needs of the much large project area. This research design was crafted to serve the purpose of evaluating the data potentials and deciding the disposition of the many scores of sites inventoried and then test-excavated within the area to be affected by pipeline construction. The most recent research design is that prepared by Schalk and Atwell (1994) to guide the analysis of the voluminous data generated by the final phase of data recovery for the PEP.

The Schalk and Atwell (1994) research design in several ways represented an advance over earlier proposals applicable to Central Oregon. Most importantly, this second PEP research design expanded the discussion of hunter-gatherer theory, bringing into play a wider array of ideas previously proposed in the literature, and focused more on the process of adaptive cultural change. In this way, the new research proposal became more universally applicable. By careful explication of the dynamics of cultural change, beyond simply a proposed series of regional cultural changes, it also became more easily connected to hypotheses testable by the archaeological record.

The present research design largely follows the trail already blazed by Schalk and Atwell (1994), with some modifications based mostly on results of the PEP final report (Atwell, Hildebrandt, et al. 1995), which exposed some weaknesses in the Schalk and Atwell (1994) construct. The final PEP research design focused on the central theme of **hunter-gatherer land use systems**. Land use is closely related to the earlier theme of cultural adaptation, but is more specifically tied to human interaction with the natural environment and its available resources. The following is a summary description of the land use theme. For a fuller account of the development of this theme and the references used, see Schalk and Atwell (1994).

The theoretical perspective is fundamentally economic in a general sense, and may be characterized also as thermodynamic: "From an evolutionary perspective, the most useful cultural variables to consider are those by which a cultural system is articulated with the energy sources in its environment" (Schalk and Atwell 1994:5-3 - 5-4). Cultural complexity may be measured in terms of the pathways by which energy flows in time and space through a cultural system. Put another way, cultures are more complex thermodynamically when they transport resources greater distances in the spatial and temporal dimensions. The more complex the energy exchanges, the more complex the cultures.

For hunter-gatherers, movement of people to resources is termed "residential mobility," and movement of resources to people "logistic mobility." Movement of resources through time from harvest to consumption is more simply referred to as "storage." Another form of energy transport to take into account is trade, by which individuals or groups exchange surplus resources for desired but more scarce resources. Both mobility and storage have been used by theoreticians in developing bipolar models or classifications of hunter-gatherers, of which the most often used is the "forager-collector" dichotomy of Binford (1980). This popular model has had its greatest success in accounting for variability among ethnographic hunter-gatherers of modern times and in predicting the archaeological signatures of sites produced at the opposite poles of the dichotomy, but the Binford model and other bipolar classifications do not account well for the wider range of variability posed by numerous temperate-zone hunter-gatherer cultures, all classifiable in the Binford system as "collectors," who once dominated vast regions that now are occupied by agricultural and industrial societies. Examples of such cultures are those that flourished in Oregon prior to the 19th century, including those of Central Oregon.

Another key concept employed by theoreticians is **intensification**, defined as "the process of deriving increased amounts of energy from a given area of land" (Schalk and Atwell 1994:5-15). The theory holds that population pressure, which is an imbalance between the resource demands of the human population and the resource supply of the occupied area, stimulates people to increase the resource output of their area through increased labor, technological improvements, exploitation of previously unimportant resources, or other measures. Reduced residential mobility is thought to be closely associated with intensification. Importantly, intensification is considered to be part of a feedback process: intensification allows population expansion, which results in further population pressure, which spurs additional intensification. Also, intensification can occur only to the extent that resources exist whose output can be increased by human manipulation.

Intensification is thought to have led in some areas of the world to the adoption of agriculture. However, where agriculture was not possible, intensification led to increasing and quite variable cultural complexity among hunter-gatherers. To account for this wider variability and provide a framework for classifying complex temperate-zone hunter-gatherers, Schalk and Atwell (1994) propose a new classification scheme employing the key measures of food storage, residential mobility, and resource transport. Different modes of resource transport include logistical transport, trade, and redistribution. Five land use strategies are proposed on a scale from simple to complex. Strategy I is **foraging**, a fully nomadic strategy with no significant dependence on food storage, little logistical transport, and a high degree of residential mobility. Population densities are low, and group territories are large. Winter subsistence is based on hunting for immediate consumption. Foragers are thought to have relatively low dietary richness (that is, the number of different food items used) and moderate niche width (evenness in the amounts of each dietary item consumed). Intensification may have caused some expansion in niche width and dietary richness, but no shift to a different adaptive strategy. No foraging societies existed in western North America in early historic times, but the earliest prehistoric societies in the Pacific Northwest (including the Paleo-Indian and at least some of the Early Archaic period) are widely thought to have followed this pattern.

Strategy II is **rest-rotation collecting**, differing from foraging in the addition of food storage as the primary solution to winter subsistence. A main consequence of this overwintering method is temporary sedentism, because residential moves are not required, and indeed are discouraged, while the group lives off stored reserves. Logistical mobility, involving temporary seasonal use of resource procurement camps used by task groups, is included in Strategy II but is not yet highly developed. Population density is still relatively low, making possible the regular relocation of residential settlements as resources are overexploited in each local catchment area. Intensification, in response to population pressure, has caused an increase in dietary richness and maximal levels of niche width along with the shift toward food storage. Beyond this point, intensification can cause no further increases in niche width. It is with Strategy II that we should see the first emphasis on storable foods, such as roots, seeds, or fish.

Strategy III is **semisedentary collecting**, and differs from Strategy II in the absence of regular relocation of residential settlements. Population density inhibits such moves, and has resulted in a greater reduction of residential mobility and an increase in the length of winter sedentism. Intensification has caused a maximal development of logistical mobility and greater dependence on a small number but large volume of stored foods. Reduced range has resulted in exploitation of resources not used much before (thus, an increase in resource richness) and more dependence on plant rather than animal foods (thus, a decrease in niche width). Because Strategy III involves population increase, greater site reoccupation, and greater numbers of seasonal resource collection camps, it should appear in the archaeological record as an apparent increase in "occupational intensity" of sites and of a region, with widespread and obvious traces of occupation. Nearby ethnographic groups that apparently matched this profile for semisedentary collectors were the Klamath to the south and the Tenino to the north. Ethnographic information for Central Oregon itself is not complete enough to evaluate local Native American groups in these terms.

Strategy IV, **fully sedentary**, not thought to include any examples in or near Central Oregon, is the culmination of the intensification process in areas of resource abundance. In this strategy, residential sites are occupied continuously, representing the lowest possible level of residential mobility. Population density is quite high by hunter-gatherer standards (village populations may reach a thousand or more), and logistical mobility has been replaced largely by trade and redistribution of foodstuffs and other key resources. Because subsistence is based on large quantities of stored foodstuffs and group territories are rather small, niche width has declined and dietary richness has either remained constant or has declined.

Strategy V is **equestrian hunting and gathering**, differing from other strategies in its reliance on the horse for transporting people and resources. This strategy is thought to have resulted not from the intensification process but rather from the introduction of the horse in protohistoric times. Strategy V groups may have been involved in different land-use systems, so this strategy stands apart from the others in not being part of the same sedentism and thermodynamic complexity gradient. Also, it existed for such a short time (about 200 years at the most) that archaeological expressions of it are difficult to find.

The proposition of these five land-use strategies was not made to artificially restrict consideration of variability among complex hunter-gatherers. In reality, individual societies may not have clearly matched any of the model strategies. However, these strategies serve the useful purpose of illustrating the key variables involved in changing hunter-gatherer land use and complexity, and may suggest the potential for other hypothetical strategies involving different mixes of food storage, winter sedentism, residential mobility, logistical mobility, trade, and other parameters.

Indeed, the results of the PEP caused some reconsideration of the proposed land use model (Schalk et al. 1995). In particular, the findings for the period between 7,000 and 4,000 B.P. in north-central Oregon suggested that Strategy II, rest-rotation collecting, was a two-step process in which the introduction of significant food storage (which we might call Strategy IIA), contradicting the expectation of Binford (1980), preceded by a substantial period the development of logistical resource collection (Strategy IIB). This development was made possible apparently by a resource structure in the Willowdale area that included accessible fish, land mammals, and storable roots within the catchment area of a single residential settlement.

This result is a reminder that the sequence of proposed land use strategies is idealized, and that it is the dynamics of the intensification process that should be the object of attention rather than the land use classification scheme. It is not as important to test the sequent land use strategies represented by the archaeological record as it is to document the path of cultural evolution in any given area, especially in terms of key variables such as residential and logistical mobility and the kinds and amount of food storage. At the same time, researchers must realize that the confirmation of a predicted pattern does not demonstrate that the predictive model is correct. Instead, alternative scenarios should be entertained, and efforts made to falsify each alternative explanation.

A set of circumstances suggests an example of an alternative scenario for Central Oregon, where one of the principal land use issues is whether a substantial resident population existed in the upper Deschutes River drainage in much of post-Mazama time (see the discussion in "Prehistory," above) or, alternatively, the archaeological record is the product of temporary visits from distant locations such as the pithouse hamlets of the middle Deschutes River drainage. A key to this issue is the local resource structure, which apparently was poor in storable food resources (unless deer meat could be stored in ice caves), but extremely rich in obsidian (from the Newberry Caldera area) highly valued by settled populations downstream. Evidence of potential craft specialization in obsidian biface manufacture exists in the form of biface caches (Davis and Scott 1991:48; Ice 1962; Minor and Toepel 1984; Scott et al. 1986) and clear evidence that the principal function of sites in the Newberry Caldera area between 4,000 and 1,000 B.P. was the mining of Newberry Volcano obsidian and the production of obsidian bifaces (Connolly 1995). In the middle Deschutes River drainage area, PEP data demonstrate that Newberry Volcano obsidian overwhelmingly dominates all other obsidian sources in assemblages postdating 4,000 B.P., during the time when pithouse hamlets provisioned by stored roots proliferated. Schalk and Atwell (1994:17) included trade among the resource transport options available to complex hunter-gatherers, but did not expect substantial trade in foodstuffs to occur prior to the development of Strategy IV (fully sedentary). For the upper Deschutes River drainage area, Schalk and Atwell (1994:5-25) predicted that "Strategy II may represent the maximal degree of intensification." Is it not possible that trade in foodstuffs could occur at lower levels of population and cultural complexity if the right circumstances apply? In this case, a resident population in the upper Deschutes River drainage might have been induced by its poverty in storable foods and its wealth of valuable lithic material to trade obsidian for roots with its neighbors to the north and thereby support a larger and more sedentary population than otherwise possible. If this is not what happened, one still must ask what the hamlet dwellers traded to the south to obtain their prized Newberry Volcano obsidian. If trade in foodstuffs is ever demonstrated, a new form of land use strategy for complex hunter-gatherers, based on intensive mining, processing, and trading of lithic raw material, could be added to the list discussed here.

Archaeological Measures of Land Use

One of the advantages of the thermodynamic land use model proposed by the final PEP research design is its potential for hypothesis testing. Schalk and Atwell (1994:5-28 - 5-40), based on published suggestions of hunter-gatherer theorists, present a series of linkages between land use and archaeological assemblage parameters. Because differential preservation normally causes lithic debris to dominate archaeological residues, most of the assemblage parameters presented are lithic.

A principal expectation is that increasing sedentism (or reduced residential mobility) should be associated with a shift away from formal lithic production techniques and toward expedient techniques, because reduced residential mobility, among other things, relaxes constraints imposed by the need to transport tools to uncertain destinations and encourages the production of task-specific tool kits. As correlates to this expectation, declining residential mobility is expected to be associated with a:

1. Higher frequency of cortical flakes;
2. Less abundant bifacial flaking debris;
3. Lower ratio of utilized biface thinning flakes to debitage;
4. Reduced frequency of bifacial cores;
5. Increased frequency of unprepared cores;
6. Lower ratio of biface fragments to debitage;
7. Less frequent bifacial tools in general;
8. Larger and heavier lithic tools;
9. Lower bifacial edge to mass ratio;
10. Less common tool retouch;
11. Reduced number of tool maintenance techniques;
12. Less tool resharpening; and
13. Less frequent tool recycling.

At the same time, declining residential mobility should be accompanied generally by reduced exploitation territory and a consequently diminished direct access to lithic raw material sources. Other means of obtaining lithic raw materials should become more attractive, and the character of raw materials found in residues should change in predictable ways. Among the lithic assemblage correlates in the case of declining residential mobility are that:

1. Exchange for raw lithic materials should become more common;
2. Raw material types should become more diverse;
3. Raw material quality should decline (unless it is traded for);
4. Intersite variability in raw material types should decline; and
5. A former disparity in distance-from-source between tools (distant) and debitage (proximate) should disappear.

Although declining residential mobility is expected to cause observable shifts in certain lithic assemblage parameters, many lithic variables are affected also by cost factors, most readily expressed in terms of distance from source. In general, more costly materials should show the effects of conservation. As distance from source increases, one should expect:

1. Tertiary reduction to become more common and primary reduction less common;
2. Percussion flakes to decline in frequency;
3. Shatter to become less frequent;
4. Flake weight and size to decline;
5. Cortex to become less frequent on flakes;
6. Cores to become less common in ratio to debitage;
7. Cores to become lighter;
8. Retouched tools to increase in relative frequency;
9. Tool recycling to become more common; and
10. Retouch of broken tools to increase.

These tendencies, which should apply at any level of residential mobility, can confuse the issue in analyses seeking to measure mobility. For example, cortical flakes are expected to be more common among more sedentary populations, with their more expedient technologies, but a substantial distance from source works in the opposite direction, toward fewer cortical flakes. This example highlights the need to control for other factors in analyzing lithic assemblages as measures of mobility.

The structure of tool assemblages is thought to be influenced by residential mobility. A frequently used measure of assemblage structure is assemblage diversity, a function of both numbers (or richness) and evenness of tool classes. This and related parameters of tool assemblages are expected to change in the following ways as residential mobility declines (and, as expected for Strategies II and III, logistical mobility increases):

1. Assemblage diversity should increase;
2. Multifunctional tools should become less frequent;
3. Single-purpose tools should proliferate;
4. The ratio of hafted to expedient tools should decline; and
5. Intersite variability in tool assemblage content should increase.

Unfortunately, one of the weaknesses of reliance upon lithic assemblage for such analyses is that total tool assemblage diversity, including tools made of perishable materials, may be much more reflective of the expected assemblage changes than the lithic assemblage alone, which probably is more closely associated with the hunting component of the economy than the gathering component.

Another factor to control for in the examination of mobility through lithic assemblages is site type. Theoreticians have noted a number of differences that should be expected between residential and non-residential sites. According to these predictions, residential sites, in contrast to non-residential sites, should exhibit:

1. A lower ratio of utilized to nonutilized biface fragments;
2. Greater biface thickness and weight;
3. A higher ratio of proximal to distal projectile point fragments;
4. A higher ratio of burins, spokeshaves, and gravers to projectile points;
5. A higher ratio of bifacial debitage to bifacial tools;

6. A higher ratio of retouch or notching flakes to total debitage;
7. A lower ratio of resharpening flakes to total debitage;
8. A higher ratio of unprepared to bifacial cores; and
9. More often stockpiled raw material (such as in the form of Stage 1 and 2 bifaces) for tool replacement.

Employing these measures to distinguish residential from non-residential sites requires careful thought. For example, it may be difficult to distinguish a residential site used by foragers (who by definition have essentially no non-residential sites) from a seasonal hunting camp used by a logistical task group (as experienced by the analysts of 35KL810 on the Deschutes-Klamath divide [Atwell et al. 1994]), because the technological constraints imposed in both situations may be similar with respect to the lithic component of the tool kit. Such difficulties may be especially imposing when a site is examined alone, without the context of multiple analyzed sites and their comparable patterns.

Lithic analyses conducted for the PEP included examination of some, but not all, of the measures listed above (Atwell, Hildebrandt, et al. 1995). For those measures examined, evaluation of their usefulness is possible through review of the PEP results, which were obtained by analyzing results from all Oregon sites subjected to data-recovery excavations. Stone tool assemblage diversity increased from pre-Mazama times to the period 4,000-2,000 B.P., as expected for increasing logistical mobility (greater diversity of site functions), but did not continue to increase, possibly reflecting a stabilized mobility level. Unexpectedly, lithic tool assemblage richness (count of tool types represented) overall dropped after 2,000 B.P. This may indicated an increasing degree of economic specialization. The analysis did not examine results from separate regions independently, so it is possible that more pronounced regional patterns exist. At site 35WS231 on the Shaniko Plateau, for example, tool assemblage diversity showed a declining trend through time, suggesting increasing specialization in local land use.

The PEP study of toolstone procurement attempted to explore mobility through evidence for direct and indirect procurement (Lebow 1995). The most robust patterns, however, were those connected with raw material availability. In fact, in the upper Deschutes River drainage south of Bend, obsidian is so plentiful and cheap that local toolstone predominates throughout the prehistoric record, leaving little room for examination of mobility changes. For Oregon at a whole, the expectation that the diversity of toolstone sources would decline over time (as a result of reduced territories) is contradicted by the opposite pattern. Similarly, although pre-Mazama assemblages were expected to show a tendency for tools to come from more distant sources and debitage to be more local, the results are to the contrary. Schalk et al. (1995:9-17) conclude that, in areas where toolstone is easily obtained, foragers will tend to retool rather than curate, and tool and debitage toolstone in residues will be similar in source profile. With decreasing mobility and reduction in territories, tool curation should become more common and a growing disparity should appear between tool and debitage raw material sources. Another complicating factor is that the portion of an annual cycle represented by a short-term forager residential site should generally be significantly less than that represented by a residential site used by a more sedentary population. Thus, the accumulated toolstone in the latter site may appear to be more diverse.

Lithic analysis of the PEP collections (Lebow and Atwell 1995) showed that tool maintenance as reflected in proportions of recycled, retouched, and resharpened artifacts did not decline through time in concert with the expected decline in residential mobility, but instead rose to its peak after 4,000 B.P. Similarly, utilized bifacial thinning flakes, expected to be most common with the formal technology of early foragers, turned out to show the reverse pattern, rising to a peak among the later residential sites. Schalk et al. (1995:9-21) suggest that these results reflect increasing lithic toolstone conservation among more sedentary peoples as their direct access to toolstone sources declined. Results generally in line with the expectations of the model were seen for the proportions of cortical flakes, bifacial and unprepared cores, and manufacturing stages of bifacial tools (reflecting tool weight-to-mass and edge-to-mass ratios).

The results of the PEP suggest that much work is yet to be done in testing the effectiveness of the land use measures listed above. Analyses had mixed outcomes, some contradictory to expectations. However, all efforts to employ the measures against the rich PEP dataset were valuable in that they (1) produced results that can guide analyses in future projects and (2) encouraged a focus on the central theme (land use) of the research design. A number of the measures were not employed in the PEP analysis and still need to be put to the test.

Regional Issues in Relation to Land Use

As mentioned above, a limitless number of questions may be asked about prehistoric human life. Indeed, several lists of research questions and issues pertinent to Central Oregon already have been published (Lebow et al. 1990:150-165; Moratto et al. 1991:2.33-2.45; Pettigrew 1982:65-67), all of them prior to the most recent PEP research design. Most if not all of these topics are considered still valid, and many of them may appear to bear little or no direct relation to land use, the central theme of this research design. However, as Schalk and Atwell (1994:5-2) point out, ". . . few archaeological research questions can be addressed effectively without a solid understanding of land use." A goal of this section is to integrate the body of previously listed research issues with the theme of land use. In this way, regional archaeological research can be crafted more ideally to view Central Oregon as a case study in the worldwide endeavor to understand land use among hunter-gatherers. Another important goal is to point out the data categories thought useful in finding answers to our research questions. To accomplish these goals, the following discussions will list in turn what are considered the most important research issues in Deschutes County and surrounding areas, exploring for each its linkage to prehistoric land use and considering what data may be useful in addressing the topic. This is not intended to be an exhaustive relisting of research questions that have already been listed by others.

Important research topics in Central Oregon directly pertaining to human prehistory include settlement and subsistence, demography, technology, exchange and external relations, ideology, and culture history. These issues may be linked to land use in various ways. Three additional topical areas are critically important to archaeological interpretation but do not pertain directly to human activity per se: chronology, paleoenvironment, and site formation processes. These topics need not be linked closely to land use, although their investigation, which builds the interpretive context of archaeological data, leads inevitably to addressing land use and all other important archaeological questions. For each topic presented below, the discussion is followed by a summary list of specific research questions and data categories considered useful for addressing those questions. Emphasis is placed on those data categories obtainable at the inventory level of data acquisition.

Settlement and Subsistence

Questions of settlement and subsistence lie at the core of the land use theme. Where people lived, in what kinds of groups and settlements they lived, and what they ate and how they procured and processed it are matters residing at the interface between human beings and their natural environment. They are also questions that tend to come first in the minds of inquiring archaeologists. In Central Oregon, the deepest archaeological puzzles have to do with where people lived and how they made their living. Although most archaeologists presume that the first human settlers of the region were foraging big-game hunters who made Clovis fluted points, we have no direct evidence of this so far, nor do we have direct evidence of the presumed shift from foragers focused on big game to foragers with a generalized economic orientation. Understanding of later periods is not much better. The hypothesized evolution from foraging to Strategy II and Strategy III collecting is not demonstrated for the Deschutes River drainage south of the Willowdale locality, in part because no sites with habitation structures have been found except for a possible simple ground-level structure described by Connolly (1993, 1995) for the pre-Mazama Paulina Lake Site in Newberry Caldera.

Evidence of pre-Mazama occupation in the upper Deschutes River drainage south of Bend now is known to be plentiful, but the sites found along the PEP corridor only hint at the actual distribution of these settlements, thought to be associated largely with marshes and lakes. Sites of this period are known to be plentiful at Odell Lake and near Paulina Prairie, and probably are numerous among both already inventoried sites, and sites yet to be found, on the margins of high lakes and marshes and lowland floodplains. Much could be learned about settlement patterning and land use by identifying such sites in this area and examining their distribution. A survey for pre-Mazama sites could be accomplished by a very simple method involving obsidian sourcing. A very useful discovery of the PEP (Skinner 1995b) is that upper Deschutes River drainage sites possessing obsidian from the McKay Butte and Unknown X sources are almost always pre-Mazama, probably because these sources, located in the Newberry Caldera area, were buried beneath Mazama pumice and used very little in post-Mazama times, when the Newberry Volcano source was extruded and became dominant in archaeological assemblages. Because vertical displacement by natural and artificial disturbance often moves sub-Mazama debitage and tools to the surface, even through a meter or more of primary and redeposited pumice, surface-collected samples of many sites containing pre-Mazama components should contain some McKay Butte or Unknown X obsidian. By systematically sourcing surface-collected obsidian in the area, even in the absence of test excavation, it should be possible to plot the distribution of pre-Mazama components. Sites in areas without thick accumulations of Mazama pumice, such as alongside the Dry River, may also possess components that are demonstrably pre-Mazama by the same method. This information could guide sampling programs designed to expand our knowledge of pre-Mazama lifeways.

Results of the PEP showed that occupational intensity in Central Oregon, especially in the Deschutes River drainage south of Bend, dropped dramatically just after the Mazama ashfall about 7,000 years ago, then slowly rebounded to something approaching former levels by about 4,000 years ago. This pattern could be tested in a manner similar to that above, by studying surface-collected obsidian. Now that a hydration rate has been established (Pettigrew and Hodges 1995) for Newberry Volcano obsidian, the most common post-Mazama obsidian in Central Oregon, a program to source obsidian artifacts and measure hydration rinds from the many inventoried sites on federal lands in the area could yield a great return in information about changing site distributions through time, again without expensive excavations.

The search for habitation sites in Central Oregon is a key element in the investigation of changing land use strategies. Analysis of existing Deschutes National Forest data could provide useful clues. For example, it is known through use of the Geographic Information System (GIS) on the Forest that ground stone tools tend to cluster near the Deschutes River just south of Bend (Paul Claeyssens, personal communication 1996). If ground stone tools tend to associate with habitation sites, as they do in the middle Deschutes River drainage, then some riverside sites in this area may be habitation sites, as suggested by Pettigrew and Spear (1984:30). Other clues may be present that could by highlighted by GIS analysis. Prehistoric resource distributions might be elucidated by examining modern, and, as far as possible, early historic distributions of key resources such as deer, plants with edible roots, and resident and anadromous fish. As suggested by Lebow et al. (1990:156), habitation sites may be more plentiful on private land, which dominate in some lowland areas.

It has been hypothesized that movement toward sedentism in Central Oregon might have been made possible through intensification of the deer harvest and storage of meat in ice caves (Lebow et al. 1990:70). If this is so, then evidence for habitation may be found in or near such caves. Similarly, if the wokas harvest in the lakes and marshes of the upper Deschutes River drainage was large and dependable enough, habitation sites may exist nearby, to some extent possibly inundated by Crane Prairie and Wikiup reservoirs. These are other cases in which analysis of federal databases might yield clues about where to look.

Research Questions

1. Did an unusually substantial Early Archaic population exist in the upper Deschutes River region that subsisted largely on a diversity of animals and made seasonal moves between low and high elevation waterside settings? *Data Categories:* Obsidian sourcing to identify sites with McKay Butte and Unknown X materials. Lithic assemblage data showing limited intersite assemblage diversity and a lack of food grinding tools. Site-landscape associations demonstrating a waterside bias. Faunal remains dominated by wetlands species. Crescents in Early Archaic components in waterside settings.

2. Was post-Mazama occupation in the upper Deschutes River region based much less on wetlands resources and much more on terrestrial game animals such as deer? *Data Categories:* Obsidian sourcing to identify sites associated with Newberry Caldera and other post-Mazama obsidian sources. Site-landscape associations more associated with game interception than with bodies of water. Faunal remains dominated by game mammals.

3. Did the intensification process play an important role in cultural evolution for people living in the upper Deschutes River region? If so, which resource(s) were selected for intensified harvesting and processing? *Data Categories:* Lithic assemblage data showing increased intersite assemblage diversity and the use of food grinding implements. Mortars associated with root grounds. Polished grinding slabs associated with wokas patches at lakes and marshes. Cultural

debris (especially faunal remains) associated with ice caves (evidence for meat freezing). Residential sites with house pits.

4. If there was a resident population in the upper Deschutes River drainage, where did the people overwinter? Are residential sites concentrated in lowland areas near the Deschutes River? *Data Categories:* Site with domestic features (housepits or stone rings), storage pits, food grinding tools, and diverse and abundant lithic tool assemblages concentrated, for example, near the Deschutes River and its major tributaries.

5. Can it be confirmed that occupational intensity in the upper Deschutes River drainage declined dramatically with the Mazama ashfall in response to locally reduced biotic productivity and rebounded only slowly over the next several thousand years? *Data Categories:* Obsidian hydration measurements to sample the frequency of tool manufacture and use over time. Site distribution patterns to examine occupational intensity versus Mazama ash thickness over time. Pollen cores from lakes and marshes to measure changes in plant communities. Paleobotanical and faunal remains from archaeological strata as a record of changing biotic communities.

6. Is the occupational gap between 3,900 and 4,500 B.P., documented for north-central Oregon, the Fort Rock Basin, and northeastern California, evident also in Deschutes County? *Data Categories:* Obsidian hydration measurements and radiometric dates from cultural deposits, especially in the northern and eastern areas of the county, where less data are currently available.

7. Did early post-Mazama people in the Bend area, as suggested by the Bon Site and its many grinding implements, already have the beginnings of a more settled lifeway? *Data Categories:* More early Middle Archaic components with food grinding implements and other indicators of sedentism such as pithouses, food storage pits, and fire-altered rock.

8. Were fish ever a significant resource in prehistoric Deschutes County? *Data Categories:* Fish remains or fishing implements in cultural deposits. Sites located at known fish interception points. Remains of fishing structures such as weirs.

Demography

The changing levels of the human population are a matter of extreme interest to those concerned with the intensification process. Population pressure is hypothesized as a cause for strategic shifts in the direction of reduced residential mobility and increased sedentism, which are thought to result in increased population. Measures of prehistoric populations are not simple to interpret, but exist in many forms in the archaeological record. These include the mass of lithic raw material consumed, site frequency, site size, count and size of dwellings, numbers of grinding stones, and measures of mining activity at obsidian sources such as McKay Butte and Newberry Volcano. Lithic quantities may be especially useful in this way, because the availability of obsidian probably obviated conservation and the reuse of expended items.

Research Questions

1. Did the human population in the upper Deschutes River drainage experience two peaks (Early Archaic and late Middle Archaic) separated by an early Middle Archaic low point? *Data Categories:* Temporal variation in site frequency, site size, mass of lithic raw material deposited. Changing intensities of obsidian mining at the McKay Butte, Unknown X, and Newberry Volcano sources.

2. Did the population of Deschutes County in general decline at some time following 1,500 B.P.? Did a sudden decline within the last 500 years occur that might be attributable to epidemic disease? *Data Categories:* Reduction in site frequency, site size, mass of lithic raw material deposited, numbers of grinding stones, numbers of projectile points, numbers of hearth features, and numbers of house features. Reduced intensity of obsidian mining at the McKay Butte, Unknown X, and Newberry Volcano sources.

3. Did a population shift occur after the Mazama ashfall between the newly depopulated areas of thickly deposited ash (particularly south of Bend) and other areas where the ashfall effects were only minor? *Data Categories:* Population indicators (as above) declining south of Bend but increasing to the north and east.

Technology

Technology plays an essential role in the intensification process, because it is often through technology that people are able to improve the efficiency of resource output. Theory holds that in general tools become more specialized as residential mobility declines. As a corollary, this change should result also in a greater number of tool classes in use. Both phenomena should be observable in the archaeological record, although their recognition may be inhibited when only lithic tools are preserved.

Raw material physical properties and availability are critical variables affecting the expression of lithic technology in the archaeological record. These characteristics, along with the technical requirements of a society, are the main factors governing prehistoric raw material selection (Lebow et al. 1991:7-13 - 7-14). Thus, understanding the technological and economic constraints associated with raw materials is required in order to interpret the land use implications of lithic technology. This need is underscored by the results of the PEP (Schalk et al. 1995:9-21). Fortunately, investigating lithic raw material usage in Central Oregon is made simple by the ready availability of lithic artifacts and the progress that has been made in identifying obsidian sources (Skinner 1995a). A program of systematic obsidian sourcing to characterize a significant number of obsidian artifacts at inventoried sites and the use of the GIS to plot the distributions of obsidian types would illustrate baseline patterns to take into account when assessing the land use implications of raw material proportions.

Technological coding of lithic artifacts was used extensively for the final phase of the PEP, yielding a huge corpus of analyzable data (Lebow and Atwell 1995; Mitchell and Bryson 1995; Root et al. 1995). The multidimensional coding system employed was theoretically based, designed to be sensitive to production patterns reflecting function, and permitted the creation of a large database with much analytic potential still untapped. Despite the value of this dataset, the generation of new and comparable datasets may be difficult, owing to the specialized nature of the artifact data recording and the training required to undertake it. From the point of view of the data recordation challenges faced by those recording sites in the field and in the lab, it is much more practical to record a simpler and more confidently comparable set of lithic data to build a regional database of lithic distributional data.

Such a scheme was prepared for the evaluation phase of the PEP (Lebow et al. 1991:Appendix II.C.7). This system employed a standard set of definitions for tool classes and raw material types. For debitage, data recordation and analysis focused on raw material, size frequency (using circle templates), cortex categories, and fragmentation categories. Analyses of test excavation data (Lebow et al. 1991:Appendix II.C.7; Price et al. 1993:Chapter 5) showed that the easily recorded data reflected a remarkable degree of variability among the sample assemblages, suggesting substantial analytical potential, even though small sample sizes and other data collection factors, such as variable mesh sizes, as well as the preliminary goals of the work, limited the analytical results to inconclusive generalizations. One important weakness of this approach, in contrast to the final technological analysis conducted for the PEP, is that the data categories were not selected on the basis of theoretical considerations, but rather for pragmatic reasons. Thus, there were no ready-made interpretations into which to fit the analytical results. Nevertheless, continued gathering and analysis of such simple lithic data in the context of theory building to explain variability, coupled with occasional comparison against the results of technological analysis would probably be the least expensive and most productive method to exploit inventory and evaluation data for regional generalizations about land use.

Ground stone tools are critically important to the interpretation of changing forms of land use, because grinding is often considered evidence for the processing of stored roots and seeds. It is not enough, however, to plot the distribution of ground stone tools, because different kinds of ground stone tools may exist, many not related to food processing. For example, careful examination of ground stone tools at the Johnson Site (Pettigrew and Hodges 1995a) showed that the flat-faced grinding stones in the pre-Mazama component there were most likely used for grinding ochre and for other purposes, not for food grinding. Furthermore, the slabs probably used for root grinding in early post-Mazama times (prior to 4,000 B.P.) were much smaller than those used later, suggesting that intensification of roots reached maximum levels only after 4,000 B.P. In Deschutes County and environs also, careful elucidation of ground stone attributes could display patterns much more useful than gross classification of ground stone artifacts alone. A systematized attribute recordation system emphasizing wear traces, devised for the ground stone tools gathered by the PEP (Root et al. 1995:2-50 - 2-56) in Oregon, may serve as a model for Deschutes County collections.

Research Questions

1. Did the expected increase in specialized tools take place? *Data Categories:* Tool classes increase in number and become functionally more limited.

2. Does the distribution of lithic raw material types in Deschutes County strictly match the patterns predicted on the basis of distance from source, or must other factors be taken into account? *Data Categories:* Obsidian sourcing and hydration. GIS plotting of source proportions by time period.

3. Is the position of a site in the land use system reflected in the characteristics of the lithic debitage? *Data Categories:* Debitage raw material, size frequency, cortex category, fragmentation category, and technological coding versus site location, association with key resources, landscape position, assemblage type, site type, distance from source.

4. Are certain kinds of ground stone tools more indicative of plant food processing than others? *Data Categories:* Ground stone tools coded in terms of raw material, size, types of ground surfaces, residues, and other attributes (see Root et al. 1995:2-50 - 2-56) and plotted in terms of temporal period, location, assemblage type, and association with resource areas.

5. Where is the Unknown X obsidian source? *Data Categories:* (1) Unknown X source percentages in obsidian assemblages plotted spatially by GIS to indicate a high probability search area (probably between the Paulina Mountains and Paulina Prairie) where percentages are highest. (2) Sourcing of obsidian from additional sites in the targeted area to further narrow down the search area. (3) Ground search of the more narrowly targeted area to inventory more sites, gather more obsidian samples, and possibly find the source. (4) Repetition of these steps until the source is identified.

6. Was the McKay Butte source actively mined after the Mazama ashfall? *Data Categories:* Spatial and stratigraphic analysis of cultural debris at the source to determine whether materials clearly were deposited above Mazama pumice. Sourcing and hydration measurement of cultural debris at the source to confirm a clear difference between pre- and post-Mazama rind thickness intervals.

7. Can a reduction in the mining of Newberry Volcano obsidian be related to the introduction of the bow-and-arrow and its effects on desired blank size, as proposed by Lebow et al. (1990:159)? *Data Categories:* Correlation of evidence for mining decline with evidence for increasing use of narrow-necked projectile points in areas where Newberry Volcano obsidian was used.

<u>Exchange and External Relations</u>

The possibility that Central Oregon obsidian was traded for foodstuffs, discussed above as a component of an alternative land use strategy, is not out of line with the Oregon ethnographic record. Trade for foodstuffs is recorded for the Rogue River Valley, where the Upland Takelma exchanged deer hides and meat with the Lowland Takelma for salmon (Sapir 1907a:252), and in the Klamath Basin, where the Molalla provided buckskins to the Klamath in return for wokas (pond-lily seeds) and beads (Spier 1930:41). Both cases involved what were probably Strategy II or III societies in economic relationships in which surplus resources were exchanged for highly prized and storable foods. In the case of Deschutes County and surrounding areas, obsidian certainly was exchanged, primarily to the north, for some commodities. Examination of Deschutes County assemblages for exotic trade items may provide clues about what products were imported. The discovery of non-food imports in significant numbers would suggest an alternative trade scenario. The absence of exotics would leave open the possibility or possibly support the idea that roots were imported. The presence of food grinding implements in significant numbers in areas where no suitable food plants associable with grinding are likely to have grown would be further support for the obsidian-for-roots hypothesis.

Research Questions

1. Did use of the Newberry Volcano obsidian source actually decline after 1,000 B.P., as proposed by Connolly (1995)? *Data Categories:* Obsidian hydration measurements of Newberry Volcano obsidian from Late Archaic contexts outside Newberry Caldera. Frequencies of Late Archaic sites before and after 1,000 B.P.

2. Did the people of the upper Deschutes River drainage after 4,000 B.P. systematically trade obsidian bifaces from the Newberry Volcano source with the people of the hamlets and villages of the middle Deschutes River drainage in exchange for stored roots? *Data Categories:* Significant numbers of non-food exotic trade items from the north lacking in upper Deschutes River sites. Significant numbers of food grinding stones at a great distance from root grounds. Remains of edible roots among paleobotanical remains in cultural deposits where native roots are not found. Obsidian sourcing of bifaces found in biface caches.

Ideology

Ideology is a difficult subject to address with archaeological data. We will never know the ideological structures of long-past peoples beyond the grossest categorization. Nevertheless, certain kinds of archaeological data exist that have close connections with prehistoric ideologies. In particular, artistic expressions such as rock art are ideological expressions, even though their meanings may remain speculative. Rock art is likely to have a connection to land use by virtue of the choices made to position motifs on the landscape. For example, petroglyphs on the east shore of Lake Abert in southeastern Oregon tend to be located at habitation sites. It seems possible that rock art at places such Pictograph Cave, a Deschutes County lava tube cave with lithic debris scattered about, may signify an economic as well as possibly a ritual significance to the site. Other rock art sites on the Deschutes National Forest southwest of Bend (Paul Claeyssens, personal communication 1996) may mark important resource zones on the east flank of the Cascade Range. Unless cultural debris is in association with rock art sites, their interpretation in connection with land use will require systematic landscape analysis.

Research Questions

1. Do patterns exist in the distribution and motifs of rock art that may offer clues as to its original meaning or at least its archaeological interpretive value? *Data Categories:* Rock art

motif types and their associations with landscape features, resource areas, site and assemblage types, and other motif types.

2. Do rock art motifs bear any relation to motifs known to have significance to modern Native American people? *Data Categories:* Rock art panels as interpreted by traditional Native Americans.

3. Do prehistoric rock cairns exist in Central Oregon? If so, can their types and distribution be interpreted to signify ritual activity? *Data Categories:* Inventory of cairn sites and GIS analysis of their distribution. Distributional patterns matched against ethnographic and other archaeological analogues and the interpretations of Native American informants.

Culture History

Many archaeologists working in Central Oregon have framed their questions largely in terms of culture history, which relates largely to prehistoric events and peoples rather than processes. From a land use perspective, such "what" questions are of value to the extent that they potentially inform on the "how" and "why" of prehistory. For example, the ethnographic Northern Paiute of Central Oregon are widely regarded archaeologically as very recent arrivals in the area (Bettinger and Baumhoff 1982; Sutton 1993). However, even more important from a theoretical perspective than the phenomenon of the Numic expansion in the Desert West are the causes of such a migration and the means by which one cultural group may supplant another (cf. Bettinger and Baumhoff 1982, 1983; Simms 1983). Seen in this way, the issue is integral to the theory of land use, because it suggests that one group possessed a land use strategy that ultimately was more successful than that of the displaced group. Thus, not only the timing of the migration but the settlement and subsistence systems of the native and immigrant groups are important objects of study. In Central Oregon, little study of this topic has been attempted. For any progress to be made, it will be necessary to show some kind of discontinuity in the archaeological record within the past 1,000 or less years in the form of site distributions, assemblage patterning, stylistic modes, or distinctive artifact introductions or disappearances. Although some might associate small side-notched projectile points with the Northern Paiute, such points have a much wider distribution than that association could explain. If Northern Paiute sites can be identified, the next step would be to describe their distribution and explain that patterning in terms of land use strategy, ideally as distinct from the strategy of the earlier population.

Research Questions

1. What indicators of the Numic arrival can be found in the archaeological record? *Data Categories:* Discontinuity within the last 1,000 years in site distributions, assemblage types, or stylistic modes of projectile points or other artistic expressions. Introduction of new artifact types or disappearance of older types. Change in house features from pithouses to wickiups.

2. What parts of the archaeological record can be confidently associated with the contact-period native population? *Data Categories:* Recorded wikiup structures. Archaeological sites at

locations where ethnographic or historical records locate aboriginal settlements. Very thin obsidian hydration rinds (1.0 μm or less). Very young radiocarbon dates (200 years or less). Cultural deposits associated with historic trade goods.

Chronology

Chronology, much like the next two topics discussed below, is a critically important procedural and background issue, but is more closely related to the means than to the ends of the archaeological enterprise. Thomas (1989:142) regards chronology as the first step in the archaeological study of any region, because the temporal framework must be in place before a sequence of cultural changes, and the processual explanations these require, can be described. Fortunately for Central Oregon archaeologists, the chronometric advances made by the PEP have been nothing short of revolutionary. These contributions include a huge database of obsidian hydration measurements (Skinner 1995b) and a set of proposed hydration rates (Pettigrew and Hodges 1995b:2-15), a very substantial new sample of radiometric dates (Skinner 1995c), a large and systematically described sample of projectile points (Pettigrew, Barnes, et al. 1995) in association with a new projectile point typology (Pettigrew, Hildebrandt, and Mikkelsen 1995), and many new stratigraphic descriptions that collectively provide new insights into geomorphic processes and stratigraphic relationships (e.g., Atwell, Bailey, et al. 1995).

The new obsidian data in particular open up new avenues for research in Central Oregon, one of the world's great centers of archaeological obsidian. It is now possible to date sites with some confidence using obsidian alone, thus greatly reducing the cost of chronometric data and expanding the proportion of datable sites from a small fraction to nearly 100 percent. This new potential allows us to conceive of projects to explore land use patterning over vast areas without much expensive manual excavation or radiocarbon dating. It also expands the utility and significance of the numerous lithic sites that yield neither cultural charcoal nor projectile points, because these can now be placed into a temporal framework with some confidence.

Some effort was made by the PEP to adopt a projectile point classification system that could serve the needs of inter-regional comparison as well as intra-regional analysis. The result was a binomial classification system (with two type codes separated by a hyphen, e.g., "NDB-PCN") in which each point was classified in terms of two distinct typologies. The first type code of the binomial pair belongs to a Project-wide morphological typology designed to classify all PEP points, from Idaho to California (Moratto et al. 1991:Appendix I.D; Moratto et al. 1993:Appendix I.B). This typology is descriptive only, not based on systematic analysis, and was designed to allow inter-regional comparison. The second type code referred to a regionally specific typology. In the case of the Oregon data, the regional typology (Pettigrew, Hildebrandt, and Mikkelsen 1995) used to classify specimens from north-central and central Oregon for the final PEP report was based on analysis of 591 points collected from sites in Umatilla, Morrow, Gilliam, Sherman, Wasco, Jefferson, and Crook counties, because this group represented a distinct geographic cluster of specimens. At the same time, a smaller number of points from Deschutes and Klamath counties were examined, albeit less rigorously, and found to have much in common with the north-central Oregon collection. It was concluded that the north-central Oregon typology could be appropriately applied on a provisional basis to Deschutes and Klamath county collections.

Systematic analysis of the north-central Oregon PEP projectile point typology using PEP data to test the temporal specificity of the types involved the use of hydration rim measurements, and showed generally positive results, but sample sizes limited temporal resolution (Pettigrew and Hodges 1995b:2-17 - 2-21). Although much more study of point type chronology clearly is needed, literature comparisons strongly support the temporal sensitivity of the typology. A program to encode Central Oregon projectile points using this typology could yield valuable benefits by permitting tests of chronological sensitivity and ultimately improving the chronological diagnosticity of points.

Research Questions

1. Can chemical variability within the McKay Butte source be documented to explain the apparent variability in associated hydration rates? *Data Categories:* Chemical and trace element analysis of samples from the McKay Butte source in concert with similar analyses of archaeological specimens with apparently different rates. Water content is a possible skewing factor.

2. How far can the hydrations rates proposed for the PEP be applied within Deschutes County? *Data Categories:* Obsidian samples in association with independent objective temporal markers (e.g., known ashfall pumice, radiocarbon dates) and compared with expected ages based on the proposed rates. Modern temperature data in association with climatic proxy data such as elevation and vegetation zones as predictors of hydration rates. Hydration rates compared between densely vegetated and open areas and between pumice and non-pumice soils (which may have different temperature characteristics). Sub-Mazama Obsidian Cliffs obsidian as a control to test the proposed rates (since the Newberry Volcano source, which hydrates similarly, is only post-Mazama).

3. Can the projectile point typology developed by the PEP on the basis of analyses of points found north of Deschutes County be used confidently to classify and estimate the ages of points from Deschutes County? *Data Categories:* Deschutes County projectile points encoded per the north-central Oregon system and compared with other temporal indicators, including hydration rind thickness. Analysis of Deschutes County points alone in the same manner as the PEP analyses to determine whether the resulting patterns match those found in the northern sample.

4. Can it be confirmed that the bow-and-arrow appeared in Deschutes County between 2,500 and 2,000 B.P.? *Data Categories:* Narrow-necked projectile points associated with hydration rind measurements and radiometric dates.

Paleoenvironment

Although the paleoenvironment is a contextual issue and not the ultimate target of archaeological study, it has a special role to play in land use research. The intensification process is thought to be spurred by population pressure, which is an imbalance or stress in the relationship between the human population and the carrying capacity of the environment.

Population pressure can be caused by a human population growing to the limits of the carrying capacity or by environmental change that reduces carrying capacity below that needed by the existing population. This relationship is usually implicit in hypotheses arguing for cultural change brought about by environmental decline (e.g., Aikens and Jenkins 1994:14).

Some environmental changes in Central Oregon are widely accepted. These include the warming and drying trend of the earliest Holocene (Pettigrew and Hodges 1995b:2-57), and the effects, at least in upper Deschutes River drainage, of the Mazama ashfall of 7,000 B.P. Less clear is the cause, whether environmental or by some other factor, of the apparent occupational gap north of Bend between 4,400 and 3,900 B.P. Unfortunately, the existing paleoclimatological record for Central Oregon is very poorly documented, so that comparisons must be made to published paleoclimatic sequences based on data from fairly distant localities (Pettigrew and Hodges 1995b:2-57 - 2-65). A new source of ideas to consider is the paleoclimatological modeling of Bryson and Bryson (1996), which suggests that the middle and upper Deschutes River drainages had distinctly different Holocene climatic trends. Ultimately, confirmation of this modeling is needed from local data sources, such as new pollen cores from lakes on the eastern slope of the Cascade Range, from Newberry Caldera, or from lowland lakes or marshes yet to be identified (such as in the LaPine Basin). Systematic identification of wood charcoal from archaeological sites also would contribute usefully to this effort, as would stratigraphic studies in the LaPine Basin designed to determine the extent of pre-Mazama lakes and marshes, and study of packrat middens in lava tube caves.

Also very valuable would be studies of important food plants such as lomatium to determine how their productivity varies under changing temperature and precipitation regimes, and similar studies pertaining to other key resources such as deer and sheep herds and important fish species. This information would allow evaluation of the probable effects of climatic change on carrying capacity.

Research Questions:

1. Did the upper Deschutes River drainage experience an early Holocene climate that was warmer and drier than modern conditions? *Data Categories:* Pollen cores from lakes and marshes. Paleobotanical remains (including wood charcoal) from Early Archaic cultural deposits. Stratigraphic data from the margins of lakes and marshes whose levels are sensitive to climatic patterns. Packrat middens in lava tube caves.

2. What biotic changes took place as a result of the Mazama ashfall and what were their extent? *Data Categories:* Pollen cores from marshes and lakes. Stratigraphic records documenting lakes and marshes buried under Mazama pumice. Wood charcoal, pollen, and other botanical remains from at least relatively datable contexts above and below Mazama pumice at a variety of locations.

3. How sensitive are lomatium and other plants with edible roots to the kinds of temperature and precipitation variation that might have occurred during the Holocene? *Data Categories:* Botanical surveys to sample and measure the productivity and densities of targeted plants found

in distinct climatic and microclimatic zones, and in the same zones during climatically distinctive years.

4. How do populations of deer, bighorn sheep, and economically valuable fish species respond to climatic changes of kinds that might have occurred during the Holocene. *Data Categories:* Literature searches to extract existing information on the topic. New studies of species productivity under varying climatic regimes. Archaeological faunal remains as indicators of prehistoric animal population levels.

Site Formation Processes

Each excavated site reported in the PEP final report (Atwell, Bailey, et al. 1995) was subjected to careful geomorphological study and yielded important data on site formation processes. Consideration of such processes is key to interpreting the archaeological record. Central Oregon presents some special problems in this area which require continuing study. Prominent among these is the stratigraphic confusion sometimes caused by Mazama pumice, which is present as a primary deposit in some places, is redeposited elsewhere, and in some places can be found in both conditions, stratigraphically superimposed. Distinguishing between primary and secondary pumice deposits can be difficult, and requires careful examination of profiles and samples. A related issue is the distinction of cultural deposits shallowly buried in redeposited ash (Pettigrew and Spear 1984:27) from those that have "filtered down" from the surface (Minor et al. 1988). This matter deserves study, not only to help explain patterns of buried cultural debris, but to provide a better context within which to interpret widespread surficial patterns of cultural debris that may or may not have originated from below the surface.

Research Questions

1. How do the thickness and consistence of Mazama pumice vary in Deschutes County? *Data Categories:* Literature review to summarize existing information. Systematic recordation of stratigraphic profiles to document spatial variation in pumice characteristics. GIS plotting of pumice thickness and consistence.

2. What is the spatial distribution of the distinctive sub-Mazama paleosol? *Data Categories:* As above, but for the paleosol as distinct from the overlying pumice.

3. What other pumice layers exist in the region and what are their characteristics and distributions? *Data Categories:* As in number 1 above, but for non-Mazama pumice types.

4. Where should sub-Mazama cultural debris tend to be expressed on the surface and where should it not? *Data Categories:* Distribution of the sub-Mazama paleosol (cultural debris may be associated with the paleosol) in concert with thickness data on Mazama pumice (the greater the thickness, the less likely sub-Mazama debris will work its way to the surface).

Key Data for Inventory and Evaluation of Prehistoric Cultural Resources

With a research orientation established and some priorities set forth for addressing important topical areas, there remains the very pragmatic task of organizing the kinds of data that will further the research goals. Data categories thought essential for project-specific research were listed for both the evaluation (Moratto et al. 1991:2.19-2.21) and data recovery phases (Schalk and Atwell 1994:5-40 - 5-42) of the PEP, and the preceding discussions have made some specific recommendations for data collection. The purpose of this section is to organize these and other data gathering recommendations to enhance the practical guidance that a research design should provide.

In an archaeological management program, archaeological data are acquired in three main research phases, the inventory or survey phase (Phase I), the evaluation or testing phase (Phase II), and the data recovery phase (Phase III). Methods and purposes for data collection differ from one phase to the next, as do the potentials for data analysis. In general, earlier phases tend to be much less expensive, acquire simpler forms of data, are limited to more elementary analytical techniques, and generate less confident conclusions about prehistoric human behavior. At the same time, later phases are much more expensive, less commonly performed, involve much smaller samples of sites, and generate conclusions about human behavior that are more dependable but less areally representative. Because archaeology seeks to know more about past human behavior, which is most clearly reflected in the detailed patterning observable within individual sites, most archaeological literature describes and interprets Phase III data.

Inventory and evaluation data do, however, have the potential, because of their larger samples of sites and greater areal representativeness, to yield uniquely clear and robust information about prehistoric land use, the central theme of this research design. Ironically, land managing agencies tend to gather large volumes of Phase I and Phase II data that go largely unanalyzed, but do little Phase III work because of its expense. To the extent that data acquisition and analysis for the earlier phases can be improved, then, more valuable results will accrue from the efforts of land managing agencies. For these reasons, and because much has already been written elsewhere about the data and analytic potentials of Phase III projects, the emphasis in this section will be on data from Phases I and II.

Both the Deschutes National Forest and the BLM Prineville District have a long history of survey and evaluation of prehistoric sites, and have established procedures for acquiring data, and together with Deschutes County have compiled a Heritage Database to accumulate, organize, and analyze acquired data. In addition, the State Historic Preservation Office has standards in place for Phase I and Phase II projects. To prepare an exhaustive list of data to gather would serve no useful purpose here. Instead, discussion will emphasize those data categories particularly conducive to the analysis of prehistoric land use.

From this standpoint, the most important data are those whose analysis will lead to an improved understanding of past land use. The best data for this purpose are those that are (1) easily and inexpensively gathered, (2) highly standardized, (3) unlikely to be subject to significant recordation error, and (4) readily analyzed using straightforward methods to yield clearly useful and understandable results. Standardization is critical, because unstandardized data are by nature noncomparable and therefore useless for analysis. Recordation error also is an important concern, especially at the inventory level, because data variability caused by inconsistent recordation may not be identified until after significant resources have been spent on analysis that may have generated what were mistakenly thought to be meaningful patterns. Such error is more likely for more complex data categories, which require more highly trained personnel for proper recordation. For similar reason, analytical methods should be chosen that can be widely conducted and understood. Both the data and the analytical results are intended to be cumulative, so that databases become more valuable as they grow, not harder to make sense of.

At the inventory level, cultural resources are identified and recorded for the first time. For many locations, this phase represents the only visit the site will receive, so it is important to acquire key data correctly and accurately. For land use study, characteristics of the **site description and setting** are very important. Particularly important are site type, location, landform position, size, cultural features, and the nature and potential depth of sediments. Survey personnel should be briefed on the geomorphic setting of the area prior to a walkover, so that contextual data are properly recorded.

An alternative to the standard site location survey is the so-called "siteless survey", in which a record is made of all traces of human use, whether considered part of a site or not. Recent examples in Oregon include two surveys in the Trout Creek-Oregon Canyon Uplands in southeastern Oregon (Lebow and Pettigrew 1989; Pettigrew and Lebow 1989) and the survey of the Redmond Training Area (Lyman et al. 1983). Surveys of this kind yield distributional data that may be optimum for land use study, because they display distributional patterns relatively unaffected by the judgments of individual surveyors.

The diachronic perspective is essential if inventory data are to be used to evidence land use changes, so **chronological data** must be gathered wherever possible. Within the limits of on-site recordation, classification of projectile points is the only practical option here. For this, personnel must be sufficiently trained to recognize important distinctions between temporal types (see the discussion above regarding the PEP point typology). They also should have calipers or other devices to measure projectile point neck widths, which are temporally sensitive and quickly measurable. A video camera with a macro lens is a very quick and inexpensive means to record images of projectile points and other tools for later description and analysis.

By far, however, the most consistently useful chronological data in Central Oregon are obsidian hydration measurements associated with x-ray fluorescence source identifications. Some surface collection of obsidian artifacts is needed to employ this method at the inventory phase. To generate statistical confidence in hydration thickness distributions, for each site or distinct spatial cluster at least 20 artifacts should be randomly collected, then sourced and measured. Smaller samples can be used, but at the expense of the confidence possible in temporal estimates.

The most numerous artifacts on sites normally are **debitage**, whose attributes are valuable in assessing site function and settlement patterns. As discussed above, technological flake types would be ideal if such data could be collected confidently, but this is probably beyond the reach of most survey personnel. Simpler attributes, however, can be recorded consistently with limited effort. Whenever possible, these should include raw material, size categories, cortex categories, and fragmentation categories. For all but the smallest sites, sampling protocols should be worked out to optimize the representativeness of the sample data.

Part of site recordation normally is the description of **lithic tool classes**, at least in terms of tool classes and counts, unless the site is so large that a strict count is not possible. If possible, additional tool data should be recorded, especially tool raw materials, biface stage (requiring a small amount of training of survey personnel), and fragmentation data. For **ground stone tools** it is not enough to simply count tools as a single group and record raw materials, because many kinds of ground stone tools have nothing to do with food processing. In addition, tool class, size, wear patterns, and fragmentation should be recorded (see the discussion above regarding the PEP ground stone classification system).

Some kinds of data useful at the inventory level need not be recorded by field personnel, but can be taken into account at the analytical level. For example, the PEP made substantial use of **assemblage types** (see Pettigrew and Hodges 1995b:2-1) rather than site types in analyzing distributional data. These assemblage types were based on the presence or absence of certain kinds of lithic tools. A measure of this kind is more useful in land use analysis than site types based on a variety of cross-cutting attributes. For example, open sites and rockshelters are different site types, but may have been used for exactly the same purpose prehistorically and contain precisely the same kinds of tool assemblages. Assemblage types can be encoded after field data are acquired.

Environmental data based on what is already known about the region can also be brought into play during analysis, whether or not they are recorded on site forms. These variables, particularly the locations and densities of key food resources, should be actively sought and accumulated for analysis of prehistoric land use. Of particular value for Central Oregon would be data on plants with edible roots and seeds, berries, deer, sheep, elk, fish, and waterfowl. Correlations between sites and resource areas are excellent bases for inferences about land use. This kind of analysis is very well suited to the capabilities of Geographic Information Systems (GIS).

Site evaluation, or Phase II, is normally carried out through test excavation designed to determine if the site is significant (eligible for the NRHP) and often to find out if a proposed project will affect the site's significant qualities. Test excavations can be designed also to optimize data acquisition to enhance the regional database for the potential analysis of land use. The data gathered should include those discussed above for inventory projects, but much larger samples of cultural debris, including lithic artifacts, charcoal, faunal remains, botanical remains, and sediment samples are usually collected for later analysis, and stratigraphic data are gathered that may be subject to geoarchaeological study. Recorded site size normally becomes larger after subsurface probing, so regional analyses involving site size should distinguish tested from simply inventoried sites. Tested sites provide opportunities for radiometric dating to test and complement age estimates made through obsidian hydration and projectile point cross-dating. Lithic artifacts can be encoded in ways to allow more complex analyses, such as that of technological flake types for debitage to compare with the cortex, size, and fragmentation data gathered at the inventory phase. More careful examination of ground stone tools, including residue analyses, can permit better evaluation of the potential for their use as food processing tools. Faunal and archaeobotanical data are even more direct evidence for land use, representing selective prehistoric sampling of the local animal population and offering clues to changes in niche width and resource diversity. Results of these analyses, if possible, should be added to the regional database accessible to GIS analysis.

Continuing systematic study of the database of accumulating data from inventory and evaluation projects, in cooperation with others from outside the agencies, should be undertaken to explore their land use implications as outlined in this research design. Results from such study will realize the potential that these data provide, facilitate continuing improvements in data acquisition and analytical methods, permit incremental refinement of management policies, procedures, and tools, and simplify the task of evaluating sites by NRHP criteria.

SITE DISTRIBUTION PATTERNS

To date Deschutes County has 1425 documented prehistoric sites scattered throughout BLM, USFS, State, County and private lands. Most of these sites are located along major water ways and/or are adjacent to the numerous lakes found throughout the County (See Fig 6). Within the Central Oregon Region however, 3411 prehistoric sites have been inventoried on all of the Deschutes National Forest and the Prineville BLM district lands combined.

Out of all sites located within Deschutes County boundaries only 1 site has been listed on the National Register of Historic Places (NRHP). The potential to yield additional information and NRHP listing is obvious with an additional 197 sites already determined eligible, and 1205 sites still unevaluated. Only 22 prehistoric sites have been determined not to be eligible. Archaeologists with the USFS and BLM are struggling due to budgetary and time constraints to improve hard data on these sites. Only 60 of those 1205 sites have had a formal analysis completed (this may include carbon 14 dating, obsidian sourcing, or macroforal testing). Only 3 sites have a verified cultural period date.

Almost all prehistoric sites in Deschutes County have a lithic component to them, 1325 sites. Note that this number includes sites with a lithic component in either site type 1 or 2 in the data base. These sites are widely scattered throughout the County but tend to concentrate on waterways and radius around known quarries (see Fig 8 for distribution of lithics).

There are 44 known rockshelters in Deschutes County, 1 rock alignment, 5 rock carins, 1 area of peeled trees and 2 sites with shell middens. Quarries of obsidian (21) are high in numbers due the volcanic activity in the region. Six basalt quarries can also be found. Eleven rock art sites can be found in the form of 9 pictographs, and 2 petroglyphs (See Fig. 7).

It is important for the reader to keep in mind the notion that relatively little of the Deschutes County has actually been surveyed. The results of the distribution map may merely be the results of where surveys have been completed. Sites surveyed by USFS, BLM and the County have typically concentrated along river banks, lakeshores and flat open spaces.

PREDICTIVE MODEL FOR PREHISTORIC SITES

The purpose of this analysis was to propose and test some environmental factors which may be useful in predicting prehistoric site locations (i.e. "high probability areas"). Elevation, slope, aspect, and distance to the closest source of water were the environmental factors selected for this initial round of analysis. The general assumption was that most prehistoric sites could be found at: a moderate elevation of 3500 to 5000 feet, on low slopes of a 0-15% grade, within a half a mile of water and on a southern aspect. These factors were chosen because they have been used as

Deschutes County Cultural Resources
All Prehistoric Sites

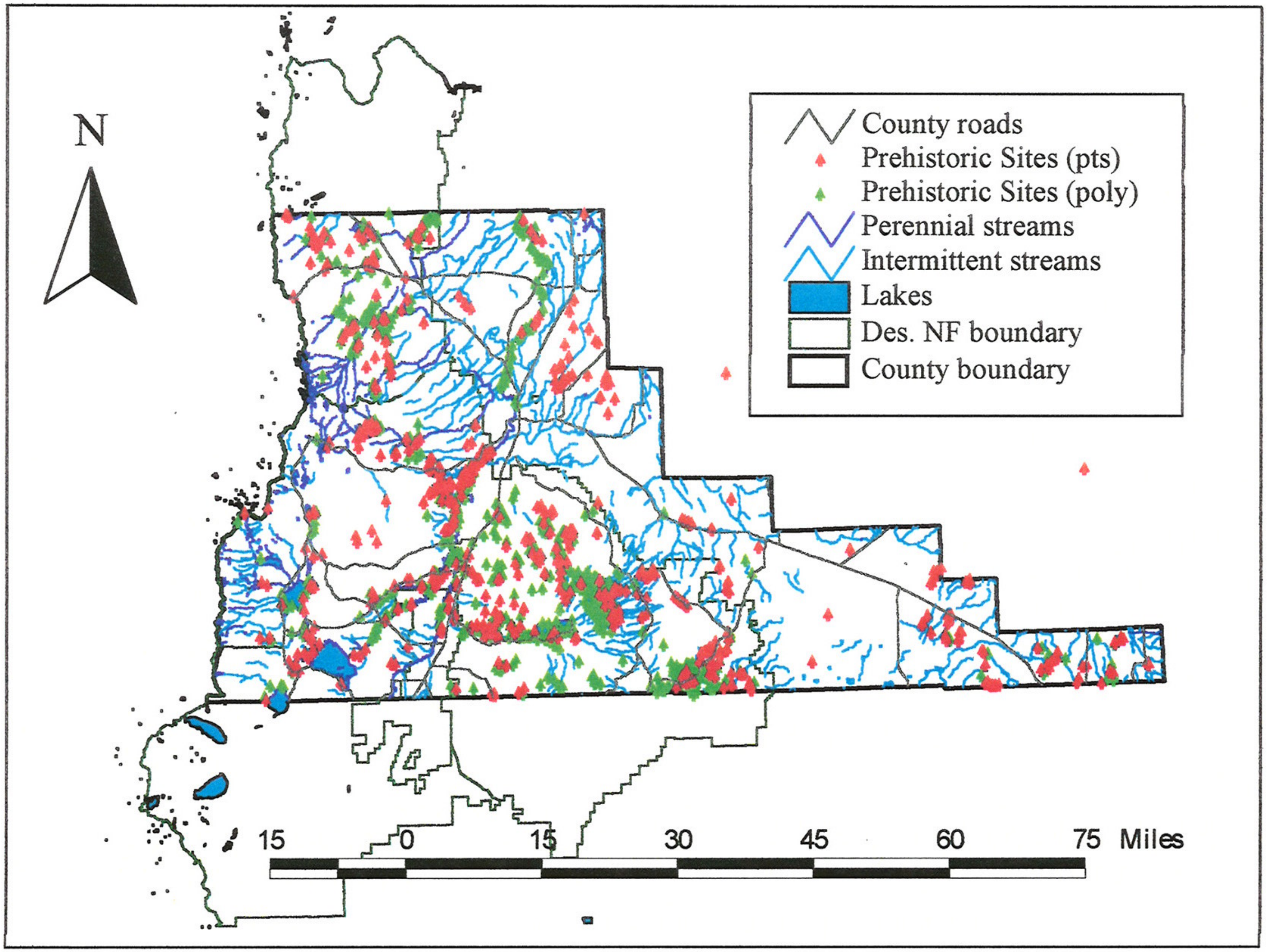


Fig. 6 All known prehistoric sites in Deschutes County as of 5/31/96.
Sites (poly) are archaeological sites with an areal extent of equal to or greater than 2 acres.
Sites (pts) are archaeological sites with an areal extent of less than 2 acres.

Deschutes County Cultural Resources
Rock art, rock features, rockshelters, and quarries

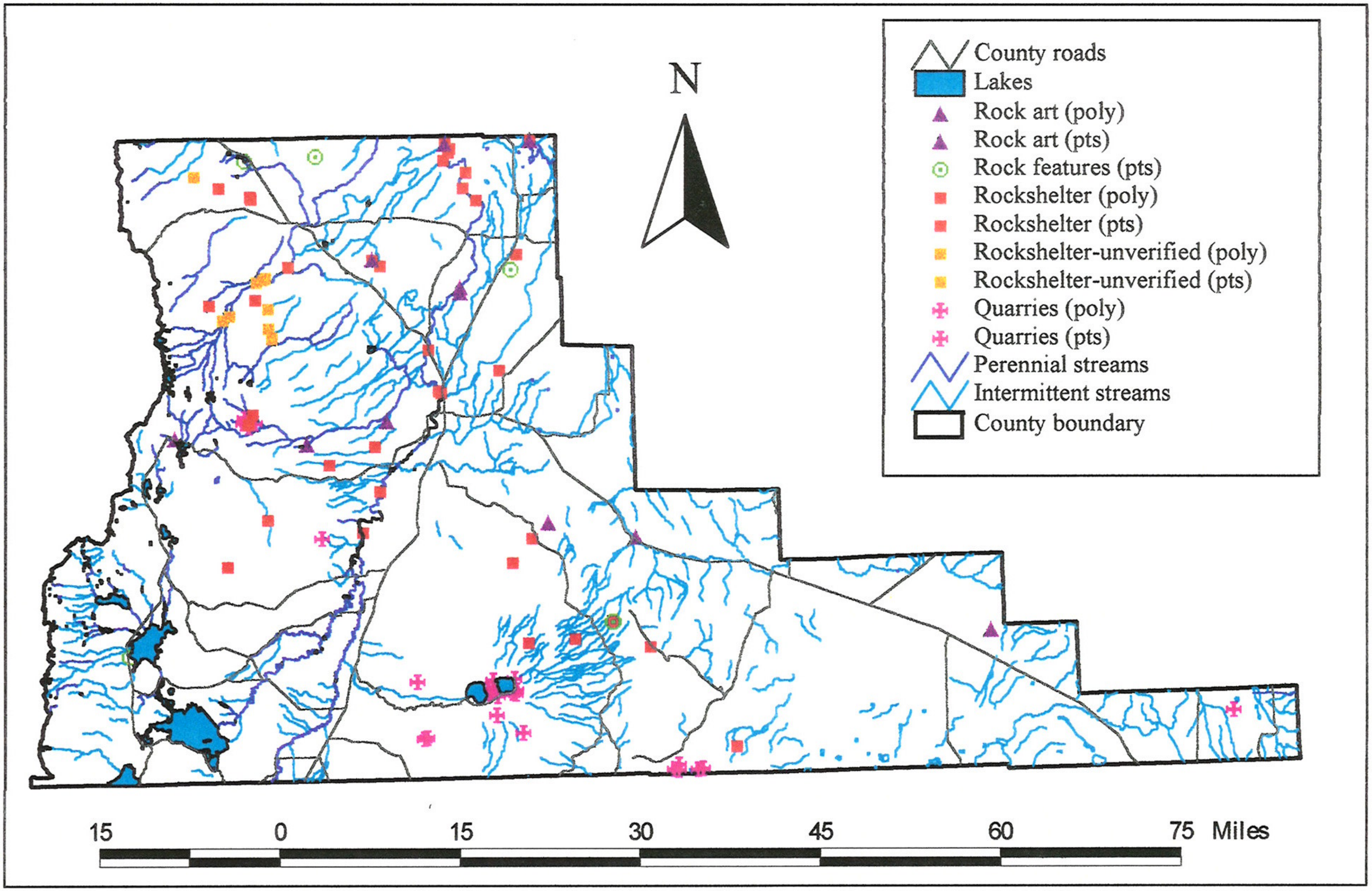


Fig. 7 All known prehistoric rock art, rock features, rockshelters, and quarry sites in Deschutes County as of 5/31/96.
Sites (poly) are archaeological sites with an areal extent of equal to or greater than 2 acres.
Sites (pts) are archaeological sites with an areal extent of less than 2 acres.

Deschutes County Cultural Resources
Sites with a Lithic component

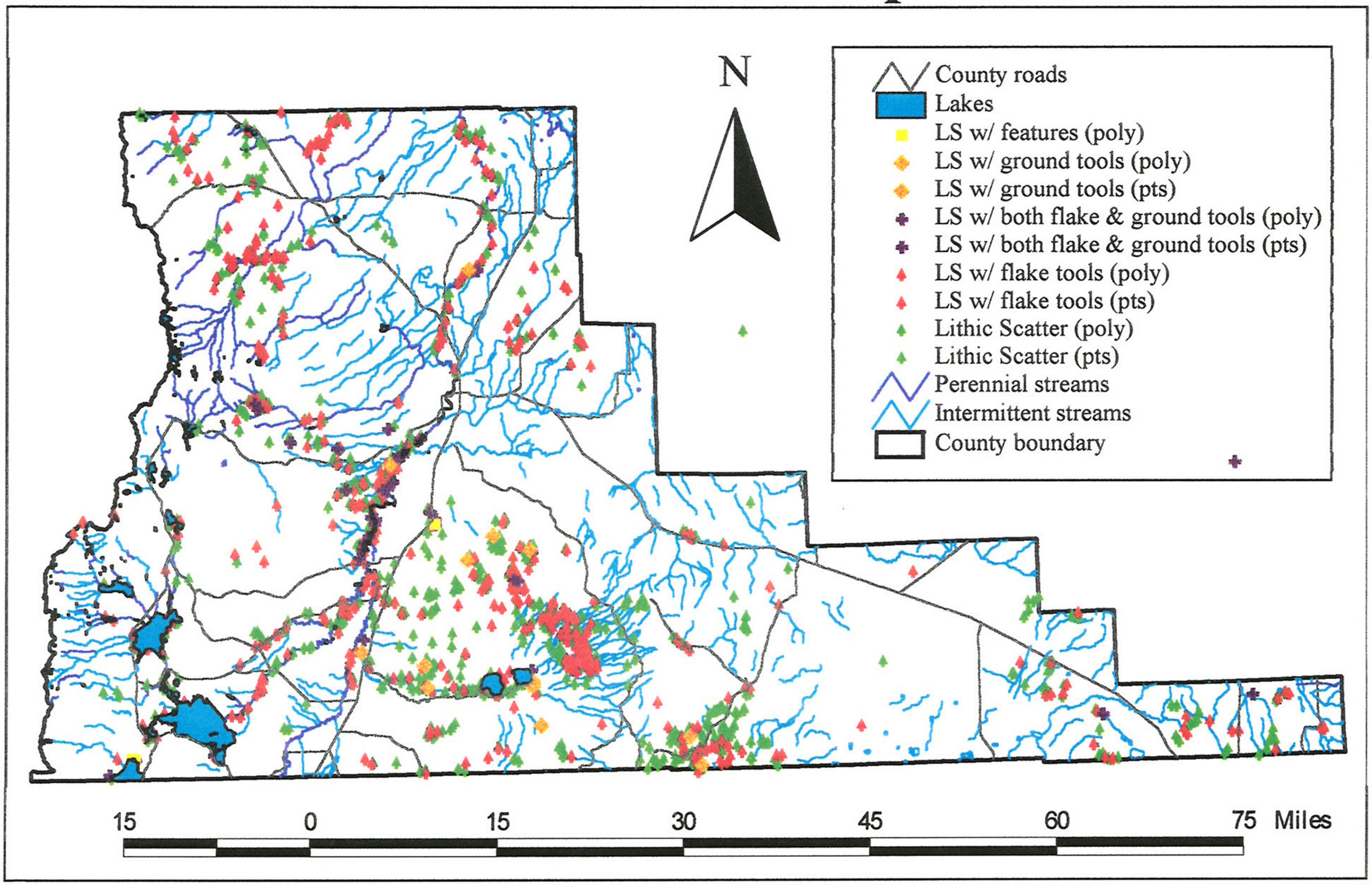


Fig. 8 All known prehistoric lithic sites in Deschutes County as of 5/31/96.
Sites (poly) are archaeological sites with an areal extent of equal to or greater than 2 acres.
Sites (pts) are archaeological sites with an areal extent of less than 2 acres.

predictors on an intuitive basis for years by archaeologists and the values for these factors could be generated relatively easily by GIS. To test these factors for suitability for site prediction the Deschutes National Forest analyzed the range of values for those environmental factors for all *known* prehistoric sites on the Deschutes National Forest and then looked for trends in the data (peak frequencies). In addition they compared the percent of occurrences for each factor against the general amount of acres which fall into the same "category." For a factor to be useful in predicting site location, the percent of sites which fall into a certain category must be significantly higher than the relative percent of acres (or acres surveyed) for the same category.

It is important to note that a vast majority of known sites have been located during cultural resource inventories, few of which used a statistically valid forest-wide sampling strategy. Therefore known site locations are most likely biased- first toward areas of merchantable timber or surveyed areas and secondly towards areas with mild slopes and relatively near to water (our intuitive "high probability" areas).

The analyzing of the data was accomplished using a Microsoft Access data base and GIS. All prehistoric sites were first categorized by site type (Site Type is a descriptor of the "kind" of site, or a brief categorization of the artifacts found at a certain location, and is tracked in the database). Correlation's were determined solely on the basis of frequencies, or the relative numbers of each site type that occurred within the specified environmental factor. Note that these frequencies were analyzed on the Deschutes National Forest as a whole, without regard to internal political boundaries, cultural areas, or other climatic or environmental factors.

The values for the environmental factors were generated by the Deschutes National Forest GIS group. Elevation was generalized to 500' bands, slope was generalized into three categories (0-15%, 16-30%, and greater than 30%), and aspect was generalized into five categories (north, east, south, west, and flat) with the cardinal directions falling in the center of each category (for example, "north" in this analysis covers 325-45 degrees on a compass). The values for distance to water were generated for .5 mile and .25 mile distances (values were either "in" or "out").

The following tables and pie charts show, where possible, the raw data (in tabular form), allowing each reader the opportunity to draw their own conclusions.

It is important for the reader to be aware of the following factors. Prehistoric sites are stored in GIS as point, line, or polygon type features. GIS generation of the values for sites designated as *point type features* in GIS yielded, in the vast majority of cases, a single value for each factor (elevation, slope, aspect, distance to water). This was not the case for prehistoric sites which have been entered into GIS as polygons (*polygonal data*). Due to the method which the GIS software performs polygon-on-polygon overlays to generate values for the environmental factors, a single polygon site had numerous values for each factor. In other words, a single polygonal heritage site could have from 1 to over 200 values for each factor (elevation, slope, aspect, and the two distances to water).

Because the predictive analysis was based on frequencies, or a simple count of sites, by site type, which fall into each of the environmental factors, the multiple values posed a significant problem. It was decided that, for each polygonal prehistoric site, the multiple values had to be reduced to a single value for each environmental factor which best represented the site as a whole. The following are the rules which were applied to guide this reduction:

- final values for each environmental factor were determined by the maximum acreage for that factor (for example, aspect was determined by summing the acreage's for each north, east, south, west, and flat- the single aspect with the most acres was then assigned to the site as a whole), and
- if any portion of a site had a value of IN (was within the specified distance to water), then the site as a whole was assigned a value of IN.

Slope and aspect, as collected in the field, are a generalization of a prehistoric site location. Field collectors assigned a single value to each prehistoric site which best represents the location's overall slope and aspect, and may include factors which GIS cannot calculate, such as a "landscape perspective." It is possible that field collected values may be more appropriate for this type of analysis.

The values generated by GIS for each environmental factor for a single prehistoric site varied differently and are listed below in order of increasing variability:

1. distance to water (was usually uniform for a single site; estimate 90% uniformity)
2. elevation (often uniform for a single site; some variation; estimate 75% uniformity)
3. slope (usually had some variation, but usually had a clear "acreage leader"; estimate 40% uniformity), and
4. aspect (varied greatly, and often acreage's were <u>very</u> close between two values; estimate 5% uniformity).

Uniformity in this case means that, for a single site, all values generated by GIS for the specific environmental factor were the same.

Confidence in the results of the analysis of polygonal data is much lower than that for the point data due to the need to generalize the large amount of raw data into a single value for each site, and due to the relative high proportion of extremely close values (sometimes acres varied only by thousandths of an acre) from which determinations were made.

In conclusion, there were a number of discrepancies between prehistoric sites in the database and prehistoric sites in GIS. At the end of the following analysis is a list of sites, by site type, for the point and polygon coverage both in GIS, and the database. This list identifies the discrepancies in numbers. The discrepancies are errors in our data. The following is the data compiled by Jimae Haynes on all Deschutes National Forest sites (arbitrary of Deschutes County boundaries).

Rockshelters (Code 01)

<u>Note following list leaves out all unverified rockshelters (code VER in Reminder field).</u>

CR_SITE	REMINDER	SITE_TYPE	SITE_TYPE2	LEVATION	SPECT	LOPE	HFMILE	QTRMILE	LASS
61500044	NON	01	00	500-3000	S	>30	IN	IN	X
61500016	TST	01	00	500-3000	S	0-15	IN	IN	X
61500040	NON	01	00	500-3000	W	0-15	IN	IN	X
61500015	NON	01	00	000-3500	E	0-15		OUT	X
61500083	TST	01	00	000-3500	S	0-15	IN	IN	X
61500007	NON	01	40	000-3500	S	0-15	IN	IN	X
61500170	NON	01	40	500-4000	E	0-15		OUT	X
61500040	NON	01	00	000-4500	E	0-15	IN	IN	P
61100172	NON	01	00	000-4500	E	0-15	IN	IN	X
61100427	NON	01	43	000-4500	S	6-30	IN	IN	X

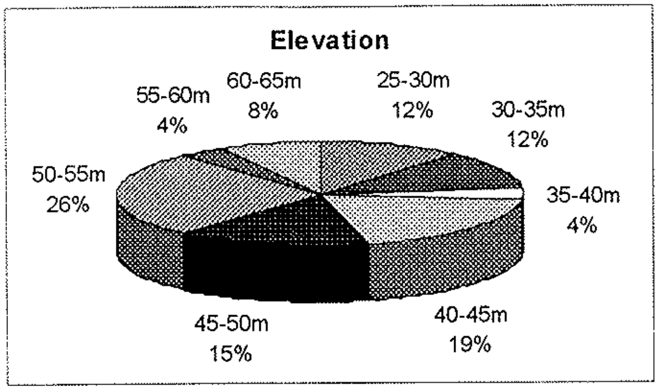
61500047	NON	01	00	4000-4500	S	16-30	IN	IN	X
61300002	NON	43	01	4000-4500	W	0-15	IN	IN	P
61301232	NON	01	00	4500-5000	E	0-15	IN	IN	X
61301289	NON	01	00	4500-5000	F	0-15		OUT	P
61301196	NON	01	40	4500-5000	F	0-15	IN	OUT	X
61300874	SRP	01	00	4500-5000	S	0-15	IN	OUT	X
61100467	NON	01	00	5000-5500	E	0-15		OUT	X
61300839	NON	01	42	5000-5500	E	0-15		OUT	P
61300107	NON	01	40	5000-5500	E	0-15	IN	IN	P
61300803	NON	01	40	5000-5500	E	0-15	IN	IN	X
61100240	NON	01	41	5000-5500	S	0-15	IN	IN	X
61300468	NON	40	01	5000-5500	S	0-15	IN	IN	P
61100108	NON	01	41	5000-5500	S	0-15	IN	IN	X
61300360	NON	01	00	5500-6000	S	0-15	IN	OUT	X
61100506	NON	01	40	6000-6500	S	0-15	IN	IN	X
61100490	NON	40	01	6000-6500	S	0-15	IN	IN	P

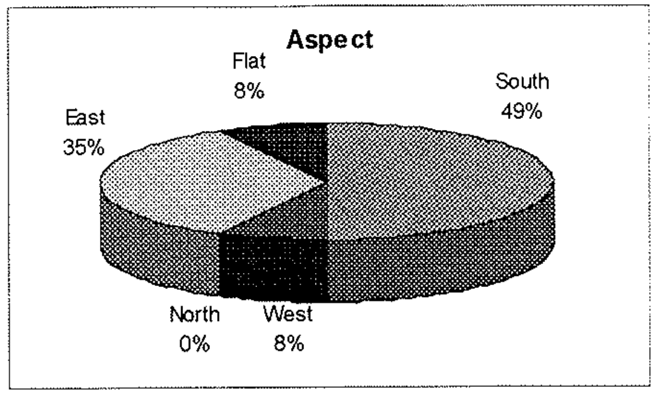
Total number of rockshelters = 26. X in the CLASS column signifies points, P signifies polygons.

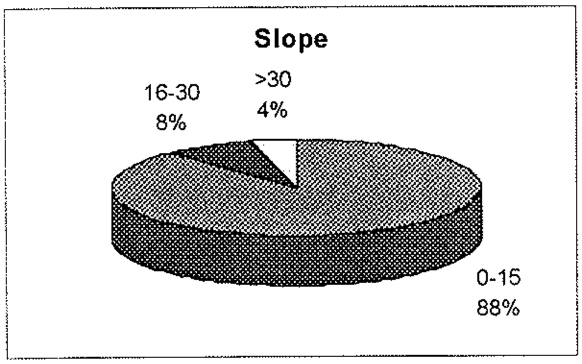
Elevation	**Aspect**	**Slope**	**Dist. to Water (.5 mile)**	**Dist (.25 mile)**
2500-3000 = 3	S = 13	0-15 = 23	w/in .5 miles = 21	w/in .25 miles = 18
3000-3500 = 3	W = 2	16-30 = 2	more than .5 miles = 5	more than .25 miles = 8
3500-4000 = 1	N = 0	>30 = 1		
4000-4500 = 5	E = 9			
4500-5000 = 4	Flat = 2			
5000-5500 = 7				
5500-6000 = 1				
6000-6500 = 2				

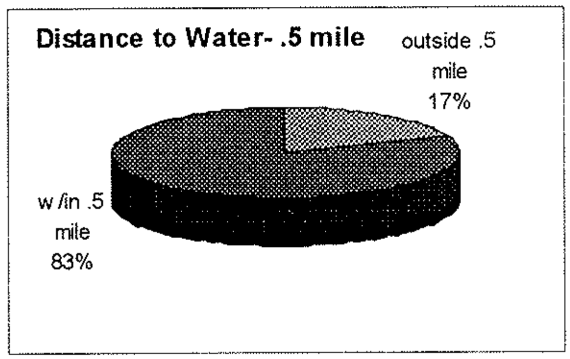
Summary:

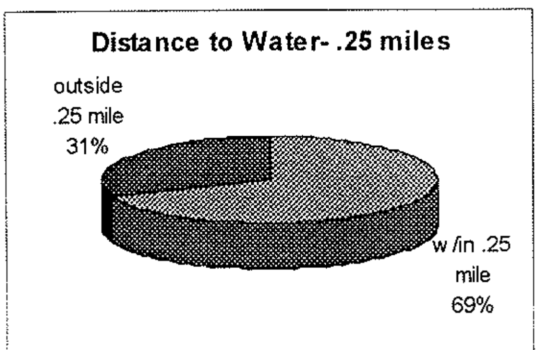
- The frequencies for rockshelters appeared to peak at the 4000-5500 elevation range. Whether this was due solely to sampling bias, environmental factors (existence of caves), or evidence of cultural bias is impossible to tell.
- The aspect of rockshelter is mainly south and secondly east.
- A notable bias for rockshelters are there location on a 0-15% slope.
- Water seemed to be an important factor in the location of rockshelters. 83% of the total number lie within .5 miles of water and 69% of the total lie within .25 miles of water
- An interesting and apparent pattern is that at the lower elevations rockshelters tended to focus in the Sisters Ranger District, in the middle elevations they focused in Ft Rock Ranger District, while at the higher elevations they focused in the Bend Ranger District. No rockshelters in Crescent Ranger District made it into this analysis.
- Rockshelters farther than .25 mile from the nearest water source, were concentrated in the Ft. Rock Ranger District.











Rock Cairns (Code 05)

CR SITE	REMINDER	SITE TYPE	SITE TYPE2	ELEVATION	ASPECT	SLOPE	HFMILE	QTRMILE	CLASS
61500535	NON	05	00	3000-3500	W	0-15	IN	IN	X
61100357	NON	41	05	4000-4500	E	0-15	IN	IN	X
61301235	NON	05	00	4500-5000	E	0-15	IN	IN	X
61301236	NON	05	00	4500-5000	N	0-15	IN	IN	X
61200053	VER	05	01	4500-5000	S	>30	IN	IN	P
61200010	NON	05	00	5500-6000	W	16-30		OUT	X
61500062	NON	40	05	6000-6500	N	>30		OUT	P
61200008	NON	05	00	6000-6500	N	16-30	IN	OUT	X

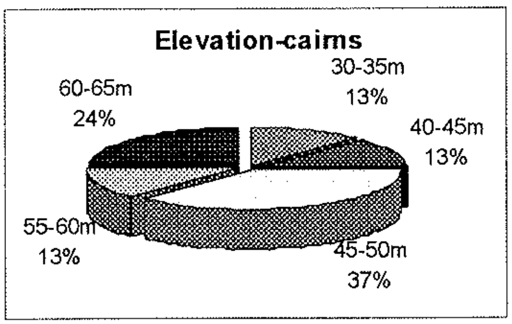
Total number of rock cairns = 8. X in the CLASS column signifies points, P signifies polygons.

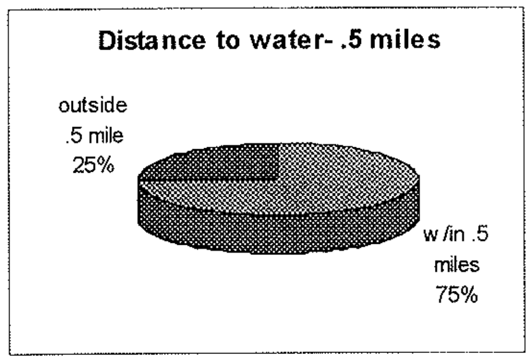
Elevation	Aspect	Slope	Dist. to Water (.5 mile)	Dist. to Water (.25 mile)
2500-3000 = 0	S = 1	0-15 = 4	w/in .5 miles = 6	w/in .25 miles = 5
3000-3500 = 1	W = 2	16-30 = 2	more than .5 miles = 2	more than .25 miles = 3
3500-4000 = 0	N = 3	>30 = 2		
4000-4500 = 1	E = 2			
4500-5000 = 3	Flat = 0			

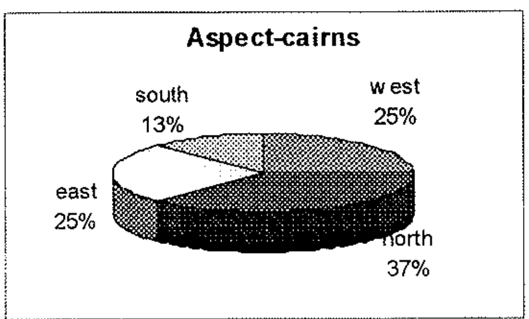
5000-5500 = 0
5500-6000 = 1
6000-6500 = 2

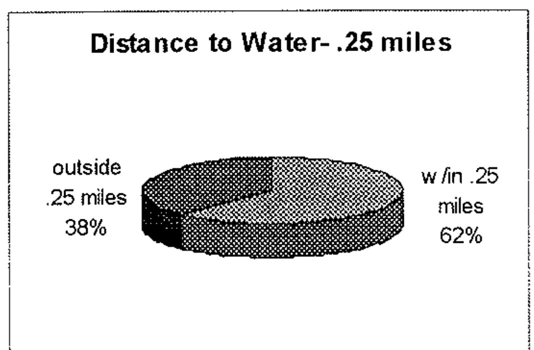
Summary:

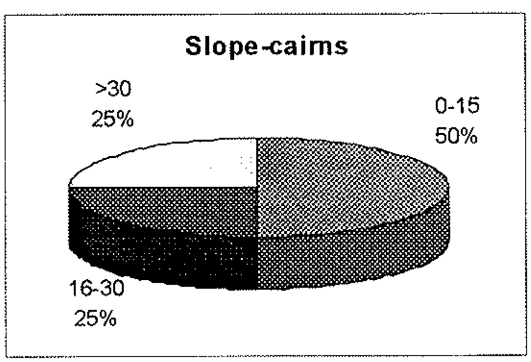
- There appears to be a increase in frequency of cairns at higher elevations range. Note however that the sample size is so small that it is likely not to be representative. From experience, the landform and viewshed may well be the main determining factors for cairn location- but we currently do not have this data in our computer database.
- The aspect of rock cairns vary; but they exclude any flat areas. Slope also varies, but is mainly 0-15%.
- 83% of the total number of rock cairns were within .5 miles of water and 67% within .25 miles of water.











Quarries (Code 10 and 11)

CR SITE	REMINDER	SITE TYPE	SITE TYPE2	ELEVATION	ASPECT	SLOPE	HFMILE	QTRMILE	CLASS
61100250	NON	41	11	4500-5000	E	0-15	IN	OUT	P
61300149	NON	11	40	4500-5000	E	16-30		OUT	P
61301110	NON	40	11	4500-5000	N	0-15		OUT	X
61301112	NON	11	00	4500-5000	N	16-30		OUT	P
61300134	NON	11	00	5000-5500	N	>30	IN	IN	P
61300136	NON	11	00	5000-5500	N	16-30	IN	OUT	P
61301113	NON	41	11	5000-5500	S	0-15		OUT	P
61300466	NON	11	42	5000-5500	W	0-15	IN	IN	P
61301114	NON	41	11	5500-6000	E	0-15		OUT	P
61300137	NON	11	42	5500-6000	W	16-30	IN	OUT	P
61100499	NON	11	00	6000-6500	E	>30	IN	OUT	X
61100513	NON	43	10	6000-6500	E	0-15	IN	IN	X
61100514	NON	40	10	6000-6500	E	0-15	IN	IN	X
61100515	NON	41	10	6000-6500	E	0-15	IN	IN	X
61301564	NON	11	42	6000-6500	N	0-15	IN	IN	P
61301557	NON	41	11	6000-6500	N	0-15	IN	IN	P
61301559	NON	11	42	6000-6500	N	0-15	IN	IN	P
61301569	NON	41	11	6000-6500	N	16-30	IN	IN	P
61300943	NON	11	42	6000-6500	S	0-15	IN	OUT	P
61300460	NON	11	40	6000-6500	S	16-30	IN	OUT	P
61301568	NON	43	11	6000-6500	W	0-15	IN	IN	P
61300610	NON	11	00	6000-6500	W	16-30	IN	IN	X
61301565	NON	11	42	6500-7000	E	0-15	IN	IN	P
61301554	NON	41	11	6500-7000	S	0-15	IN	IN	P
61100501	NON	10	00	6500-7000	S	0-15	IN	IN	X
61100505	NON	10	00	6500-7000	S	0-15	IN	IN	P
61100069	NON	10	41	6500-7000	S	0-15	IN	OUT	P

Total number of quarries, obsidian and basalt combined = 27. X in the CLASS column signifies points, P signifies polygons.

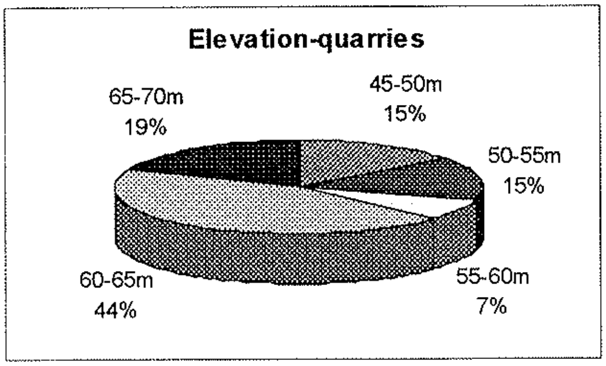
Elevation	**Aspect**	**Slope**	**Dist. to Water (.5 mile)**	**Dist. to Water (.25 mile)**
2500-3000 = 0	S = 7	0-15 = 19	w/in .5 miles = 22	w/in .25 miles = 15
3000-3500 = 0	W = 4	16-30 = 7	more than .5 miles = 5	more than .25 miles = 12
3500-4000 = 0	N = 8	>30 = 1		
4000-4500 = 0	E = 8			
4500-5000 = 4	Flat = 0			
5000-5500 = 4				
5500-6000 = 2				
6000-6500 = 12				
6500-7000 = 5				

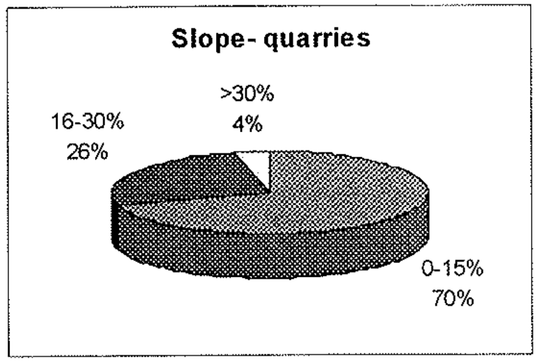
Summary:

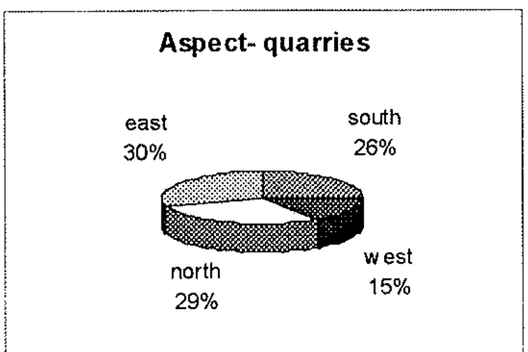
- Note an increase in frequency of quarries at higher elevations; although this may well reflect geologic more than human patterns.
- The aspect of quarries varies, with flat and west being least common. The slope also varies, mainly 0-15%, with a lesser number at 16-30%.
- 81% of the total number of quarries were within .5 miles of water and slightly over half, 56% are within .25 miles of water.
- 19 of these quarries are on the Ft. Rock Ranger District and 8 are on the Bend Ranger District. No quarries for either Sisters or Crescent Ranger Districts show up in this analysis; however we do believe that there are quarry sites, at least on Sisters Ranger District. On the Bend Ranger District, 6 out 8 quarries are of basalt material, all but 1 quarry is above 6000'. The aspects are confined to east

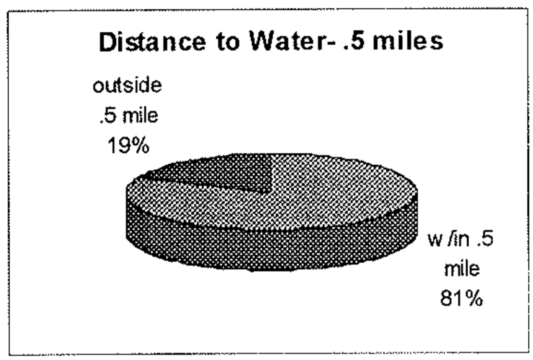
and south (in that order of frequency). On Ft. Rock District there is much more variability, except that all quarries are of obsidian.

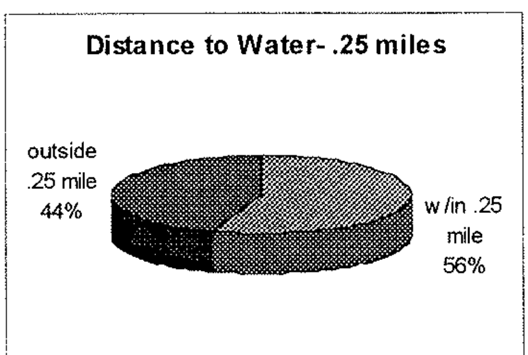
- Quarries represent a utilized resource, often of "high" economic value, as well as a site. In many cases the presence of quarries may be a predictive factor for other types of sites (especially lithic sites). Gilsen's model stresses the economic aspect of prehistoric lives- toolstone quarries are our most obvious resource procurement foci in Central Oregon. The location of quarries in relationship to prehistoric sites may be a good predictive model, although it was not used as such in this initial analysis.











Peeled Trees (Code 15 and 16)

CR SITE	REMINDER	SITE TYPE	SITE TYPE	ELEVATION	ASPECT	SLOPE	HFMILE	QTRMILE	CLASS
61200313	NON	44	16	4000-4500	W	0-15	IN	IN	P
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X

61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	0-15	IN	IN	X
61200106	NON	16	00	4500-5000	W	16-30	IN	IN	X
61200106	NON	16	00	4500-5000	W	16-30	IN	IN	X

Total number of peeled trees, for food and fiber combined = 16. X in the CLASS column signifies points, P signifies polygons.

Elevation	**Aspect**	**Slope**	**Dist. to Water (.5 mile)**	**Dist. to Water (.25 mile)**
2500-3000 = 0	S = 0	0-15 = 14	w/in .5 miles = 16	w/in .25 miles = 16
3000-3500 = 0	W = 16	16-30 = 2	more than .5 miles = 0	more than .25 miles = 0
3500-4000 = 0	N = 0	>30 = 0		
4000-4500 = 1	E = 0			
4500-5000 = 15	Flat = 0			
5000-5500 = 0				
5500-6000 = 0				
6000-6500 = 0				
6500-7000 = 0				

Summary:

- As you can see from the Site#s in the table, all but one of these trees have been given the same Site#, and subsequently they have similar environmental data. Fifteen of the peeled trees are in fact, in the same area (Simax Beach in Crescent Ranger District) and thus should be a single polygon site (with 15 archaeologic features- the peeled trees). This would result in a total of 2 sites for peeled trees, and thus the sample size is to small to draw any conclusions based solely on this set of data.

Rock Art (Code 30 and 31)

CR_SIT	REMIND	SITE_T	SITE_TYP	ELEVATI	ASP	SLO	HFM	QTRMI	CL
61	NON	31	00	3500-4000	N	0-15	IN	IN	X
61	NON	31	00	5000-5500	S	>30	IN	IN	X
61	NON	31	00	5500-6000	S	>30	IN	IN	P

Total number of rock art sites, petroglyphs and pictographs combined = 3. X in the CLASS column signifies points, P signifies polygons.

Elevation	**Aspect**	**Slope**	**Dist. to Water (.5 mile)**	**Dist. to Water (.25 mile)**
2500-3000 = 0	S = 2	0-15 = 1	w/in .5 miles = 3	w/in .25 miles = 3
3000-3500 = 0	W = 0	16-30 = 0	more than .5 miles = 0	more than .25 miles = 0
3500-4000 = 1	N = 1	>30 = 2		
4000-4500 = 0	E = 0			
4500-5000 = 0	Flat = 0			
5000-5500 = 1				
5500-6000 = 1				
6000-6500 = 0				
6500-7000 = 0				

Summary:

- The sample size is too small to draw an conclusive remarks. Eleven known rock art sites lie within Deschutes County boundaries, three however were used in this initial analysis. It is interesting to note however, that none of the 3 rock art sites are associated with lithics and that the predominate slope is >30%.

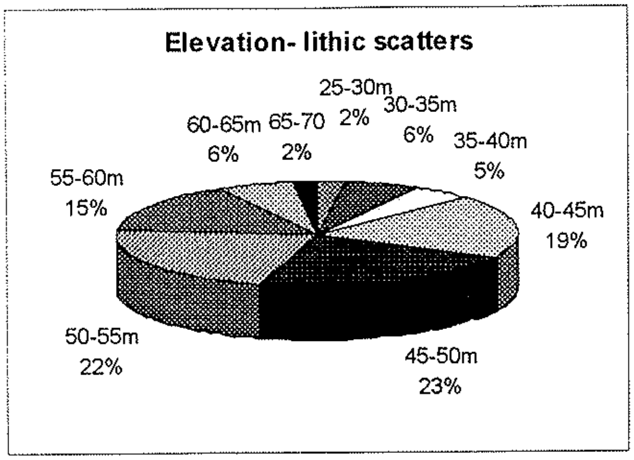
Lithic Scatters (code 40)

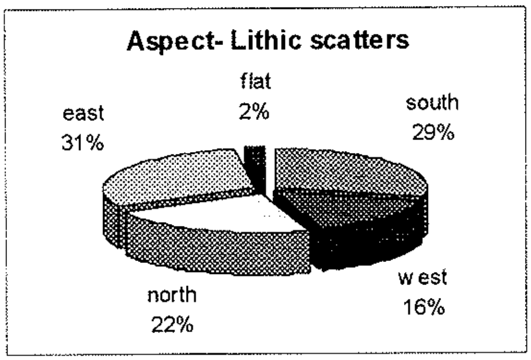
Total number of lithic scatters = 855. A table for lithic scatters is not included due to space needed to create table for 855 sites. If you wish to see the raw data please contact Jimae Haynes at the Deschutes NF.

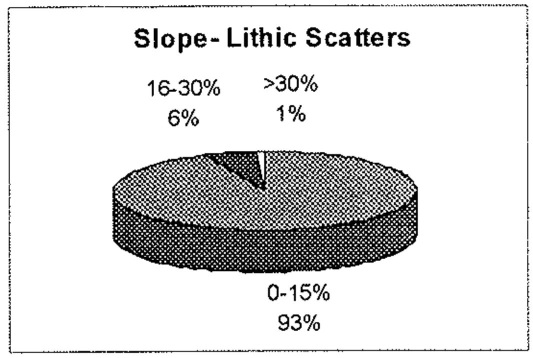
Elevation	**Aspect**	**Slope**	**Dist. to Water (.5 mile)**	**Dist. to Water (.25 mile)**
2500-3000 = 19	S = 244	0-15 = 799	w/in .5 miles = 668	w/in .25 miles = 551
3000-3500 = 52	W = 140	16-30 = 50	more than .5 miles = 187	more than .25 miles = 304
3500-4000 = 44	N = 192	>30 = 6		
4000-4500 = 164	E = 259			
4500-5000 = 189	Flat = 20			
5000-5500 = 188				
5500-6000 = 131				
6000-6500 = 52				
6500-7000 = 16				

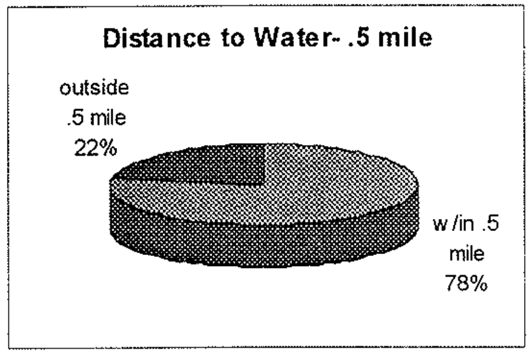
Summary:

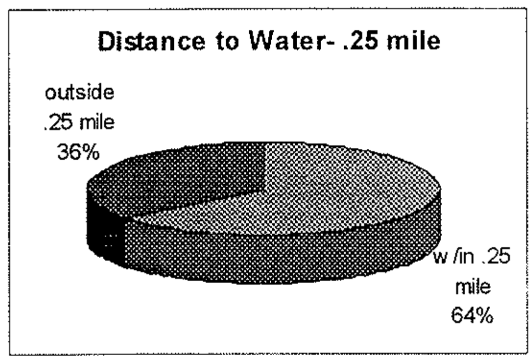
- The frequency for lithic scatter sites peak between 4000-5500 feet in elevation
- Aspect is of most the sites are south and east (almost equal in numbers), north and west are a second peak (almost equal in number), and flat is least common.
- Lithic scatters tended to be on slopes of 0-15% grade (93% of the total).
- 78% of the total lithic scatter sites were within .5 miles of water and 64% were within .25 miles of water.
- A pattern appears in which lithic scatter sites focus at the lower elevations in the Sisters Ranger District. In the 2500 to 3500' elevation ban 100% of the sites (72) are in the Sisters Ranger District.
- The frequency of sites with slopes of 16-30% and >30% increases greatly at elevations of 6000' and above. The frequency of lithic scatter sites below 6000' is roughly one in every 21.3 sites, while the frequency above 6000' is roughly one in every 4 sites.
- Of the 187 sites falling outside .5 miles to the nearest source of water, 162 are on the Fort Rock Ranger District and have an average elevation of 4500-6000'. Thirteen are on Sisters Ranger District and have an average elevation of 3500-5000'. Eleven are on Bend Ranger District, and 1 is on Crescent Ranger District.











Lithic Scatters with Flaked Tools (code 41)

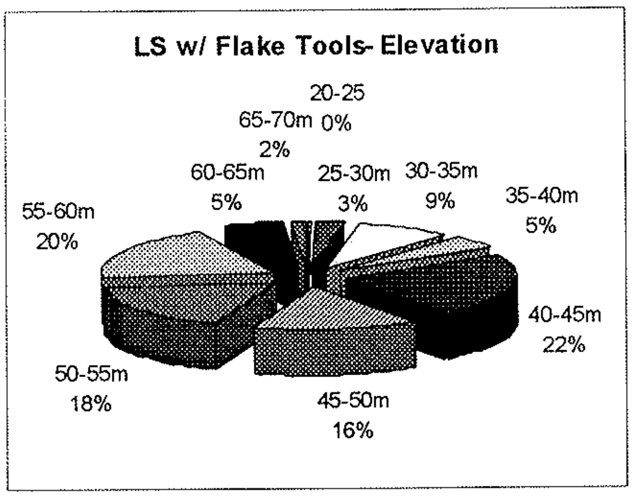
Total number of lithic scatters with flake tools = 526. A table for lithic scatters with flaked tools is not included due to space needed to create table for 526 sites. If you wish to see the raw data please contact Jimae Haynes at the Deschutes NF.

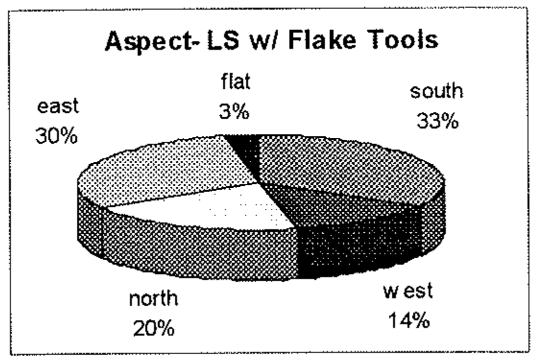
Elevation	Aspect	Slope	Dist. to Water (.5 mile)	Dist. to Water (.25 mile)
2000-2500 = 2	S = 174	0-15 = 496	w/in .5 miles = 415	w/in .25 miles = 370
2500-3000 = 14	W = 72	16-30 = 26	more than .5 miles = 111	more than .25 miles = 156
3000-3500 = 49	N = 104	>30 = 4		
3500-4000 = 25	E = 160			
4000-4500 = 120	Flat = 16			
4500-5000 = 83				
5000-5500 = 93				
5500-6000 = 104				
6000-6500 = 28				
6500-7000 = 8				

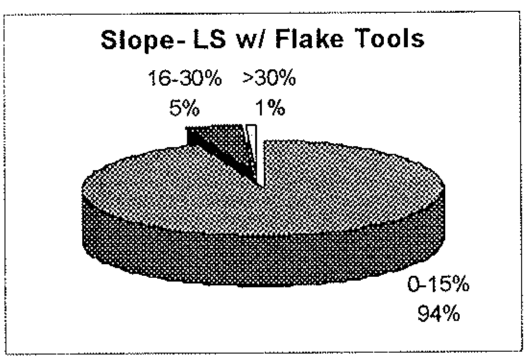
Summary:

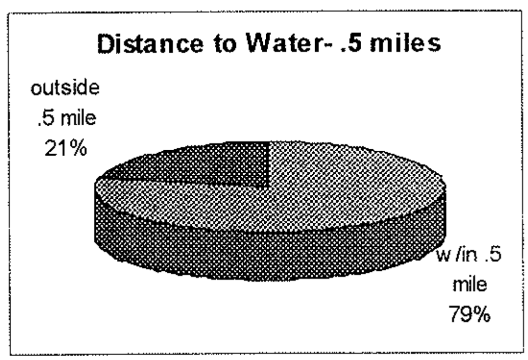
- Most lithic scatter sites with flaked tools are found in the 4000-4500' elevation range and/or in the 5500-6000' range. Note that there is a noticeable dip between the two peaks of sites in the elevation ranges.

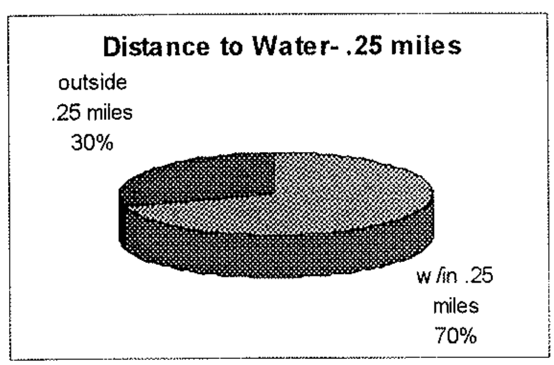
- An almost equal number of sites have a south and east aspect. North and west sites have a second peak, with flat being the least common location. Note that this pattern is similar to simple lithic scatters sites except that the north aspect appears to have a greater frequency for lithic scatters with flake tool sites.
- 94% of the lithic scatter sites that had evidence of flaked tools lie on a slope of 0-15% grade. 79% of the site are within .5 miles of water and 70% are within .25 miles of water.
- The lower elevations are monopolized by sites falling within the Sisters Ranger District- below 3500' 100% (65) of lithic scatters with flake tools sites are located in Sisters Ranger District
- Of the 111 sites falling outside .5 miles to the nearest source of water, 87 are on the FR Ranger District. Those sites have an average elevation of 4500-6000'. Eighteen sites are on SR District and have an average elevation of 3000-4500'. There are only 5 sites on Bend Ranger District, and 1 on Crescent Ranger District.











Lithic Scatters with Ground Tools (code 42)

CR_SIT	REMIN	SITE_TY	SITE_TYP	ELEVATI	ASPE	SL	HFM	QTRM	CL
615002	OPW	42	00	3000-35	E	0-	IN	IN	
611005	NON	42	00	4000-45	N	0-	IN	IN	
613009	NON	42	00	4500-50	N	0-		OUT	
613001	NON	42	00	4500-50	N	0-	IN	IN	
613006	NON	42	00	4500-50	N	0-	IN	OUT	
612002	NON	42	00	4500-50	S	0-	IN	OUT	
613001	NON	00	42	4500-50	W	0-		OUT	
613008	NON	01	42	5000-55	E	0-		OUT	
612000	NON	40	42	5000-55	E	0-	IN	IN	
613003	NON	42	00	5000-55	N	0-		OUT	
613004	NON	11	42	5000-55	W	0-	IN	IN	
613001	NON	11	42	5500-60	W	16-	IN	OUT	
613015	NON	11	42	6000-65	N	0-	IN	IN	
613015	NON	11	42	6000-65	N	0-	IN	IN	
613009	NON	11	42	6000-65	S	0-	IN	OUT	
613015	NON	11	42	6500-70	E	0-	IN	IN	

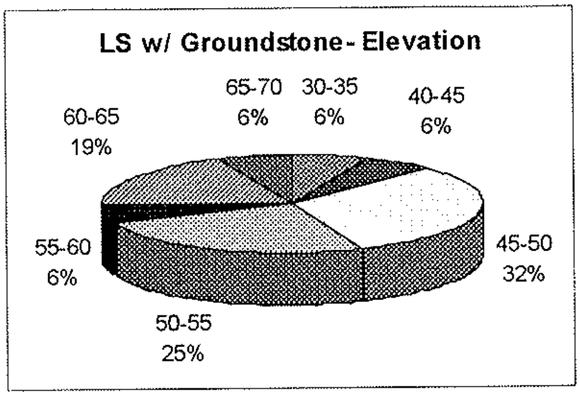
Total number of lithic scatters with ground tools =16. X in the CLASS column signifies points, P signifies polygons.

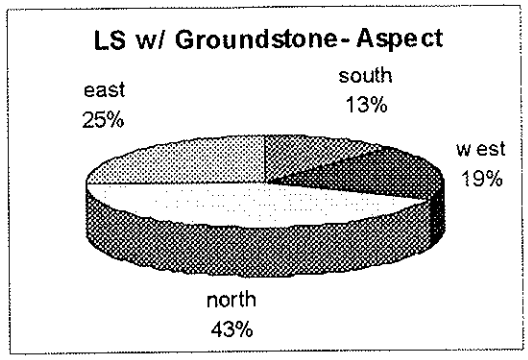
Elevation	Aspect	Slope	Dist. to Water (.5 mile)	Dist. to Water (.25 mile)
2500-3000 = 0	S = 2	0-15 = 15	w/in .5 miles = 12	w/in .25 miles = 8
3000-3500 = 1	W = 3	16-30 = 1	more than .5 miles = 4	more than .25 miles = 8
3500-4000 = 0	N = 7	>30 = 0		
4000-4500 = 1	E = 4			
4500-5000 = 5	Flat = 0			
5000-5500 = 4				
5500-6000 = 1				
6000-6500 = 3				
6500-7000 = 1				

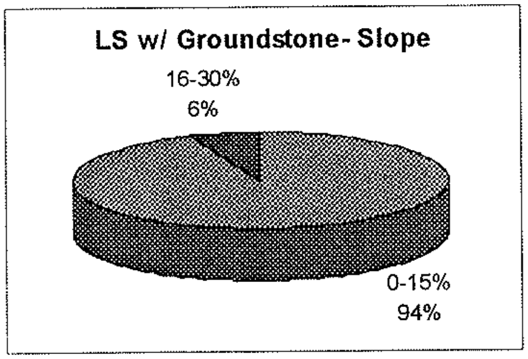
Summary:

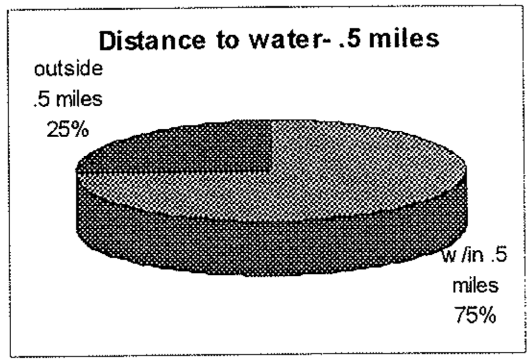
Note that the sample size may be to small to draw definitive conclusions from, but there are a few noteworthy items:

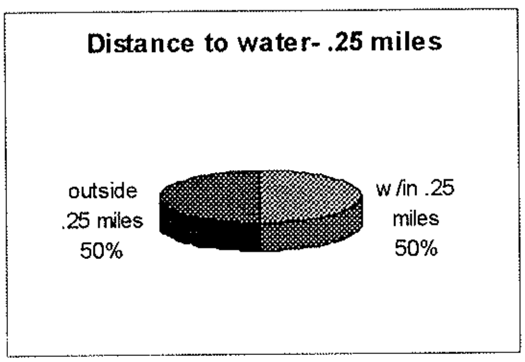
- The frequency of lithic scatter sites with groundstone tools concentrates in the 4500-5500' elevation range. This is similar to lithic scatter and lithic scatter with flaked tools sites.
- The aspect of lithic scatter sites with ground stone tools is mainly to the north.
- 94% of the sites are on a 0-15% slope.
- 75% of all sites were within .5 miles of water and 50% of the sites fell within .25 miles of water.
- Note that over a third of all lithic scatter w/ groundstone tool sites are associated with obsidian quarries.











Lithic Scatters with both Flake Tools and Groundstone (code 43)

CR_SIT	REMIN	SITE_T	SITE_TYP	ELEVATI	ASPE	SL	HFM	QTRM	CLA
615002	NON	43	44	2500-3	E	0-	IN	IN	P
611002	NON	43	00	3500-4	E	0-	IN	IN	X
611001	NON	43	00	3500-4	S	0-	IN	IN	X
611001	NON	43	00	3500-4	S	0-	IN	IN	X
611001	NON	43	00	3500-4	S	0-	IN	IN	X
611001	NON	43	00	4000-4	E	0-	IN	IN	X
611000	NON	43	00	4000-4	E	0-	IN	IN	P
611005	NON	43	00	4000-4	E	0-	IN	IN	X
611000	NON	43	00	4000-4	E	0-	IN	IN	P
613008	NON	43	00	4000-4	N	0-		OU	P
611000	NON	43	00	4000-4	S	0-	IN	IN	P
611000	NON	43	00	4000-4	S	0-	IN	IN	P
611003	NON	43	00	4000-4	S	0-	IN	IN	P
611000	NON	43	00	4000-4	S	0-	IN	IN	P
611000	NON	43	00	4000-4	S	0-	IN	IN	X
611000	NON	43	00	4000-4	S	0-	IN	IN	P
612001	NON	43	00	4000-4	S	0-	IN	IN	P
611004	NON	01	43	4000-4	S	16-	IN	IN	X

611000	NON	43	00	4000-4	S	16-	IN	IN	X
612001	NON	43	44	4000-4	W	0-	IN	IN	P
613000	NON	43	01	4000-4	W	0-	IN	IN	P
611000	NON	43	00	4000-4	W	0-	IN	IN	P
611002	NON	43	00	4500-5	E	0-	IN	IN	X
612001	NON	43	00	4500-5	E	0-	IN	IN	P
612001	NON	43	00	4500-5	E	0-	IN	IN	P
612001	NON	43	00	4500-5	E	0-	IN	IN	P
612000	NON	43	00	4500-5	E	0-	IN	IN	X
612000	NON	43	00	4500-5	E	0-	IN	IN	P
613008	NON	43	00	4500-5	N	0-		OU	P
613016	NON	44	43	4500-5	N	0-		OU	P
612001	NON	43	00	4500-5	N	0-	IN	IN	P
613008	NON	43	00	5000-5	E	0-		OU	P
611001	NON	43	00	5000-5	E	0-	IN	IN	X
613009	NON	43	00	5500-6	E	0-		OU	P
613009	NON	43	00	5500-6	F	0-		OU	P
611001	NON	43	00	5500-6	W	0-	IN	OU	X
611005	NON	43	10	6000-6	E	0-	IN	IN	X
613016	NON	43	00	6000-6	N	0-		OU	P
613015	NON	43	11	6000-6	W	0-	IN	IN	P
611005	NON	43	00	6500-7	S	0-	IN	IN	X

Total number of lithic scatters with groundstone and flaked tools = 40. X in the CLASS column signifies points, P signifies polygons.

Elevation
2500-3000 = 1
3000-3500 = 0
3500-4000 = 4
4000-4500 = 17
4500-5000 = 9
5000-5500 = 2
5500-6000 = 3
6000-6500 = 3
6500-7000 = 1

Aspect
S = 13
W = 5
N = 5
E = 16
Flat =

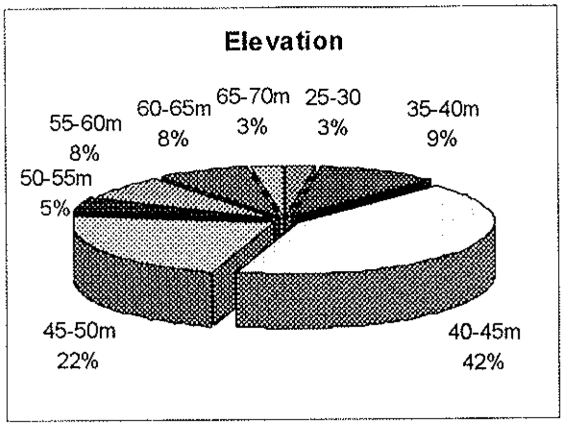
Slope
0-15 = 38
16-30 = 2
>30 = 0

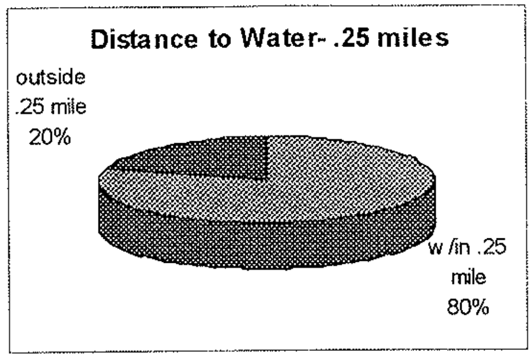
Dist. to Water (.5 mile)
w/in .5 miles = 33
more than .5 miles = 7

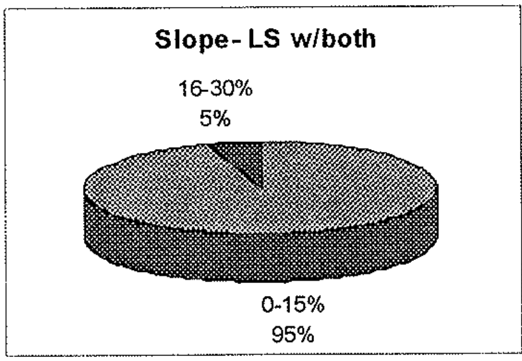
Dist. to Water (.25 mile)
w/in .25 miles = 32
more than .25 miles = 8

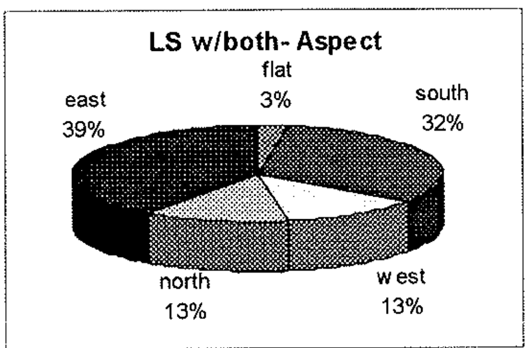
Summary:

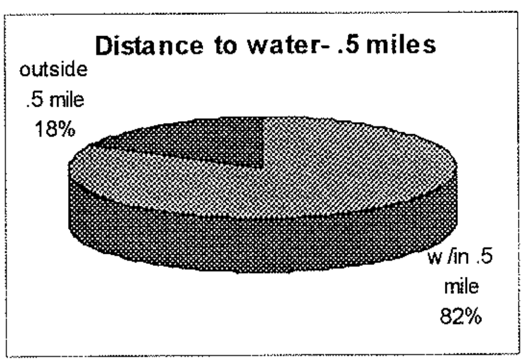
- The frequency concentrates of both lithic scatters with flake tools and groundstone tools combined lie in the 4000-5000 elevation range. This is similar to basic lithic scatters, lithic scatters with flaked tools, and lithic scatters with groundstone sites.
- The aspect of these sites is mainly south and east. This follows the primary aspect pattern of lithic scatters and lithic scatters with flaked tools, with a secondary focus on west and north.
- 95% of the sites are on a 0-15% slope.
- 83% of the sites are within .5 miles of water and 80% are within .25 miles of water.
- Over half (22 of 40) of these sites are on Bend Ranger District, 8 are on Crescent Ranger District, 9 are on Fort Rock Ranger District. Only 1 is located on the Sisters Ranger District.


Elevation
55-60m
8%
60-65m
8%
65-70m
3%
25-30
3%
35-40m
9%
50-55m
5%
45-50m
22%
40-45m
42%


Distance to Water- .25 miles
outside
.25 mile
20%
w/in .25
mile
80%


Slope- LS w/both
16-30%
5%
0-15%
95%


LS w/both- Aspect
flat
3%
east
39%
south
32%
north
13%
west
13%


Distance to water- .5 miles
outside
.5 mile
18%
w/in .5
mile
82%

Lithic Scatters with Features (code 44)

CR_SITE	REMINDER	SITE_TY	SITE_TYPE	ELEVATI	ASPE	SLO	HF	QTR	CLA
6150023	NON	43	44	2500-30	E	0-	I	I	P
6120031	NON	44	16	4000-45	W	0-	I	I	P
6120018	NON	43	44	4000-45	W	0-	I	I	P
6130162	NON	44	43	4500-50	N	0-		O	

Total number of lithic scatters with features = 4. X in the CLASS column signifies points, P signifies polygons.

Elevation	Aspect	Slope	Dist. to Water (.5 mile)	Dist. to Water (.25 mile)
2500-3000 = 1	S = 0	0-15 = 4	w/in .5 miles = 3	w/in .25 miles = 3
3000-3500 = 0	W = 2	16-30 = 0	more than .5 miles = 1	more than .25 miles = 1
3500-4000 = 0	N = 1	>30 = 0		
4000-4500 = 2	E = 1			
4500-5000 = 1	Flat = 0			
5000-5500 = 0				
5500-6000 = 0				
6000-6500 = 0				
6500-7000 = 0				

Summary:

Note that the number of sites in this site type may be too small to be draw definitive conclusions.

- The frequency of lithic scatter sites with features concentrates in the 4000-5000 elevation range. This is similar to the other lithic site types.
- The aspect is mainly west, with a secondary focus on east and north.
- All the sites are located on a 0-15% slope.
- 75% of the sites are within .25 miles of water.

All Prehistoric Sites- combined

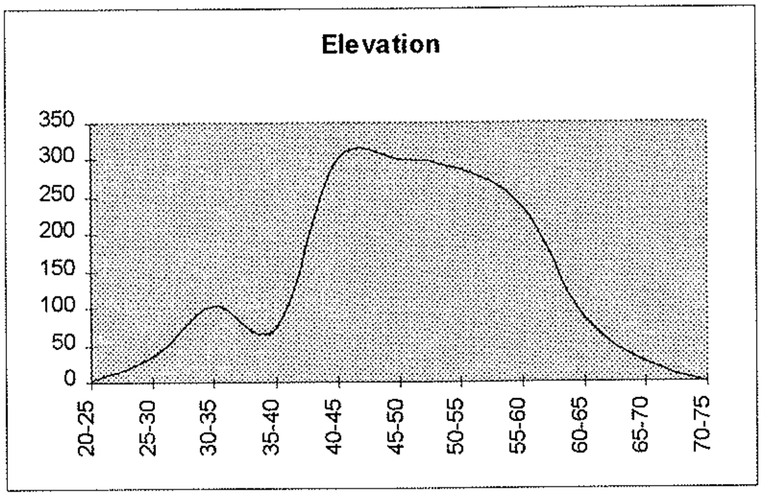
Total number of prehistoric sites, regardless of site type = 1456 (leaving out all sites coded "VER" in the reminder field).

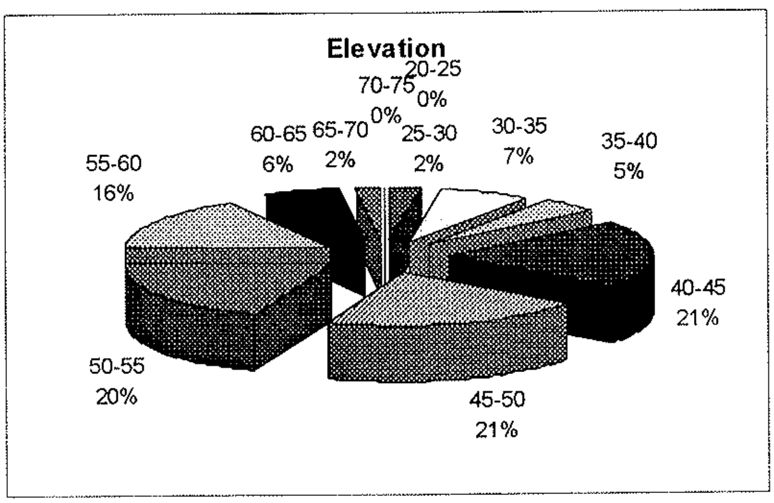
Elevation	Aspect	Slope	Dist. to Water (.5 mile)	Dist. to Water (.25 mile)
2000-2500 = 2	S = 437	0-15 = 1354	w/in .5 miles = 1141	w/in .25 miles = 971
2500-3000 = 36	W = 238	16-30 = 87	more than .5 miles = 315	more than .25 miles = 485
3000-3500 = 102	N = 307	>30 = 15		
3500-4000 = 73	E = 437			
4000-4500 = 300	Flat = 37			
4500-5000 = 302				
5000-5500 = 287				
5500-6000 = 237				
6000-6500 = 88				
6500-7000 = 28				
7000-7500 = 1				

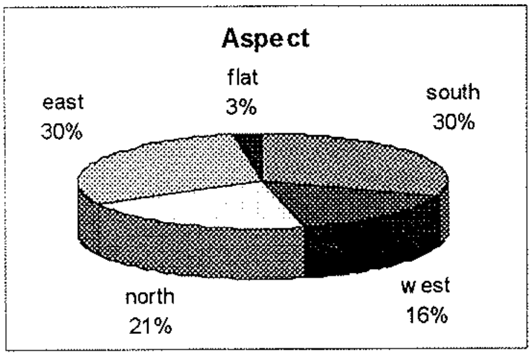
Summary:

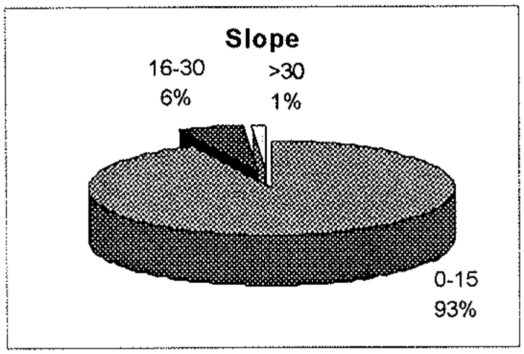
Out of a total of 1456 prehistoric sites, 1431 (98%) have some lithic component- therefore the results of this "combined" analysis should and does show a strong correlation to the results of *analyses performed by individual site type for the lithic types. Because so many of the Deschutes National Forest prehistoric sites are associated with lithics, the test model (if based on the results of this analysis) was unfortunately strongly biased to predict the factors associated with lithic type sites and may have missed prehistoric site types often not associated with lithics (such as rock cairns, rock art, peeled trees...).*

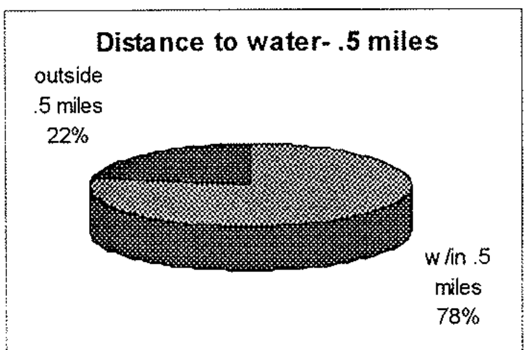
- The highest frequency of sites are concentrated in the 4000-6000 elevation range.
- The aspect of all sites is mainly east and south (30% each), and have a secondary focus on north (21%), and a third focus on west (16%).
- 93% of the total number of sites were located on a 0-15% slope.
- 78% of all sites were within .5 miles of water and 67% were within .25 miles of water.

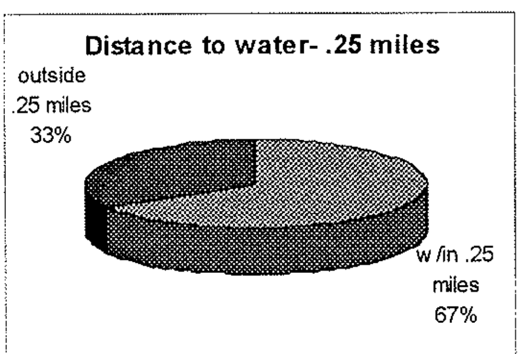












ANALYSIS SUMMARY

The vast majority of Deschutes National Forest prehistoric sites had a lithic component (98%). By using these sites to establish the baseline for predictors, the model may be biased toward lithic type sites. The remainder of the sites, those without a lithic component (2%), were so few that the baseline data available unfortunately is probably not wholly representative. As stated in the summary for the "combined" prehistoric sites, this analysis may have produced a good model for finding lithic scatters but likely did not produce a good model for finding those types of prehistoric sites which often can lack a lithic component. If a predictive model is to be successful in finding "non-lithic" site types, enough data will need to be amassed on other environmental factors.

Bearing in mind possible data bias, the results for "combined" prehistoric sites clearly portrays the correlation's between the four environmental factors and known prehistoric sites on the Deschutes National Forest. While some of the factors did tend to have a clear frequency peak, there were some notable anomalies which tended to undermine the usefulness of the model if it was used forest-wide or regional wide.

One of the hopes of the predictive model was to have only two values (high and low) for the probability of finding new prehistoric sites. Out of the environmental factors examined there was a clear and single frequency peak; with the exception of aspect. Site frequency with respect to aspect tended to correlate strongly with a south and/or east aspect (30% each), a north aspect tended to form a secondary "tier (21%). A west aspect tends to form a third "tier" (16%). In the near future Central Oregon archaeologists will need to come to some decision about how to break out aspect into high/low or high/medium/low categories. Another "anomaly" with respect to the high/low probability scheme was a trend for the higher elevation prehistoric sites (6000' and above) to have a much greater frequency of steeper slopes. Again, archaeologists will have to decide how they want to deal with this "gray area" in the larger pattern.

It is interesting to note that 137 prehistoric sites on Sisters Ranger District were principally found at the lower elevations; 3500' and less in elevation. This number is well over 1/3 of all of the prehistoric sites on the Sisters Ranger District (total of 307). The peak frequency for the forest as a whole falls between 4000'- 6000'; therefore archaeologists may need to adjust the elevation range to better include the Sisters Ranger District. It is also interesting to note that an analysis of prehistoric site frequency by 1000' elevation bands completed on the Prineville District of the BLM in 1990 showed clearly that the peak for all prehistoric sites (combined together) fell within the 4000-4999' band. Site locations on the Fort Rock Ranger District show a marked lesser correlation to be within either .5 or .25 miles of a water source than any of the other districts; this needs to be compensated for in the model.

The initial test run for the predictive analysis is inconclusive of definitive results. This is mainly due to the results of assumptions that most prehistoric sites would be found at a moderate elevation, on slopes of 0-15% and within a half mile of water. It turns out that the test area also falls within these perimeters. The GIS department calculated that the total percent of acres on the Deschutes NF and found that 67% of the forest lies between 3500' and 5500'; 67% of our known prehistoric sites also lie within that range. However, the direct correlation between percent of acres and percent of sites in the elevation range of 3500' to 5500' coupled with the above mentioned anomalies associated with elevation concludes that elevation, alone, is *not* a good predictor of site location. You should also note that 81% of the Deschutes National Forest has a 0-15% slope and 93% of the sites on the forest fell within that category. Out of the 1431 sites tested, 78% lie within .5 miles of water and within the forest as a hole, 64% of it lies within .5 miles of water. Aspect turned out to be an even clearer problem as a site predictor. As mentioned above, aspect never did show a single peak for frequency; the percentages for each of the four aspects were relatively close.

RECOMMENDATIONS

In conclusion, none of the environmental factors selected for this initial analysis was a good candidate as a site predictor. The Central Oregon heritage Team suggest that a new predictive model be developed with Central Oregon divided into geographic regions, based upon uniformity of climate and landscape. The model would include other factors such as resources, culture areas, and soils. This geographic division is necessary due to the vast diversity of environmental factors which are all present and or adjacent in the Central Oregon region. For example, would a site predictor such as distance to water function the same in the east Cascades foothills where water is abundant or near Glass Buttes where water is extremely scarce. If archaeologists decided that slopes from 0-15% are high probability areas, then large areas of Prineville BLM and much of the Deschutes National Forest would fall into a high probability zone.

Other environmental factor which may "predict" archaeological site location are: the distance to known quarries, along edges of large lava flows, ridgetops (travel routes) and ecotones (edges of large meadows, etc., edges of old lake beds). These could be implemented into GIS relatively easily, however in order to use each of these additional factors, archaeologists would need to supply a value (such as the radius around known quarries, or the distance out from the edge of lava flows). To date these factors are not currently being collected in the field and such data would still only be guess work.

Le Gilson, State of Oregon Archaeologist has proposed a prehistoric research design based upon economics (his thermo-dynamic model). He suggests that we can understand human use of the landscape by examining resource procurement, storage, and use. While reconstructing the patterns, over 13,000 years, of most of the organic resources (plants and animals) may be beyond the scope of most archaeological work, archaeologists could easily begin to examine the human patterns associated with at least one resource, tool stone resources. At a regional level, archaeologists could ask themselves about know human patterns associated with tool stone procurement, storage, and use. From here they might assess what other information they would need to know to fill in data gaps (more sourcing and a workable hydration rate table at least), and thus work towards fulfilling that goal.

For the initial run of this analysis, the Heritage Team looked at environmental factors "sorted" by Site Type. Another method of analysis could be to look at Site Type "sorted" by environmental factors. For example elevation band or aspect could be used to see what site types, and in what combinations, correlate to the specified environmental factors. Another way to create a more accurate predictive model would be to look at landforms associated with prehistoric sites. The Heritage Team at the USFS are currently working on environmental fields of primary and secondary landforms for the data base. Once fully implemented into the database it will be relatively easy to complete a new analysis on these factors.

Currently the data base has a few fields which track "scientific" or archaeological data- most track administrative type data. The other three fields, besides Site Type, which have to do with archaeologic information are Cultural Period, Absolute Date, and Inferred Function. Unfortunately none of these fields contain reliable data. Inferred function and Absolute Date fields are under-utilized by archaeologists. However, it might be interesting to look for patterns based on that data.

Total number of sites, by Site Type, in the Heritage database and in GIS. The discrepancies between the totals in the two columns point out errors in our data.

(Table 3)

Site Type Code	Total in database	Total GIS points	Total GIS polygons	Total in GIS
01	41	19	7	26
05	17	6	2	8
10 & 11	28	7	20	27
15 & 16	5	15	1	16
30 & 31	4	2	1	3
40	943	428	427	855
41	567	185	341	526
42	19	5	11	16
43	49	15	25	40
44	4	0	4	4
Sum totals	1677	682	839	1521

TREATMENT

All of the products of past cultures should be considered nonrenewable resources, therefore their protection is of paramount importance. What we can learn from these from evolves overtime, with our scientific sophistication and more significantly, our cultural sensitivity. Over the years what we have learned, to our disgrace, is that writing off seemingly meaningless prehistoric litter forecloses forever the opportunity for future generations to decipher the patterns of the past. Lithic scatters, for instance, were once reviewed as a "dime a dozen." Archaeologists now know that lithic scatters can provide valuable information about hunting and gathering patterns of people.

The debate surrounding how to best protect such important resource is at the forefront of most cultural resource planners. Deschutes County has decided to take the lead role in proposing the protection of prehistoric resources by instituting an ordinance that requires developers to conduct archaeological surveys before the ground is broken. The proposed ordinance however would not be a useful tool in protecting archaeological sites under the current system of land-use planning in the County. Deschutes County does not currently have a grading permit requiring developers to seek approval for any ground disturbing actives occur. Lack there of, would leave the proposed survey requirement to the good will of the developer. If such an ordinance should pass it must be instituted with a County-wide grading permit and thus become part of the sign-off process before development could occur.

Predictive model analysis of site probability areas was inconclusive in results and thus a holistic approach to the survey requirement is recommended. Archaeological site density in the County is believed to be as high as 1 to 5 sites per acre. Having a high, medium, and low area with different requirements would not only be a burden to preservation staff but be perceived as to confusing for developers to follow.

The attached Cultural Resource Clearance permit handbook was modeled after the City of Santa Fe, New Mexico's guidelines. The handbook is written to be a user friendly, simple to follow book that would take developers through the clearance permit process. Several archaeological ordinances from throughout the Country were examined and compared prior to the compilation of this handbook.

Initial reaction to the proposed handbook was not favorable. The Deschutes County Planning Commission felt that the requirements upon developers was to great even without this ordinance and to add another requirement would be "more government bureaucracy, an increase in developmental costs and a loss of time for developers". County Preservation Planning staff will continue to promote the handbook and run the proposed ordinance through the appropriate channels.

FIELD INVENTORY STANDARDS

Field inventory standards have been established via a single, standardized, computer database, proposed to be used by all agencies in the Central Oregon region. The database was built by Jimae Haynes, under the direction of Paul Claeyssens, Forest Archaeologist, for the Deschutes National Forest beginning about 2/1/94. It is set-up using Microsoft Access software. In 1996 the data base was expanded and modified to include Prineville BLM and Deschutes County. Database design, implementation, and input is ongoing. The following documentation is the current data dictionary as of 5/23/96.

The purposes for computerizing Central Oregon archaeological data was to make possible a rapid retrieval of regional-wide archaeological data. This will in turn allow for regional perspective and analyses of that cultural resource information. Linking with Geographical Information Systems (GIS), the data base will also provide base data for spatial analyses of archaeological sites.

The data base and GIS link will also provide an overview of the state of cultural resource information in the region, thereby identifying data gaps and aiding in the development of a comprehensive cultural resource management plan. The database makes readily available a set of baseline data covering both management and scientific arenas. It was set-up for use by both in-house and out-of-house researchers. For a complete copy the Heritage Data Dictionary please contact the Deschutes National Forest.

Tables are the essence of any database; they store all the data. The Heritage database uses two types of tables:

1) **data tables**, which hold information taken from the site files and project reports
2) **lookup tables**, which are essentially lists of valid codes and their descriptions for coded fields (these lookup tables are displayed below with the documentation covering each field).

There are currently 7 data tables in the Heritage database:

1. **ArchSite**
2. **Numbers**
3. **Field Visit History**
4. **Site Analysis**
5. **Projects**
6. **Survey**
7. **Isolates**

The first 4 hold information related to archaeological or historic sites. The 5th holds information related to projects (such as timber sales or road construction) which required a cultural resource inventory. The 6th holds information about specific surveyed (inventoried) areas and the 7th stores information related to archaeological or historic isolates. The fields in each of these tables are:

ArchSite:
1) CR_SITE#
2) NRHP_STATUS
3) REMINDER
4) THREATS
5) ARTIFACT_LOCATION
6) DIAGNOSTIC
7) PHOTOS?
8) CULTURAL_PERIOD
9) DATING_METHOD(PERIOD)
10) ABSOLUTE_DATE
11) DATING_METHOD(ABSOLUTE)
12) SITE_TYPE
13) SITE_TYPE2
14) INFERRED_FUNCTION
15) FUNCTION2
16) BASIN
17) SUB_BASIN
18) PROVINCE
19) ELEVATION
20) SLOPE
21) ASPECT_DEGREES
22) WATER_DIST
23) PRIMARY_LANDFORM
24) PRIM_POSITION
25) SECOND_LANDFORM
26) SECND_POSITION
27) GPS
28) COMMENTS

Field Visit History:
1) *VISIT_ID# {record counter}*
2) CR_SITE#
3) VISIT_DATE
4) VISIT_TYPE
5) COND_CODE
6) AGENT
7) COND_PERCENT
8) ARTIFACTS_COLLECTED
9) VANDALIZED?
10) COMMENTS

Numbers:
1) CR_SITE#
2) TRINOMIAL
3) 2ND_TRINOMIAL
4) ID_NUMBER1
5) 2ND_FS#
6) 3RD_FS#
7) 4TH_FS#
8) 5TH_FS#
9) 6TH_FS#
10) SITE_NAME
11) PROJECT_NAME
12) CR_PROJECT#1
13) CR_PROJECT#2
14) CR_PROJECT#3

Analysis:
1) *ANALYSIS_ID# {record counter}*
2) CR_SITE#
3) LAB_NAME
4) DATE_DONE
5) ANALYSIS_TYPE
6) ANALYSIS_RESULTS
7) AGE_BP
8) RIND_(HYDRATION)_THICKNESS
9) COMMENTS

Project:
1) CR_PROJECT#
2) IN_GIS
3) AUTHORS_NAME
4) REPORT_DATE
5) SHPO_CONCURRANCE
6) CONCURRANCE_DATE
7) FINDING_OF_EFFECT
8) SHPO_BIBLIO#
9) PROJECT_NAME
10) COMMENTS

Survey:
1) CR_SURVEY#
2) SURVEYORS_NAME
3) DATE_SURVEYED
4) SURVEY_INTERVAL
5) PROBABILITY
6) CR_PROJECT#
7) GPS

Isolates:

1) CR_ISOLATE#
2) ID_NUMBER1
3) COLLECTED?
4) LOCATION
5) DIAGNOSTIC?
6) PHOTOS?
7) CULTURAL_PERIOD
8) METHOD(PERIOD)
9) ISO_DESCRIPTION
10) CR_PROJECT#
11) CR_PROJECT#2
12) CR_PROJECT#3
13) OBS_FLAKES
14) CCS_FLAKES
15) BAS_FLAKES
16) OTH_FLAKES
17) OBS_BIFACES
18) CCS_BIFACES
19) BAS_BIFACES
20) OTH_BIFACES
21) OBS_POINTS
22) CCS_POINTS
23) BAS_POINTS
24) OTH_POINTS
25) OBS_TOOLS(FLAKE)
26) CCS_TOOLS(FLAKE)
27) BAS_TOOLS(FLAKE)
28) OTH_TOOL(FLAKE)
29) OBS_CORES
30) CCS_CORES
31) BAS_CORES
32) OTH_CORES
33) GROUNDSTONE
34) CORTEX
35) HIST_CANS
36) HIST_BOTTLES
37) HIST_CERAMICS
38) HIST_OTHER
39) LITHIC_OTHER
40) OTHER
41) BASIN
42) SUB_BASIN
43) PROVINCE
44) ELEVATION
45) SLOPE
46) ASPECT_DEGREES
47) WATER_DIST
48) PRIMARY_LANDFORM
49) PRIM_POSITION
50) SECOND_LANDFORM
51) SECND_POSITION
52) GPS
53) COMMENTS

The fields above are listed in the order that they appear in the tables. The two *{Record Counter}* fields (in the Field Visit History and Analysis tables) are automatically updated by the computer. Further documentation on each field is located on the following pages.

General Rules regarding Valid Data:

The data in the computerized database is a subset of the information found on site records, monitoring and update sheets, testing records, LEO/ARPA violation reports, isolate records, etc. It was never our intention to store *all* of the available data in the computer. The data that we have entered into the computer are there specifically to allow for rapid querying and analyses of certain management and/or scientific variables. Therefore, to acquire all the information related to a site or project, the site record, isolate record, or project report and other paper records should be read. Only data which was documented on paper was entered into the computer. For example, if a visit was made to a site but no update, monitoring, field visit, etc. form was filled out and placed in the site file, then it was not entered into the database. All information contained in the computer database should be immediately verifiable by looking at the site records and the project reports.

Some basic definitions are key to any data base so the users can verify that they are all speaking the same language. The basic site types, or typology, established from this study are a compilation of work and study by the Bureau of Land Management, Prineville District; the U.S. Forest Service, Deschutes National Forest and the Warm Springs Indian Reservation.

- **Artifact**- any object showing evidence of modification or use by humans.
- **Biface**- a chipped stone tool or preform which has two flaked faces and a cutting edge over all or most of its perimeter. *For our use*- an incomplete artifact which can become only one type of a tool when it is finished; e.g. a projectile point preform may be a triangular biface too thin for a knife or scraper but suitable for notching and hafting on an arrow shaft. A stage in lithic reduction.

- **Burial / Grave / Cemetery**- A burial, grave, and or cemetery site is one in which human remains are the predominant feature.
- **Core**- a tool stone piece from which usable flakes have been removed.
- **Cortex**- the outer, unmodified (natural) surface of a stone.
- **Debitage**- flake debris generated during stone tool manufacture.
- **Diagnostic**- indicating a known time period, cultural group, function, or other type of information. Temporally diagnostic- indicating a known time period.
- **Feature** (in anthropological terms)- an artifact or set of artifacts which loses its integrity when moved due to its size and complexity (e.g. fire hearth, house floor, rock cairn, rock art, etc.)
- **Groundstone**- a stone artifact shaped by pecking and grinding. Larger groundstone artifacts such as mortars and pestles or metates and manos were most often used for grinding plant foods.
- **Isolate**- any single artifact or group of artifacts which does not meet the minimum criteria for a site. In other words, 9 or fewer artifacts and NO features. Artifacts must be at least 50 years old to qualify as historic or prehistoric.
- **Lithic Scatters**- Lithic Scatter Sites are generally evidenced by chipped stone tools and or flakes, and occasionally by plant-processing equipment (mano, metates, mortars and pestles). These particular sites are abundant in Deschutes County because of the high concentration of obsidian and basalt flows. They are found in many different topographical locations, and frequently contain buried archaeological materials. Many are found near water, though others are located up to 10 miles away from major water resources. Because these sites are frequently found in areas which lack features (such as water, raw materials or shelters) commonly associated with prehistoric sites, it is difficult to predict where these sites might be found. The various types of Lithic Scatter sites have been broken down into the following categories: (1) Lithic Scatter Reduction, (2) Lithic Scatter with Flake Tools, (3) Lithic Scatter with Ground Stone, (4) Lithic Scatter w/Flake Tools and Ground Stone, and (5) Lithic Scatter w/Features.
- **Projectile point**- often called "point"; chipped stone tool (biface) worked to a point on one end and worked into a shape suitable for hafting on the opposite end; many projectile points are temporally diagnostic.
- **Reduction** (lithic)- stone tool manufacture (flintknapping).
- **Resource Gathering / Procurement**- Resource Gathering and Procurement sites are associated with the exploitation of lithic, plant and animal resources. Materials acquired by this task were used for hunting, cooking, clothing, medicine, and habitation. They include (1) Lithic Sites, (2) Flora Sites, and (3) Fauna Sites. Most lithic sites are associated with Quarrying / Workshops. These sites are comparatively abundant in Deschutes County (Scott 1984:18). Some 29 discrete obsidian flows are located with the County boundaries, and numerous prehistoric quarrying and workshop sites are immediately adjacent to or near these flows (Skinner 1938). Obsidian flows are generally concentrated in the mountains and upland foothills of the region. These lithic sites are generally associated with the extraction of lithic materials. Quarry and workshop sites have been further broken down into four subgroups for easier identification as to the type of material that is being extracted. They are as follows: (A) Basalt, (B) Obsidian, (C) CCS (crypto, crystalline, and silicate), and (D) Minerals. Floral gathering areas have been broken down into two categories: (A) Peeled Trees, and (B) Roots. The uses of peeled trees can be further divided for use as (1) Food or (2) Fiber. Faunal gathering areas have been divided into two sections: (A) Shell Midden or (B) Fishing Stations. Shell Middens are sites that exhibit evidence of the accumulation of shellfish shells as the result of the harvesting of clams, oysters, and muscle shells. Fishing Stations are those sites that are known to have been associated with the harvest and procurement of fish species through hook/line, net, spear and/or fish weir fishing systems.
- **Rock Art**- Rock Art has one or more elements pecked, ground or painted on a rock surface, usually on a boulder or outcropping. Rock Art falls under two subcategories: (1) Petroglyphs which are carved into the rock face to create a relief, or (2) Pictographs which are painted designs on a smooth rock surface. Rock Art is typically found near water courses, in caves / rockshelters and lava tubes, and along rimrock of suitable stone surfaces, including large boulders at the bases of talus slopes, and along the edges of valley floors. Previous studies show that in Deschutes County pictographs are more frequently found than petroglyphs. They are usually painted with orange paint composed of a mixture of hematite and

water or fat (Scott 1984:19). Common pictograph design motifs in the County include tally marks, abstract forms and human and animal like figures (Cressman 1937). Pictographs are thought to represent events, counts (of game, seasons or days), signatures, or magic. Some may even be artistic representations of Native American life.

- **Rock Features-** Rock Features are considered humanly modified and/or placed boulders, rocks and stones into distinct patterns. For purposes of data collection and study Rock Features have been broken down into two groups, (1) Rock Alignments and (2) Cairns. Cairns are usually considered stacks of rocks, typically in pyramidal form, used to mark the locations of trails or used to mark spiritual locations. Rock Alignments have been broken down even further into three subgroups: (A) Circular, (B) Linear, and (C) Depressions.
- **Rock Shelters / Caves-** On the High Lava Plains these features are usually part of lava tubes or a lava tube system. Typically found along river canyons and rimrocks, these sites were used for habitation, storage and/or human burial locations. Rock shelters and caves are bounded on at least one side and covered at least partially overhead by a rock outcropping. They often contain dark organic stained stratified soils and preserved perishable cultural debris (Hanes 1992:5).
- **Site-** the current definition of a Site is: a minimum of ten or more artifacts found within a 10 x 10 meter area. Any feature (using the archaeological definition) qualifies as a Site. Artifacts must be a minimum of 50 years old to qualify as historic or archaeologic.
- **Traditional Cultural Property-** Traditional Cultural Properties are sites that are associated with the traditions, beliefs, practices, lifeways, arts, crafts, and social institutions of Native American peoples. These sites are rooted deep within the tribal history and are considered important in maintaining the continuing cultural identity of that group or tribe. traditional Cultural Properties have been subdivided into four groups: (1) Bulletin 38, (2) Sacred Site, (3) Ethnographic Village, and (4) Ethnographic Trail.

Descriptions for each Field:

ArchSite Table:

The ArchSite table is the "main" table in the Heritage database. It stores administrative and scientific data about each site. Information in this table, once entered, is relatively stable and only changes when new information or administrative conditions arise.

1) CR_SITE#

This is the 8 digit number that has been assigned as the **key** attribute/name/identifier of each archaeological and historic site. When a site is entered into GIS, it is assigned the exact same number (CR_SITE#) as it has in the database. The CR_SITE# is the link between GIS/map entities (points, polygons, lines) and their associated records in the database. An entry is required, and each CR_SITE# MUST be unique. No duplicates will be allowed.
The FS numbering convention is: 1st digit (Region); 2nd digit (Forest); 3rd digit (Ranger District); the last 5 digits (unique number for each site- starting at 00001). Example: 61200113.

For BLM, the numbering convention is: 1st digit (5 designates BLM); 2nd digit (District); 3rd digit (Area); 5th digit (County); the last four digits (unique number for each site). We received no direction about BLM numbering conventions, so we assigned Prineville District BLM numbers as follows: 5 (for BLM), 1 (for Prineville), X (Area: 2 for CORA, 1 for DRA, and 3 for unknown), X (for the county: 1 for Deschutes, 2 for Lake. 3 for Jefferson, 4 for Crook, 5 for Sherman, 6 for both Grant and Wheeler, 7 for Wasco, 8 for Gilliam, 9 for Harney, and 0 for both Klamath and unknown), and incremental numbers for the rest. Example: 51110001. Numbers for Deschutes County begin with 9.

2) NRHP_STATUS

Site status, as determined by the criteria for the National Register of Historic Places. An entry is required in this field. If codes E, L, N are not applicable, or you are unsure of which code to use, enter U. When using the data entry form, pick an option from the pull-down list.

Code	Description
E	Eligible
L	Listed
N	Not Eligible
U	Unevaluated

3) REMINDER

Field used for management purposes; a flag/reminder of work that needs to be done. This field is intended to help archaeologists organize their work; sites can be tagged using these codes and then, using queries to compile lists, field or office work can be planned, work days can be estimated, etc. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Code	Description
DAT	Needs datum
GIS	Needs GIS update/edit
ISO	Site should be an Isolate.
MAP	Needs map
MON	Needs monitoring
NON	None
OFW	Needs other field work
OPW	Needs other paper work
RMS	Needs to be removed as a site
SRP	Needs site report
TAG	Needs tags
TST	Needs testing
UPD	Needs update
VER	Needs field verification

4) THREATS

Identify the primary threat to site integrity. The appropriate answer is based upon the archaeologist's knowledge of past impacts to the site and its surrounding area, present impacts to the site and surrounding area, and both specific known future impacts and general trends for future use/impacts to the site itself and its surrounding geographic area. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Code	Description
00	No Data/Agent unknown
04	Multiple Agents
08	Partial/Full excavation
11	Water/Inundated
14	Weathering
15	Erosion
20	Vandalization - Surface Collected
21	Vandalization - Potted
22	Vandalization - Dismantled/removed
23	Vandalization - Altered
24	Vandalization - Destroyed (human action)
30	Road
31	Trail
32	Utilities
33	Logging
34	Railroad
37	Recreation: non-motorized
38	Recreation: motorized
39	Campground
40	Animal/grazing
98	None

99	Other

5) ARTIFACT_LOCATION

Field to track the location of collected artifacts. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Code	Description
DISP	On display
DSHC	Deschutes Historical Center
FSDS	Deschutes National Forest
LABS	Located at a laboratory
MUL	Multiple locations
NONE	No artifacts collected
OSM	Oregon State Museum of Anth.
OSUV	Oregon State University
OTHR	Other location
UCOL	Unknown whether artifacts were collected
ULOC	Location of artifacts is unknown

6) DIAGNOSTIC

Were the artifacts found at this site (whether collected or not) **temporally diagnostic**?
In general, historic artifacts are *diagnostic* if they (the artifacts themselves) identify an absolute date. For example, a cement bridge with the date of construction imprinted in the cement or a "Cy Bingham tree" (Cy Bingham is a well-known historical figure) with the date carved into the bark or wood. Most historically diagnostic artifacts will have some reference in literature.

In general, prehistoric artifacts are *diagnostic* when studies have been done tying that particular artifact type to a certain time frame. In Central Oregon, diagnostic prehistoric artifacts usually means projectile point typology; therefore use code Y (yes) for artifacts (points) which match established point typologies; use code U (unknown) for artifacts (points) which do not match established typologies, for all points with intact bases (except those which can be coded Y), or when the recorder is unsure; and use code N (no) for all other artifacts.
One space is allowed for the answer; Y (yes), N (no), or U (unknown). An entry is required in this field.

7) PHOTOS?

Were sketches or photos made of **artifacts** (whether collected or not)? Answer Y (yes) *only* if the sketches or photos are of the ***ARTIFACTS*** (such as obsidian flakes, projectile points, glass bottles, a cabin, etc.) themselves. Photos of the datum tree, the site from a distance, or sketches of the site from plan view, etc. are coded N (no).
One space is allowed for the answer; Y (yes), N (no), or U (unknown). If Y (yes), then the sketches or photos should be located in the site record or some other easily referenced location (if not in the site record, note location in comments field). An entry is required in this field.

8) CULTURAL_PERIOD

Cultural period during which the site was utilized. This field is used to identify the general ***time frame*** of site development.

Multi-component options (codes 71, 72, and 73) are used to designate sites which display evidence of human occupation from *more than one time period.* For example, at prehistoric sites evidence of muti-component occupation could be finding, in context, several projectile points some of which match the established typology for the Paleolithic period and some which match the typology for the Late Archaic period. Another example is finding, during excavation, several distinct occupation layers (strata) which are separated by a thick layer of intact Mazama ash.

To code a historic site as multi-component, there must be a *distinct and significant* amount of time between occupations/usage. An example of this might be a single site which displayed evidence of a historic wagon road (used around 1850 and then abandoned) and a historic railroad grade built around 1920.

Be as specific as possible. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Code	Description
00	Unknown
10	Paleo (10,500 BP or earlier)
20	Archaic (Specific period not established)
21	Early Archaic (10,500 BP - 7,000 BP)
22	Middle Archaic (7,000 BP - 2,000 BP)
23	Late Archaic (2,000 BP - Contact)
50	Historic Indian
51	Historic European
52	Historic Chinese
70	Multicomponent (Historic/Prehistoric)
71	Multicomponent (Prehistoric)
72	Multicomponent (Historic)
73	Historic (Unknown)
74	Prehistoric (Unknown)

9) DATING_METHOD(PERIOD)
Method by which the Cultural Period was determined. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Code	Description
AT	Artifact type
HR	Historic Record
MZ	Post-Mazama
NO	None
OH	Oral History
OT	Other
PM	Pre-Mazama
PT	Point Typology

10) ABSOLUTE_DATE
Absolute dates are determined either by historic records or chronometric analysis (specifically; Carbon 14 isotope ratios or dendrochronology). If an absolute date is entered for a site and was determined by chronometric methods rather than by historic records, there should be an associated record in the Analysis Table detailing the analysis and its results.

- Absolute date is stated in years before present (B.P.). Present is equivalent to 1950. Enter the date only (+/- values are <u>not</u> recorded). If a number of C14 analyses return a range of dates: use the oldest date or the date that best reflects the age of the Site, as a whole.
- If the Site has multiple components, use the oldest reliable absolute date.

Note this field may be left empty. However, if an entry is made, it must fill 5 spaces. Use leading zeros, if needed; for example: 00900.

11) DATING_METHOD(ABSOLUTE)
Method by which the Absolute Date was determined. An entry is required in this field. If an Absolute Date (above) is not entered, then enter the code NO (none). When using the data entry form, pick an option from the pull-down list.

Code	Description
DE	Dendrochronologic
HR	Historic Record
NO	None
RM	Radiometric

12) SITE_TYPE

Describes what "kind" of artifacts/features were noted at the specific location. This is not site function (which is captured in the "Inferred Function" fields discussed on page 14 and 15), but a categorization of the culturally modified materials actually found at the site. Be as specific as possible, if code 99 (Other) is used or if more than two site types are needed to adequately describe the site, place additional information in the comments field. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Code	Description
00	No Data
01	Rockshelter/Cave
02	Rock Alignment- Circular
03	Rock Alignment- Linear
04	Rock Alignment- Depressions
05	Rock Cairns
10	Quarry- Basalt
11	Quarry- Obsidian
12	Quarry- CCS
13	Quarry- Minerals
15	Peeled Trees- Fiber
16	Peeled Trees- Food
17	Root Gathering Area
18	Shell Midden
19	Fishing Station
20	Burial/Grave/Cemetery
30	Petroglyph
31	Pictographs
40	Lithic Scatter Reduction
41	Lithic Scatter w/ Flake Tools
42	Lithic Scatter w/ Ground Tools
43	Lithic Scatter w/ both Flake Tools and Ground Stone
44	Lithic Scatter w/ Features
50	Bulletin 38
51	Sacred Site
52	Ethnographic Village
53	Ethnographic Trail
60	Trail
61	Road
62	Bridge
63	Cabin
64	Hunters' Shelter
65	Sawmill
66	Railroad Grade/Trestle
67	Logging Camp
68	Historic Camp/Community
70	Flume
71	Ditch
72	Dam/Intake
75	Mine/Adit
76	GLO Survey
80	Lookout
81	Guard Station
82	Ranger Station
84	Lodge/Resort
85	Picnic/Community Kitchen/Other Developed Recreation Facility
86	Grazing Camp
87	Fence/Corral
88	Stock Driveway/Corridor
89	Trap set/line

90	Dendroglyphs
91	Non-residential wood structure
92	Historic wood- purpose unknown
95	Trash Dump
99	Other

13) SITE_TYPE2

Same description and codes as used for SITE_TYPE above; this field is used to record a second site type code. For example: the primary site type was a rockshelter, but there were also pictographs found on the same site. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

14) INFERRED_FUNCTION

Use this field to identify the mostly likely function of this site. The appropriate answer is based upon the archaeologist's knowledge of the site and use patterns in the surrounding geographical area. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Code	Description
00	No data/Unknown
03	Temporary Camp/Overnight
04	Base Camp
05	Habitation
07	Resource Gathering/Procurement- vegetable
08	Resource Gathering/Procurement- mineral
09	Resource Gathering/Procurement- animal
10	Spiritual Site
14	Tool Manufacture/Chipping Station
15	Cache
19	Historic Exploration
20	Historic Residence
21	Historic Homestead
22	Historic Animal Herding/Care (sheep, cattle, etc.)
23	Historic Logging
24	Historic Mining
25	Historic Trapping
26	Historic Hunting
27	Historic Logging Camp
28	Historic Community
29	Historic Utilities
30	Historic Irrigation
31	Trash Dump only
33	Travel: Non-motorized
34	Travel: Motorized
40	Land Administration
41	Forest Administration
42	Fire Prevention
45	Military Purposes
99	Other

15) FUNCTION2

Same description and codes as used for INFERRED_FUNCTION above; this field is used to record a second function either for a second site type or to further define the inferred uses of the site. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

16) BASIN

This field stores the major hydrologic drainage basin, as defined by the State of Oregon Water Resources Department, in which the site is located. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Basin	Description
DS	Deschutes
GO	Goose/Summer Lakes
JD	John Day
MA	Malheur
ML	Malheur Lake
OT	Other
UN	Unknown

17) SUB_BASIN

This field stores the more localized hydrologic drainage basin, as defined by the State of Oregon Water Resources Department, in which the site is located. Most basins contain a series of sub-basins which are the next step down in the stream hierarchy. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Sub Basin	Description
00	No data/unknown
01	Upper Deschutes
02	Middle Deschutes
03	Lower Deschutes
04	Upper Crooked River
05	Lower Crooked River
11	Upper John Day
12	Middle John Day
13	Lower John Day
14	South Fork John Day
15	Middle Fork John Day
16	North Fork John Day
99	Other

18) PROVINCE

This field stores the physiographic province in which the site is located. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Phys. Prov.	Description
00	No data/unknown
01	Basin/Range
02	Blue Mountains
03	Cascades
04	Coastal Plain
05	Coast Range
06	Deschutes/Umatilla Plateau
07	High Lave Plain
08	Klamath Mountains
09	Owyhee Uplands
10	Snake River Canyon
11	Willamette Valley
99	Other

19) ELEVATION

This field stores the elevation, *in feet*, of the site location. An entry is not required. Five spaces are allotted; if an entry is made it must use five spaces, use leading zeros as needed. For example, an elevation of 2250 feet is entered as 02250. Generally elevation is taken from USGS 7.5' quad maps and interpolated from the nearest two enclosing contour lines for the site location. If the site is large enough to have a range of elevations, record the highest elevation for the site's location. For example, 3200-3240' would be recorded as 03240'.

20) SLOPE

This field stores the slope, *in percent*, of the site location. An entry is not required. Three spaces are allotted; if an entry is made it must use three spaces, use leading zeros as needed. For example, a slope of 5 percent is entered as 005. If the slope for the site was recorded as a range of values, enter the steepest value. For example, 5-10% would be recorded as 010%.

21) ASPECT_DEGREES

This field stores the aspect, *in compass degrees from North*, of the site location. An entry is not required. Three spaces are allotted; if an entry is made it must use three spaces, use leading zeros as needed. For example, an aspect of 90 degrees (due east) is entered as 090. If the aspect has not been collected as an azimuth in compass degrees, leave this field empty.

22) WATER_DIST

This field stores the distance, *in meters*, from the site to the nearest source of water. An entry is not required. Five spaces are allotted; if an entry is made it must use five spaces, use leading zeros as needed. For example, a distance of 210 meters is entered as 00210.

23) PRIMARY_LANDFORM

This field stores the dominant landform at the site location. While the Secondary Landform refers to the site's immediate setting, the Primary Landform refers to the site's general geographic/topographic setting. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Primary Landfrm	Description
00	No data/Unknown
01	Badland
02	Butte
03	Canyon
04	Coastal Plain
05	Flat Plain
06	Hill
07	Island
08	Mesa/Tableland
09	Mountain
10	Rolling Plain
11	Valley
99	Other

24) PRIM_POSITION

This field stores the site's position on the dominant landform. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Primary Pos.	Description
B	Base
E	Edge
F	Floor
O	Other
S	Slope
T	Top
U	Unknown

25) SECOND_LANDFORM

This field stores the smaller, or minor, landform at the site location. The Secondary Landform refers to the site's immediate topographic setting, while the Primary Landform refers to the site's general geographic/topographic setting. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

2nd Lndfrm	Description
00	No data/Unknown
01	Alluvial Fan
02	Arroyo/Gully
03	Beach
04	Bench
05	Bluff
06	Cliff
07	Dune
08	Estuary
09	Flood Plain
10	Headland
11	Hill
12	Intermit. Stream
13	Lake
14	Marsh
15	Meadow
16	Mountain
17	Playa
18	Ridge
19	Rimrock
20	River
21	Seep
22	Spring
23	Stream
24	Talus Slope
25	Terrace
41	Swale
42	Slope
99	Other

26) SECND_POSITION
This field stores the site's position on the secondary landform. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

2nd Position	Description
BA	Base
CO	Confluence
CR	Crest
ED	Edge
FL	Floor
OT	Other
SA	Saddle
SL	Slope
TP	Top
UN	Unknown

27) GPS
This field tracks whether or not the *site location in GIS* has been determined by GPS (Global Positioning Satellite). One space is allowed for the answer; Y (yes) or N (no). An entry is required in this field. Small sites (2 acres or less) will be GPSed as point type features, with the point being taken at the center of the site boundary. Larger sites (more than 2 acres in extent) will be GPSed as polygon type features, with the site perimeter being GPSed. Linear sites will be GPSed as linear type features, with the line running along the (imaginary) center-line of the site. Because the potential for accuracy is so much greater with GPS as compared to manual recording and input techniques, the data is, in essence, not comparable. It is important to be able to distinguish the method of determining the site's location as it is recorded in GIS.

28) COMMENTS
This alpha-numeric field can be used to track data that does not fit into any of the above fields. Any text type entry is allowed; space is limited to about one short paragraph. This field may be left blank. Note: the computer cannot search or query on data in this field.

Numbers Table:

The Numbers table, as the name implies, tracks identifying numbers and names for each site. As in the ArchSite table, the information in this table is relatively stable and changes only when new numbers (such as SHPO trinomials) are assigned or sites are split or combined.

1) CR_SITE#
This is the 8 digit number that has been assigned as the **key** attribute/name/identifier of each archaeological and historic site. The CR_SITE# field is the **link** between the four "site-related" tables in the Heritage database. It is also the link between sites in the database and features (points, lines, and polygons) in GIS. In order to establish the link between the data related to a certain site stored in the Numbers table and the data for the same site stored in GIS or any of the other tables, for example the ArchSite table, the CR_SITE# must be exactly the same in all locations.

An entry is required in this field and should match an already existing entry in the ArchSite table. The computer will not allow a site to be entered into the Numbers table before the site has been entered into the ArchSite table. If initial data entry is being done on the Site data entry Form, then once the CR_SITE# (Site #:) field has been filled in, all other data can be entered. We strongly urge the use of the data entry forms for all data entry and editing.

2) TRINOMIAL
This field tracks numbers assigned by SHPO to prehistoric sites. It may be left empty. If used, there are 10 spaces and any entry must conform to the following format: ##LL?##### where # equals any number, L equals any capitalized letter, and ? equals either a space or a capitalized letter. The ? is replaced by a letter if the abbreviation for the county in which the site is located is three letters long, otherwise insert a space (use the space bar on the keyboard). SHPO format uses the first two numbers to designate the state in which the site is located, the following three spaces/letters to designate the county in which the site is located, and the remaining five numbers to identify the specific site. Examples are 35DS 00345 and 35LIN00112. DO NOT insert an extra zero instead of either the space or third letter! All letters must be entered in CAPS!!!

3) 2ND_TRINOMIAL
This field tracks numbers assigned by SHPO to historic sites. It may be left empty. If used, there are 10 spaces and any entry must conform to the following format: ?????##### where # equals any number and ? equals either a space or a capitalized letter. SHPO format uses the first two spaces/letters to designate the state, the following three spaces/letters to designate the county in which the site is located, and the remaining five numbers to identify the specific site. The fifth ? is replaced by a letter if the abbreviation for the county in which the site is located is three letters long, otherwise insert a space (use the space bar on the keyboard). Examples are ORDS 00345 and ORLIN00112. DO NOT insert an extra zero instead of either the space or third letter! All letters must be entered in CAPS!!!

4) ID_NUMBER1
In-house identifying number; for the FS it is usually in the format 499FRD87P. For Deschutes County, this field has been renamed TAX_LOT# and is used to track the primary county tax lot upon which a site is located. For the BLM, this field is used to track BLM in-house identifying number. There are 16 spaces allowed and an entry is not required. No particular format is required; however <u>consistency</u> is essential when querying. In general the FS has removed all dashes (use of dashes was inconsistent even within a single site record) and, in the case of multiple in-house numbers, attempted to maintain a common format within each ID number field. For example, on the Deschutes NF a large number of sites have been given two identifying numbers in the following formats: 499FRD87P and 84-112. All the numbers conforming to the first format have been placed into the ID_NUMBER1 field and all the numbers conforming

to the second format (84-112) have been placed in the 2ND_FS# field (described below). Complying with this rule of consistency greatly increases both human and computer querying efficiency.
PLEASE NOTE: letters must be entered in all CAPS!!!

5) 2ndFS#
This is a second field for tracking in-house identifying numbers. There are 12 spaces allowed and an entry is not required. No particular format is required; however consistency is essential when querying. Please see the documentation for ID_NUMBER1 for further information.
PLEASE NOTE: letters must be entered in all CAPS!!!

6) 3rdFS#
This is a third field for tracking in-house identifying numbers. There are 12 spaces allowed and an entry is not required. No particular format is required; however consistency is essential when querying. Please see the documentation for ID_NUMBER1 for further information.

7) 4thFS#
This is a fourth field for tracking in-house identifying numbers. There are 12 spaces allowed and an entry is not required. No particular format is required; however consistency is essential when querying. Please see the documentation for ID_NUMBER1 for further information.

8) 5thFS#
This is a fifth field for tracking in-house identifying numbers. There are 12 spaces allowed and an entry is not required. No particular format is required; however consistency is essential when querying. Please see the documentation for ID_NUMBER1 for further information.

9) 6thFS#
This is a sixth field for tracking in-house identifying numbers. There are 12 spaces allowed and an entry is not required. No particular format is required; however consistency is essential when querying. Please see the documentation for ID_NUMBER1 for further information.

10) SITE_NAME
Many sites are given a descriptive name, for example Devil's Lake Pictograph, and are often more easily recognized by these names than by their ID numbers (above). This field tracks names given to sites. An entry is not required. If an entry is made, 35 spaces are the maximum allowed. No particular format is required.

11) PROJECT_NAME
On the Deschutes NF, the majority of sites have been found during cultural resource inventory done for large timber sale projects. The newly found or revisited sites are then referenced in the project report to SHPO. It is our intention to establish, as much as possible, a bibliography of reference materials for each site on our forest.

Each (recent) site record lists the name of the project(s), if applicable, for which the inventory was done. Collecting the names of projects related to each individual site, where possible, is the first step in establishing a link between the information in the Project table (including SHPO bibliography #) and sites. This field is temporary; when all project names are collected their CR_PROJECT# (see below) will be entered and this field will no longer be needed and will then be deleted. At that time, the linking field, CR_PROJECT#, will allow querying in two directions- 1) a user specified site can access all related project information (including SHPO biblio#) or 2) a user specified project can access all related sites and their data.

An entry is not required. If an entry is made, 50 spaces are the maximum allowed. No particular format is required. Enter the name of all projects associated with each site; use the slash (/) to separate multiple names. Because project names often are very similar to each other, record the entire name as it appears in the site record. Use abbreviations only when space is limited and the full name will not fit.

This field does not appear on the Site data entry form. The data can only be entered into the table directly. We strongly urge that this data be collected on paper and data entry directly into the table be done only by a person well experienced with MS Access databases.

12) CR_PROJECT#1
This field is used to track the CR_PROJECT# assigned to the cultural resource inventory project in which the site was found, revisited, monitored, etc. This field is the linking field between Site data and Project and Survey data, including the SHPO bibliography number assigned to the project.

The numbering convention is: 1st digit =Region; 2nd digit = Forest; 3rd digit = Ranger District; 4 digits = unique number for each Project; followed by a capital P. The CR_Project# is the FS project report number. Example: 6120001P.)

13) CR_PROJECT#2
This field is used to track the CR_PROJECT# assigned to a second cultural resource inventory project in which the site was found, revisited, monitored, etc. This field is a linking field between Site data and Project and Survey data, including the SHPO bibliography number assigned to the project.

The numbering convention is: 1st digit =Region; 2nd digit = Forest; 3rd digit = Ranger District; 4 digits = unique number for each Project; followed by a capital P. The CR_Project# is the FS project report number. Example: 6120001P.)

14) CR_PROJECT#3
This field is used to track the CR_PROJECT# assigned to a third cultural resource inventory project in which the site was found, revisited, monitored, etc. This field is a linking field between Site data and Project and Survey data, including the SHPO bibliography number assigned to the project.

The numbering convention is: 1st digit =Region; 2nd digit = Forest; 3rd digit = Ranger District; 4 digits = unique number for each Project; followed by a capital P. The CR_Project# is the FS project report number. Example: 6120001P.)

Field Visit History:

The Field Visit History table tracks information collected on field visits to each site. This table is different from the two discussed above in that it stores multiple records which are linked to a single site. *You enter a separate record for each field visit that was documented on paper.* For example, if "site 1" has three documented field visits, then it would have three records in the Field Visit History table. If "site 2" had only one documented field visit, then it would have one record in the Field Visit History table.

By collecting specific data on each visit to a site, we hope to identify changes to site condition over time. Additionally, when changes to site condition over time are analyzed on the Forest as a whole, we hope to identify trends that will help us determine management priorities.

As mentioned in the "General Rules regarding Valid Data" section, only data which is recorded on paper and located in the site file should be entered into this table.

1) VisitID# *{record counter}*
This field is used solely by the computer- do NOT ALTER IN ANY WAY. DO NOT enter or edit data in this field. When using the data entry form, this field is not displayed nor available.

2) CR_SITE#

This is the 8 digit number that has been assigned as the **key** attribute/name/identifier of each archaeological and historic site. The CR_SITE# field is the **link** between the four "site-related" tables in the Heritage database. It is also the link between sites in the database and features (points, lines, and polygons) in GIS. In order to establish the link between the data related to a certain site stored in the Field Visit History table and the data for the same site stored in GIS or any of the other tables, for example the ArchSite table, the CR_SITE# must be exactly the same in all locations.

An entry is required in this field and should match an already existing entry in the ArchSite table. The computer will not allow a site to be entered into the Field Visit History table before the site has been entered into the ArchSite table. If initial data entry is being done on the Site Form, then once the CR_SITE# (Site #:) field has been filled in, all other data can be entered. We strongly urge the use of the data entry forms for all data entry and editing.

3) VISIT_DATE

This field stores the dates of all documented field visits to each site. An entry is not required; however if an entry is made it must conform to the following format: MM/DD/YY, where MM is two spaces for the month, DD is two spaces for the day of the month, and YY is two spaces for the year. Examples are: 12/3/94 and 9/23/90.

In some cases (usually on older visit documentation) the date of a visit was not recorded at all or was incompletely recorded. If no date is available, then leave the field empty. If an incomplete date was recorded, replace the missing information (month and/or day) with a 1. For example, if the visit date is recorded as June '87, then the date entered into the computer becomes 6/1/87. If the visit date is recorded as 1987, then the visit date becomes 1/1/87. The computer will not accept partial dates.

4) VISIT_TYPE

This field stores the type of field visit made, or the purpose for visiting the site. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

The code MONT is used to indicate a visit to an existing site, the primary purpose being to monitor an on-going project, such as road construction or digging sewer lines. The code UPDA is used to indicate a visit to an existing site, the primary purpose being a check of the site condition.

The code TSTI refers to subsurface testing for which a formal research design has not been prepared. This could include shovel probes and other exploratory excavations. The code TSTF refers to subsurface testing for which a formal research design has been prepared.

Codes	Description
ARPA	ARPA
DATA	Data Recovery
INTP	Interpretation
MONT	Monitoring
OTHR	Other
RECD	Recording
STAB	Stabilization
STWD	Site Steward Visit
TSTF	Testing- formal
TSTI	Testing- informal
UKNW	Visit Type Unknown
UPDA	Update

5) COND_CODE

This field tracks Site condition as noted during each field visit. An entry is required in this field. When using the data entry form, pick an option from the pull-down list. This data is an estimate of the percent of the total site area which has suffered damage. Consider the *total site extent* when estimating the percent that has been damaged. The first time a site is recorded, factor in all damages the site area. On subsequent visits record only new impacts (not previously recorded); if no new impacts have occurred then use code 06 (same condition as last visit).

Code	Description
00	No data; condition unknown
01	Excellent; = or < 5% damage overall to Site.
02	Good; Site damage > 5% and < 40%.
03	Fair; Site damage = or > 40% and < 60%.
04	Poor; Site damage = or > 60% and < 95%.
05	Destroyed; Site damage = or > 95%.
06	Same condition as last visit.
99	Other

6) AGENT
This field is used to identify the impacting agent or cause of damage to the site condition. An entry is required in this field. When using the data entry form, pick an option from the pull-down list. If code 04 (multiple agents) is used, list the agents in the COMMENTS field for that visit.

Code	Description
00	No Data/Agent unknown
04	Multiple Agents
08	Partial/Full excavation
11	Water/Inundated
14	Weathering
15	Erosion
20	Vandalization - Surface Collected
21	Vandalization - Potted
22	Vandalization - Dismantled/removed
23	Vandalization - Altered
24	Vandalization - Destroyed (human action)
30	Road
31	Trail
32	Utilities
33	Logging
34	Railroad
37	Recreation: non-motorized
38	Recreation: motorized
39	Campground
40	Animal/grazing
43	Fire
98	None
99	Other

7) COND_PERCENT
Percent of site total affected by the impacting agent(s) listed above. Surface and sub-surface manifestations must be considered. If a site has not been tested and it is unknown if a sub-surface component exists, then factor the damaged area as a percent of the total surface site extent. If a sub-surface component is known to exist, then factor the damaged area as a percent of the total surface area and sub-surface area.

An entry is not required. However, if an entry is made it must use three spaces; use leading zeros as needed. For example. 25% would be 025.)

8) ARTIFACTS_COLLECTED
This field is used to track whether or not artifacts were collected on each visit. An entry is required. One space is allotted and allowable answers are Y, N, or U- where Y equals yes (artifacts **were** collected on this particular visit), N

equals no (artifacts **were not** collected on this particular visit), U equals unknown (it is unknown whether or not artifacts were collected on this particular visit).

It is our goal to add a table to the database which will store information specific to collected artifacts (descriptive information, accession numbers. etc.) and the data contained in this field will then help us locate and describe collected artifacts.

9) VANDALIZED?
This field is used to track whether or not vandalism has occurred at a site ***since the last recorded visit***. An entry is required. One space is allotted and allowable answers are Y, N, or U- where Y equals yes (*previously unreported vandalism has occurred* since the last visit), N equals no (*no new vandalism was noted* on this particular visit), U equals unknown (it is unknown whether or not previously unreported vandalism was noted on this particular visit).

PLEASE NOTE: only previously unreported vandalism is recorded as Y. In order to answer this question correctly, the documentation for previous visits to a site must be reviewed before going to the field.

Vandalism is arguably the number one threat to our resource. We hope to use this data to identify patterns or trends of vandalism over time for a single site and for the Forest as a whole, and thereby determine management strategies to help alleviate the problem.

10) COMMENTS
This alpha-numeric field can be used to track data that does not fit into any of the above fields. Any text type entry is allowed; space is limited to about one short paragraph. Common entries are: a list of specific impacting agents where code 04 (Multiple agents) was recorded in the "Impacting Agent" field, a list of collected artifacts, a list of artifacts which were noted in the field but not collected, recommendations for treatment, etc. This field may be left blank. Note: the computer cannot search or query on data in this field.

Analysis Table:

The Analysis table tracks information regarding formal laboratory analyses performed on materials from a particular site. This table is similar to the Field Visit History table in that it stores multiple records which are linked to a single site. It is not our intention to store every detail related to analyses, but rather to provide a summary of analyses performed and the results. Therefore, analyses **of the same type** and yielding the **same results** should be entered as a single record. For example, if 10 obsidian samples were sent to a lab for sourcing (Xray fluorescence) and 9 samples were sourced to Glass Buttes and one sample was sourced to Obsidian Cliffs, then 2 records would be entered into the Analysis table- one recording Glass Buttes as the result and one recording Obsidian Cliffs as the result. PLEASE NOTE: when a number of analyses are combined into a single record as described above, note the number of samples in the comments field for that record.

As mentioned in the "General Rules regarding Valid Data" section (page 2), only data which is recorded on paper and located in the site file should be entered into this table. Note to archaeologists: We need to have some policy regarding how to locate documentation of analyses (Bibliography??). If biblio, perhaps we should add a biblio# field in the analysis table to facilitate location of the reference work and require an entry in the Biblio table...???

1) ANALYSIS_ID# *{record counter}*
This field is used solely by the computer- do NOT ALTER IN ANY WAY. DO NOT enter or edit data in this field. When using the data entry form, this field is not displayed nor available.

2) CR_SITE#
This is the 8 digit number that has been assigned as the **key** attribute/name/identifier of each archaeological and historic site. The CR_SITE# field is the **link** between the four "site-related" tables in the Heritage database. It is also the link between sites in the database and features (points, lines, and polygons) in GIS. In order to establish the link between the data related to a certain site stored in the Analysis table and the data for the same site stored in GIS or any of the other tables, for example the ArchSite table, the CR_SITE# must be exactly the same in all locations.

An entry is required in this field and should match an already existing entry in the ArchSite table. The computer will not allow a site to be entered into the Analysis table before the site has been entered into the ArchSite table. If initial data entry is being done via the data entry forms, then once the Site Form has been filled in, analysis data can be entered on the Analysis Form. We strongly urge the use of the data entry forms for all data entry and editing.

3) LAB_NAME
Name of the lab that did the analysis. An entry is not required. There are a maximum of 50 spaces allowed and no particular format is required.

4) DATE_DONE
Date that the analysis was performed. An entry is not required; however if an entry is made it must conform to the following format: MM/DD/YY, where MM is two spaces for the month, DD is two spaces for the day of the month, and YY is two spaces for the year. Examples are: 12/3/94 and 9/23/90.

In some cases the date of an analysis has not been recorded at all or was incompletely recorded. If no date is available, then leave the field empty. If an incomplete date was recorded, replace the missing information (month and/or day) with a 1. For example, if the analysis date was recorded as June '87, then the date entered into the computer becomes 6/1/87. If the analysis date was recorded as 1987, then the analysis date becomes 1/1/87. The computer will not accept partial dates.

5) ANALYSIS_TYPE
Type of analysis that was done. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Code	Description
01	Carbon 14/ Radiometric
02	Sourcing- Xray fluorescence
03	Sourcing- Neutron activation
04	Hydration
05	Lithic Analysis
10	Pollen Analysis
11	Macro Floral
12	Macro Faunal
13	Phytolith
14	Flotation
20	Blood Residue
99	Other

6) ANALYSIS_RESULTS
This field stores the results of the analysis. An entry is required in this field. When using the data entry form, pick an option from the pull-down list.

Code	Description
FTROT	Fish; trout
MBOVN	Family BOVIDAE: bison, mt. goats, bighorn sheep
MCATS	Family FELIDAE: mt. lion, bobcat, lynx
MDEER	Family CERVIDAE: elk, mule and whitetail deer, moose

MDOGS	Family CANIDAE: coyote, wolf, fox
MOTHR	Other animal species identified
MPHRN	Family ANTILOCAPRIDAE: pronghorn
MRABT	Family LEPORIDAE: hare, jackrabbit, cottontail
OCOBU	Obsidian Source: Coglan Buttes
OCUMT	Obsidian Source: Cougar Mountain
OGLBU	Obsidian Source: Glass Buttes
OHOBR	Obsidian Source: Horseshoe Bar
OINCR	Obsidian Source: Inman Creek/Salt Creek
OLOCR	Obsidian Source: Long Creek
OMKBU	Obsidian Source: McKay Butte
ONWBY	Obsidian Source: Newberry Volcano (includes all flows)
OOBCL	Obsidian Source: Obsidian Cliffs
OQZMT	Obsidian Source: Quartz Mountain
OSPMT	Obsidian Source: Spodue Mountain
OSYMR	Obsidian Source: Silver Lake/Sycan Marsh
OTHER	Other Obsidian Source
OWHRG	Obsidian Source: Whitewater Ridge
RDATE	Valid date obtained
REPND	Results Pending
RINDF	Results were indefinite or unusable
RNCDE	No current code for these results, see report.
RNDAT	No data
RNRES	No results
RPOSA	Positive animal species ID (multiple species)
RPOSP	Positive plant species ID

7) AGE_BP

This field is used to store valid absolute dates acquired by radiometric analysis. An entry is not required. However, if an entry is made it must fill all 5 spaces, therefore use leading zeros as needed. For example, a carbon 14 sample assigned an age of 2000 years BP, would be entered as 02000.

The date is formatted as some number of years B.P. (where B.P. stands for "before present" and present is considered to be 1950). Each sample which returns a different date/age should be recorded as a separate record.

8) RIND_(HYDRATION)_THICKNESS

This field tracks the results of hydration analyses. Enter the *mean* hydration rind thickness for the sample. Always include, where available, the obsidian source (in the ANALYSIS_RESULTS field) for hydration data. Several samples may be recorded in a single record, as long as the obsidian source is the same and the mean hydration rind is the same.

9) COMMENTS

This alpha-numeric field can be used to track data that does not fit into any of the above fields. Any text type entry is allowed; space is limited to about one short paragraph. Entries could include: obsidian sources not listed in the ANALYSIS_RESULTS field, the number of samples tested for multiple samples being recorded in a single record, a list of plant names from a pollen analysis, etc. This field may be left blank. Note: the computer cannot search or query on data in this field.

Project Table:

The Project table tracks data related to projects which have required input, usually in the form of cultural resource inventories and reports to SHPO, from the Heritage Program. All projects should be entered into the database, regardless of whether SHPO concurred or not. The main table is linked to the Survey table via the CR_PROJECT#. Data from the Project and Survey tables are combined and then linked to our GIS Survey layers. For a detailed description of the Project Table contact the Deschutes National Forest.

Survey Table:

The Survey table stores data related to individual areas which have been surveyed for cultural resources. Each record in this table should have an associated feature in GIS. The current rule is that only those surveyed areas associated with projects which have received SHPO concurrence will be entered into GIS; therefore each surveyed area in this table should have concurrence. For a detailed description of the Survey Table contact the Deschutes National Forest.

Isolates Table:

The purpose of the Isolate portion of the database is to store a number of data elements regarding cultural resource isolates. An Isolate is defined as any single artifact or group of artifacts which does not meet the minimum requirements to be a Site. The current definition of a Site is: a minimum of ten or more artifacts found within a 10 x 10 meter area. Any feature (using the archaeological definition) qualifies as a Site. Additionally, artifacts must be a minimum of 50 years old to qualify as historic or archaeologic. We are currently developing a GIS Isolate layer; the Isolate data table will be linked to the GIS Isolate layer (the GIS Isolate layer will be points only). For a detailed description of the Isolates Table contact the Deschutes National Forest.

Data Standardization Guidelines

The Heritage database system has three main "data" components to it: paper filing system and office procedures, computer database, and GIS. In addition, field data collection, recordation, and input procedures were considered for changes and adjustments. Successful implementation of an automated information system required that all of the above mentioned components be adjusted to work together.

Paper filing systems will be ordered using the Site Number (the CR_SITE# in the database) for sites, the Project# (the CR_PROJECT# in the database) for projects, and the Isolate# (the CR_ISOLATE# in the database) for isolates. The local, or unit, numbering system (a.k.a. temporary number), will be tracked in the database for identification purposes, but the number used by the database and GIS will be used to order the paper files. Please be aware that the CR_SITE#, the CR_ISOLATE# are the linking items between files in the cabinet, records in the database, and features (points, lines, or polygons) in GIS; it is essential to maintain the relationship between the three "data" components by using the CR_ number as the primary identifier within each of the components and the system as a whole. Note: the CR_SURVEY# (assigned to individual surveyed areas within Projects)is the linking number between Project information in the paper files, the database, and GIS.

The data entered into the computer database came from the site files, the project files, and the isolate files. Anything which is not documented on paper in one of those locations was entered into the computer. Note: a future exception to this rule will be the annotated bibliography of reference materials which is still being developed. Any site or isolate which could not be mapped was not entered into GIS or the database.

GIS (Geographic Information Systems)

The Deschutes National Forest, Ochoco National Forest, Deschutes County Public Works, and Prineville BLM currently uses Arc/Info GIS software running on a UNIX platform. All prehistoric site input data was manuscripted at a scale of 1:24,000 on USGS 7.5' quads.

The Deschutes National Forest and Deschutes County currently has two GIS "layers." The existing "layers" are 1) site locations and 2) surveyed, or inventoried, areas. The Deschutes National Forest is preparing to input an isolate "layer." Note that Prineville BLM will adhere directly to the Deschutes National Forest data standards, while Ochoco National Forest has already input some GIS data using somewhat different data standards.

The Deschutes National Forest, Deschutes County and BLM Prineville **SITE** "layer" is composed of three coverage's: #1) points- sites with an area extent of 2 acres or less, #2) lines, and #3) polygons- sites with an area extent of more than 2 acres. The Ochoco NF has not yet begun data entry (into the tabular database), and some issues of data standardization remain to be ironed out.

The **SURVEY** "layer" is composed of multiple, overlapping polygon coverage's. This was necessary because over the course of twenty years of cultural resource inventory, a number of geographic areas have been surveyed more than once and we determined that, due to the differences in transect intervals, probability zones, concurrence, by SHPO, surveyors, etc. it was important to be able to get at the data for each surveyed area. These multiple, overlapping areas will be turned into agency-wide "regions" coverage's in Arc/Info. The **ISOLATE** "layer" is a single point coverage.

The tabular data from the Heritage database in MS Access and is to be linked to the GIS data on the Deschutes National Forest 615 system about once per year. Because the various agencies have our GIS coverage's on their PC's (in ArcView), they can link data in any configuration desired, whenever they desire. A regular update schedule has been proposed: GIS updates will be delivered to the GIS folks twice yearly; the main time will be in early spring (between March 15 and March 30) and a secondary time, if needed, will be in the late fall (between November 15 and November 30). Database updates will be handed in after survey is completed for each project or as often as needed to maintain data quality standards.

CONCLUSIONS

The evaluation of prehistoric resources in Deschutes County has been an impetus for co-operation among Federal, County and private agencies to join efforts in protecting and managing cultural resources. With the 1400+ known archaeological sites, it is clear that the area now encompassing Deschutes County was an important location to many Native American groups. It appears that the region did not however act as a permanent settlement location for Native groups but rather acted as a rich location to support the lifeways of Native American Groups. Large deposits of obsidian, an abundance of large and small game, and fresh mountain lakes and rivers contributed to the Native Americans utilization of the region.

The study of prehistoric sites in Deschutes County has just begun. Only 70 of the 1400 known prehistoric sites are on private land, the rest are on Federal land. Obviously the potential to find additional prehistoric sites on private land is great resulting in the proposed ordinance to require developers to survey their land before ground disturbing activities occur. As an area where many Native American Groups and tribes were passing through and utilizing, the ground within the County as well as a region as a whole offers a unique perspective for archaeological study.

Whether expanding sewers or transportation corridors, or developing properties for business use, developers are often motivated by a bottom line: cost efficiency. Because of this, recognition, preservation and protection of cultural resources are often viewed as burdensome costs and impediments to profit and efficiency, and perhaps rightly so. For native American people however, few things could be less burdensome than connection with and continuation of their cultural resources. This outlook needs to be changed in a positive way to protect, preserve and at the very least, retrieve the cultural resource information before it is destroyed. We know that once lost, prehistoric sites are irretrievable, and in essence could create a significant hole in the understanding of our prehistory as a result. The attached Cultural Resource Clearance Permit Handbook was devised to preserve and gather information about prehistoric people on private land. The Handbook was written in a streamlined, efficient manner, taking a path of least resistance and cost to developers.

Continuing co-operation among the development community, the U.S. Forest Service, the Bureau of Land Management, the State Forestry Department and City and County Governments to protect cultural resources should be a high priority for each organization. Without a joint effort, studies, laws, ordinances, surveys, and management strategies will only be piecemeal in approach and effect. Continuing this combined effort will only bring the protection of prehistoric and historic resources to the forefront of the public eye.

BIBLIOGRAPHY

Aikens, C. Melvin

1970 Toward the Recognition of Cultural Diversity in Basin-Plateau Prehistory. *Northwest Anthropological Research Notes* 4 (1):67-74.

1984 *Archaeology in Oregon*. U.S. Department of Interior, Bureau of Land Management, Oregon State Office. Portland, Oregon.

Aikens, C. Melvin, David L. Cole and Robert Stuckenrath

1977 Excavations at Dirty Shame Rock Shelter, Southeastern Oregon. *Tebiwa, Miscellaneous Papers of the Idaho State University Museum of Natural History* 4. Pocatello, Idaho.

Aikens, C. Melvin, and Dennis L. Jenkins

1994 *Archaeological Researches in the Northern Great Basin: Fort Rock Archaeology Since Cressman.* University of Oregon Anthropological Papers 50. Eugene.

1994 Environment, Climate, Subsistence, and Settlement: 11,000 Years of Change in the Fort Rock Basin, Oregon. In *Archaeological Researches in the Northern Great Basin: Fort Rock Archaeology Since Cressman*, edited by C. Melvin Aikens and Dennis L. Jenkins, pp. 1-19. University of Oregon Anthropological Papers 50. Eugene.

Aikens, C. Melvin, and R. Minor

1977 The Archaeology of Coffeepot Flat, South-Central Oregon. *University of Oregon Anthropological Papers* 11. Eugene, Oregon.

Aikens, C. Melvin, and Y.R. Witherspoon

1978 Great Basin Numic Prehistory: Linguistics, Archaeology, and Environment. In *Anthropology of the Desert West: Essays in Honor of Jesse D. Jennings*, edited by Carol Condie and Don Flower. University of Utah Anthropological Papers 110:7-20.

Anderson, J.

1978 Preliminary Cultural Resource Overview of the Deschutes National Forest. Ms. on file, Deschutes National Forest. Bend, Oregon.

Appleby, Rex R.

1984 *West Wickiup Cultural Resource Report.* USDA Forest Service, Deschutes National Forest, Bend, Oregon. Submitted to USDA Forest Service, Deschutes National Forest. Bend, Oregon.

Atwell, Ricky G., Andrew J. Bailey, Charles M. Hodges, and Clayton G. Lebow

1994 *Archaeological Investigations at 35-KL-810: Prehistoric Land Use on the Deschutes-Klamath Divide, Klamath County, Oregon.* INFOTEC Research, Inc., Fresno, California. Submitted to Pacific Gas Transmission Company, San Francisco.

Atwell, Ricky G., Andrew J. Bailey, Clayton G. Lebow, Richard M. Pettigrew, Charles M. Hodges, Melinda C. Horne, Randall F. Schalk, Judith A. Willig, Kurt T. Katsura, Jill Onken, David G. Weatherby, and Douglas R. Harro

1995 *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume 2B, Summary Reports: Prehistoric Sites, Oregon.* INFOTEC Research, Inc., Fresno, California. Submitted to Pacific Gas Transmission Company, San Francisco.

Atwell, Ricky G., William R. Hildebrandt, Clayton G. Lebow, Patricia Mikkelsen, Michael J. Moratto, Richard M. Pettigrew, Lester A. Ross, Randall F. Schalk, Lynda J. Sekora, and Lou Ann Speulda

1995 *Archaeological Investigations, PGT-PG&E Pipeline Expansion, Project, Idaho, Washington, Oregon, and California, Volume IV: Synthesis of Findings.* INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Atwell, Ricky G., and Charles M. Hodges
1995 Site 35-DS-557. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California. Volume IIB: Summary Reports: Prehistoric Sites, Oregon*, edited by Randall F. Schalk, Richard M. Pettigrew, Clayton G. Lebow, Michael J. Moratto, and Ricky G. Atwell, pp. 19-1 - 19-50. INFOTEC Research, Inc., Fresno, California. Submitted to Pacific Gas Transmission Company, San Francisco.

Bacon, C. R.
1983 Eruptive History of Mount Mazama and Crater Lake Caldera, Cascade Range, U.S.A. *Journal of Volcanology and Geothermal Research* 18:57-115.

Bailey, Andrew J.
1995 Site 35-DS-263. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California; Volume IIB: Summary Reports: Prehistoric Sites, Oregon*, edited by Randall F. Schalk, Richard M. Pettigrew, Clayton G. Lebow, Michael J. Moratto, and Ricky G. Atwell, pp. 20-1 - 20-32. INFOTEC Research, Inc., Fresno, California. Submitted to Pacific Gas Transmission Company, San Francisco.

Bailey, Andrew J., Clayton G. Lebow, Charles M. Hodges, and Douglas R. Harro
1995 Site 35-DS-33 (The Lava Butte Site). In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume IIB, Book 2 of 2, Summary Reports: Prehistoric Sites, Oregon*, edited by Randall F. Schalk, Richard M. Pettigrew, Clayton G. Lebow, Michael J. Moratto, and Ricky G. Atwell, pp. 16-1 - 16-71. INFOTEC Research, Inc., Fresno, California. Submitted to Pacific Gas Transmission Company, San Francisco.

Baldwin, Ewart M.
1991 *Geology of Oregon*, Forth Edition. Kendall and Hunt Publishing. Dubuque, Iowa.

Barnosky, Cathy W.
1985 Late Quaternary Vegetation in the Southwestern Columbia Basin, Washington. *Quaternary Research* 23(1)109-122.

Barrett, Samuel
1910 The Material Culture of the Klamath Lake and Modoc Indians of Northeastern California and Southern Oregon. *University of California Publications in American Archeology and Ethnology* 5(4):239-293.

Beckman, Stephen Dow
1984 The La Pine B.L.M. Management Unit: A Cultural Resource Overview. Ms. on file, USDI Bureau of Land Management, Prineville District. Prineville, Oregon.

Beckman, Stephen Dow, Rick Minor, and Kathryn Ann Toepel
1981 Prehistory and History of BLM Lands in West-Central Oregon: A Cultural Resources Overview. *University of Oregon Anthropological Papers* 25. Eugene, Oregon.

Bedwell, Stephen F.
1970 *Prehistory and Environment of the Pluvial Fort Rock Lake area of South Central Oregon*. Unpublished Ph. D. Dissertation, University of Oregon, Eugene, Oregon.

1973 *Fort Rock Basin: Prehistory and Environment*. University of Oregon Press. Eugene, Oregon.

Bedwell, Stephen F. And L. S. Cressman
1971 Fort Rock Report: Prehistory and Environment of the Pluvial Fort Rock Lake Area of South-Central Oregon. In *University of Oregon Anthropological Papers* 1:1-25. Eugene, Oregonedwell, Stephen F.
1969 *Prehistory and Environment of the Pluvial Fort Rock Lake Area of South Central Oregon*. Ph.D. Dissertation, University of Oregon, Eugene.

Bettinger, Robert L., and Martin Baumhoff
1982 The Numic Spread: Great Basin Cultures in Competition. *American Antiquity* 47(3):485-503.

1983 Return Rates and Intensity of Resource Use in Numic and Prenumic Adaptive Strategies. *American Antiquity* 48(4):830-834.

Bettis, Greg
1987 *Indian Rock Art of the Lower Deschutes River*. Greg Bettis. Portland, Oregon.

Binford, Lewis R.
1980 Willow Smoke and Dogs' Tails: Hunter-gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.

Bryant, Richard L., and Linda Goddard
1979 *Cultural Resource Overview of the Deschutes National Forest.* Prepared by Prolysts, In., Eugene. Ms. on file, USDA Forest Service, Deschutes National Forest. Bend, Oregon.

Bryson, Robert U., and Reid A. Bryson
1996 A Comparison of Cultural Evidence and Simulated Holocene Climates of the Pacific Northwest: An Experiment in Archaeoclimatology. In *Occasional Papers of the Association of Oregon Archaeologists, Volume 6,* edited by Albert C. Oetting. Association of Oregon Archaeologists, Eugene, Oregon. in press.

Blyth, Beatrice
1938 Northern Paiute Bands in Oregon. *American Anthropologist* 40:402-405.

Campbell, Sarah K.
1990 *PostColumbian Culture History in the Northern Columbia Plateau, A.D. 1500-1900.* Garland. New York.

Chatters, James C.
1994 Early and Middle Holocene Vegetation History of Odell Lake, Klamath County, Oregon: Pollen Analysis of Sediments from Sites 35KL231 and 35KL884. In *The Odell Lake Basin Project: Test Excavations at the Odell Lake Site, 35KL231, Sunset Cove Site, 35KL884, and Shelter Cove Site, 35KL482, Klamath County, Oregon,* by Manfred E. W. Jaehnig, Appendix E. Mount Emily Archaeological Services, La Grande, Oregon. Submitted to USDA Forest Service, Deschutes National Forest. Crescent District, Crescent, Oregon.

Cheaton, Richard D.

1992 *Archaeological Test Excavations at the Bon Site (35DS608) Deschutes County, Oregon.* Oregon State Museum of Anthropology, University of Oregon, OSMA Report 92-4.

1992 *Preliminary Results of Test Excavations Conducted at 35DS947 within the Proposed Right-of-way of the Deschutes River U.S. 97 Section of the McKenzie-Bend Highway U.S. 20, Deschutes County.* Report to the Oregon Department of Transportation from the Oregon State Museum of Anthropology.

Chitwood, L.A.

1976 Physiography and Geology of Deschutes National Forest. *Soil Resource Inventory: Deschutes National* by Daniel M. Larsen. USDA Forest Service PNR.

1977 The Age of Lava Butte. *Ore Bin* 39(10):157-164.

Cole, David L.

1975 *Archaeological Survey in the Sun River Vicinity, Deschutes County, Oregon.* Report of the Museum of Natural History, University of Oregon. Eugene, Oregon.

1977 *Archaeological Explorations at Sun River, Deschutes County, Oregon.* Report of the Museum of Natural History, University of Oregon, to the Deschutes National Forest, Bend, Oregon.

Connolly, Thomas J.

1983 *An Archaeological Survey Near the Inn of the Seventh Mountain and Further Testing of Site 35DS57, Deschutes County, Oregon.* Report of the Oregon Museum of Anthropology, University of Oregon, to the Inn of the Seventh Mountain. Bend, Oregon.

1993 Pre-Mazama Occupations at the Paulina Lake Site (35DS34), Newberry Crater, Central Oregon. *Current Archaeological Happenings in Oregon* 18(1):6-12.

1994 Paleo Point Occurrences in the Willamette Valley, Oregon. *Contributions to the Archaeology of Oregon, 1990-1994, Association of Oregon Archaeologists Occasional Papers No. 5,* edited by Paul W. Baxter, pp. 81-88. State Museum of Anthropology, University of Oregon, Eugene.

1995 *Human and Environmental Holocene Chronology in Newberry Crater, Central Oregon.* State Museum of Anthropology, University of Oregon, Eugene. Submitted to Oregon Department of Transportation, Salem.

Connolly, Thomas J., Dennis L. Jenkins, and Jane Benjamin

1993 *Archaeology of Mitchell Cave (35WH122): A Late Period Hunting Camp in the Ochoco Mountains, Wheeler County, Oregon.* University of Oregon Anthropology Papers 46. Department of Anthropology and Oregon State Museum of Anthropology, University of Oregon, Eugene.

Connolly, Thomas J., and Robert R. Musil

1994 Patterns of Lithic Procurement and Reduction at the Newberry Crater Obsidian Quarries. In *Contributions of the Archaeology of Oregon, 1990-1994, Association of Oregon Archaeologists Occasional Papers No. 5*, edited by Paul W. Baxter, pp. 89-117. State Museum of Anthropology, University of Oregon, Eugene.

Cressman, Luther S.

1937a *Petroglyphs of Oregon.* University of Oregon Monographs, Studies in Anthropology No. 2. Eugene, Oregon.

1937b The Wickiup Damsite No. 1 Knives. *American Antiquity* 3(1):53-67.

1940 Archaeological Exploration and Excavation in SE Oregon. *American Philosophical Society*, Philadelphia, Yearbook 1941, 152-156.

1942 Archaeological Researches in the Northern Great Basin. *Carnegie Institution Publication* No. 538. Washington D.C.

1948 Odell Lake Site: A New Paleo-Indian Campsite in Oregon. *American Antiquity* 14 (1):57-58.

Cressman, Luther S., Howel Williams, and Alex D. Krieger
1940 Early Man in Oregon: Archaeological Studies in the Northern Great Basin. In *University of Oregon Monographs, Studies in Anthropology* No. 3, pp. 4-78.

Crowley, Suzanne
1981 *Cultural Resource Survey Report of LaPine Salvage Timber Sale*. Prineville District USDI Bureau of Land Management, Prineville, Oregon. Submitted to USDI Bureau of Land Management, Portland, Oregon.

Davis, Carl M.
1983 Deschutes National Forest Cultural Resource Inventory Plan. *Cultural Resource Inventory Plans: Documenting Inventory Strategies*, edited by James D. Keyser, pp. 34-76. Studies in Cultural Resource Management 4. USDA Forest Service, PNR.

Davis, Carl M. and Sara Scott
1984 The Lava Butte Site, Central Oregon. Paper presented at the 49th annual Meeting of the Society for American Archaeology. Portland, Oregon.

1986 Aspects of the Upper Deschutes River Basin Prehistory. In *Contributions to the Archaeology of Oregon, 1983-1986*, Association of Oregon Archaeologists Occasional Papers 3, edited by Kenneth M. Ames, pp. 102-128. Association of Oregon Archaeologists, Salem, Oregon.

1991 The Lava Butte Site Revisited. *Journal of California and Great Basin Anthropology* 13(1):40-59.

Davis, Carl M. and Scott Stuemke
n.d. *An Archaeological Assessment of 87 Prehistoric Sites located on the West Bank of the Deschutes River, Bend Ranger District, Deschutes National Forest*. A Preliminary Management summary to Bend Ranger District, Deschutes National Forest.

Ellis, C.H.
1984 *Excavations at the Deschutes Park West (35WS143) Wasco, County, Oregon*. CRM Report 5. Willamette Associates, Portland.

Endzweig, Pamela E.
1994 *Late Archaic Variability and Change on the Southern Columbia Plateau: Archaeological Investigations in the Pine Creek Drainage of the Middle John Day River, Wheeler County, Oregon*. Ph.D. dissertation, Department of Anthropology, University of Oregon. UMI Dissertation Services, Ann Arbor, Michigan. Order Number 9434774.

Flenniken, J.J
1987 *The Lithic Technology of the East Lake Site, Newberry Crater, Oregon*. Report on file at the Deschutes National Forest Supervisors Office. Bend, Oregon.

Follansbee, Julia A., and Ellen E. Frances

1980a *An Assessment of the Potential National Register Eligibility of the Bend-Prineville Wagon Road and Archaeological Site 35-DS-54.* Report on file, Cultural Resource Management, Inc., Eugene, Oregon.

1980b *Rock Features and Military Maneuvers in Central Oregon.* Cultural Resource Management, Inc., Eugene, Oregon. Submitted to Bend Engineering Consultants, Bend, Oregon.

Gannon, Brian L., Charles Hibbs, and Cynthia Willard

1977 *Cultural Resource Inventory of BLM Lands, Lower Deschutes River, Oregon.* Ms. on file, USDI Bureau of Land Management, Prineville District, Prineville, Oregon.

Gibbs, Charles, Brain Gannon and Cynthia Willard

1976 *Deschutes River Cultural Resources Survey.* Report on file, Bureau of Land Management, Prineville District Office, Prineville, Oregon.

Gibson, Eric C.

1989 *A Cultural Resources Survey of the FY 1990 La Pine, Oregon, Timber Sale.* Infotec Research, Inc., Eugene, Oregon. IRI Report PNW89-3. Submitted to USDI Bureau of Land Management, Prineville, Oregon.

Gibson, Eric C., and Richard Pettigrew

1989 *Archaeological Investigations at Eagle Crest Site (OR-05-792), Deschutes County, Oregon.* IRI Report No. PNW89-7. Submitted to USDI Bureau of Land Management, Prineville, Oregon.

Goddard, Linda, Richard Bryant and John Nelson

1979 *Cultural Resource Overview: Deschutes National Forest, Oregon.* Report by Pro-Lysts, Inc., Eugene, Oregon. Report on file a Deschutes National Forest Office, Bend, Oregon.

Hanes, Richard C.

1977 Lithic tools of the Dirty Shame Rockshelter: Typology and Distribution. *Tebiwa, Miscellaneous Papers of the Idaho State University Museum of Natural History* 6.

Hatton, R.

1977 *The High Desert of Central Oregon.* Portland, Oregon: Binfords and Mort.

1978 *Bend in Central Oregon.* Portland, Oregon: Binfords and Mort.

Hickerson, Leslie

1993 The Davis Lake Canoes: An Overview and Discussion. Paper presented at the annual Northwest Anthropological Conference, Bellingham, Washington.

1995 Davis Lake Canoes: Updated Information. Paper presented at the annual Northwest Anthropological Conference, Portland State University, Portland, Oregon.

Horne, Melinda C.

1995 Site 35-JE-49. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume IIB, Book 2 of 2, Summary Reports: Prehistoric Sites, Oregon*, edited by Randall F. Schalk, Richard M. Pettigrew, Clayton G. Lebow, Michael J. Moratto, and Ricky G. Atwell, pp. 12-1 - 12-78. INFOTEC Research, Inc., Fresno, California. Submitted to Pacific Gas Transmission Company, San Francisco.

Ice, Dannie M.

1962 *Archaeology of the Lava Butte Site, Deschutes County, Oregon*. Report of Investigations 15. Laboratory of Anthropology, Washington State University, Pullman.

Infotec

1990 *Archaeological Investigations PGT-PG&E Pipeline Expansion Project Idaho, Washington, Oregon, and California*. Volume I: Synopsis of Testing and Evaluation.

Jaehnig, Manfred E. W.

1994 *The Odell Lake Basin Project: Test Excavations at the Odell Lake Site, 35KL231, Sunset Cove Site, 35KL884, and Shelter Cove Site, 35KL482, Klamath County, Oregon*. Mount Emily Archaeological Services, La Grande, Oregon. Submitted to USDA Forest Service, Deschutes National Forest, Crescent District, Crescent, Oregon.

Jenkins, Dennis

1988 *Testing and Evaluation of Mitchell Cave (35WH122), Wheeler County, Oregon*. Oregon State Museum of Anthropology Report 88-5. University of Oregon, Eugene. Submitted to the Oregon Department of Transportation, Highway Division, Salem.

1994 Settlement-Subsistence Patterns in the Fort Rock Basin: a Cultural-Ecological Perspective on Human Responses to Fluctuating Wetlands Resources of the Last 5000 Years. In *Archaeological Researches in the Northern Great Basin: Fort Rock Archaeology Since Cressman*, edited by C. Melvin Aikens and Dennis L. Jenkins, pp. 599-628. University of Oregon Anthropological Papers 50. Department of Anthropology and State Museum of Anthropology, University of Oregon, Eugene.

Jenkins, Dennis L., and Ann Brashear

1994 Excavations at Four Habitation Sites in the Boulder Village Uplands: a Preliminary Report. In *Archaeological Researches in the Northern Great Basin: Fort Rock Archaeology Since Cressman*, edited by C. Melvin Aikens and Dennis L. Jenkins, pp. 431-484. University of Oregon Anthropological Papers 50. Department of Anthropology and State Museum of Anthropology, University of Oregon, Eugene.

Jenkins, Dennis L., and Thomas J. Connolly

1994 *Archaeological Excavations at the Paquet Gulch Bridge Site: A Pithouse Village in the Deschutes River Basin, Southwestern Columbia Plateau, Oregon*. University of Oregon Anthropological Papers 49. Department of Anthropology and Oregon State Museum of Anthropology, University of Oregon, Eugene.
Fresno, California.

Kelly, Robert., and Lawrence C. Todd

1988 Coming into the Country: Early Paleoindian Hunting and Mobility. *American Antiquity* 53(2):231-244.

Keyser, James D.

1980 *Proposal for Site Significance Testing Lava Island Rock Shelter*. USDA Forest Service, Portland. Submitted to State Historic Preservation Office, Salem, Oregon.

Lamb, Sydney M.

1958 Linguistic Prehistory in the Great Basin. *International Journal of American Linguistics* 24(2):95-100.

Layton, Thomas N.
1972 Lithic chronology in the Fort Rock Valley, Oregon. *Tebiwa* 15(2):1-21.

Lebow, Clayton G.
1995 Toolstone Procurement. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume IV: Synthesis of Findings*, edited by Randall F. Schalk, pp. 5-1 - 5-79. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Lebow, Clayton G., and Ricky G. Atwell
1995 Lithic Production Technology: Pacific Northwest. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume IV: Synthesis of Findings*, edited by Randall F. Schalk, pp. 6-1 - 6-44. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Lebow, Clayton G., and Richard M. Pettigrew
1989 *A Cultural Resource Survey of Land Exchanges in the Oregon Canyon Mountains Area, Malheur County, Oregon.* INFOTEC Research, Inc., Eugene, Oregon (IRI Report No. PNW89-9). Submitted to the USDI Bureau of Land Management, Vale District, Vale, Oregon.

Lebow, Clayton G., Melinda C. Romano, Christian Miss, Karl K. Benedict, Lou Ann Speulda, Scott A. Williams, Susan K. Goldberg, Gordon A. Lothson, Richard M. Pettigrew, Randall F. Schalk, Jon M. Silvermoon, and Judith A. Willig
1991 *Archaeological Testing and Evaluation Report, 1990-1991 Field Season, and Historic Properties Treatment Plan for 1991 Field Season, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California. Volume II.C: Descriptive Reports and Data Compendia, Prehistoric Sites, Oregon.* INFOTEC Research, Inc., Fresno, California. Submitted to Pacific Gas Transmission Company, San Francisco.

Lebow, Clayton G., and Eric C. Gibson
1990 *Evaluation of the Eagle Crest Site (35DS518), Deschutes County, Oregon.* INFOTEC Research Report No. PNW90-2. Eugene. Submitted to the Prineville District, USDI Bureau of Land Management, Prineville, Oregon.

Lebow, Clayton G., R.M. Pettigrew, J.M. Silvermoon, D.H. Chance, R. Boyd, Y. Hajda, and H. Zenk
1990 *A Cultural Resource overview for the 1990's, BLM Prineville District, Oregon.* USDI Bureau of Land Management Cultural Resource Series 5. Portland, Oregon.

Loy, William G.
1976 *Atlas of Oregon.* University of Oregon Books, Eugene.

Lyman, R.L., M.A. Gallagher, C.G. Lebow, and M.K. Weber
1983 *Cultural Resource Reconnaissance in the Redmond Training Area, Central Oregon.* Report to the Department of Anthropology, Oregon State University, to the Oregon Military Department, Salem, and to the Bureau of Land Management, Prineville District, Prineville, Oregon.

McFarland, Janine R.
1986 *Test Excavations of the Fall River Prehistoric Site, Bend Ranger District, Deschutes National Forest.* Report on file with the Deschutes National Forest Supervisor's Office. Bend, Oregon.

1989 *An Analysis of Two Post-Mazama Prehistoric Flakes Stone Scatters in the Upper Deschutes River Basin of Central Oregon.* Unpublished master's thesis, Oregon State University, Corvallis.

McFarland, Janine and Carl M. Davis
1985 *1983 Reconnaissance Survey of the Upper Deschutes River.* Report on File at the Bend Ranger District, Deschutes National Forest. Bend, Oregon.

Mehringer, Peter J. Jr.
1986 Prehistoric Environments. *Handbook of North American Indians* Volume 11. Smithsonian Institution. pp. 31-50.

Mehringer, Peter J., and William J. Cannon
1994 Volcaniclastic Dunes of the Fort Rock Valley, Oregon: Stratigraphy, Chronology, and Archaeology. In *Archaeological Researches in the Northern Great Basin: Fort Rock Archaeology Since Cressman*, edited by C. Melvin Aikens and Dennis L. Jenkins, pp. 283-327. University of Oregon Anthropological Papers 50. Department of Anthropology and State Museum of Anthropology, University of Oregon, Eugene.

Minor, Rick
1985 Paleo-Indians in Western Oregon: A Description of Two Fluted Projectile Points. *Northwest Anthropological Research Notes* 19(1):33-40.

Minor, Rick, and Kathryn Anne Toepel
1982 *Lava Island Rockshelter: An Early Hunting Camp in Central Oregon.* Heritage Research Associates Report 11. Eugene, Oregon.

1983 *Archaeological Testing at the Inn of the Seventh Mountain Lithic Scatters, Deschutes County, Oregon.* Heritage Research Associates Report 22. Eugene, Oregon.

1984 *Lava Island Rock Shelter: An Early Hunting Camp in Central Oregon.* Occasional Papers of the Idaho Museum of Natural History No. 34. Pocatello, Idaho.

Minor, Rick, Kathryn Anne Toepel, and Albert C. Oetting
1988 *The Inn of the Seventh Mountain Lithic Scatters: Post Mazama Hunting Camps in the Cascade Foothills of Central Oregon.* Heritage Research Associates, Eugene, Oregon. HRA Report No. 79. Submitted to The Inn of the Seventh Mountain, Bend, Oregon.

Minor, Rick, Stephen Dow and Kathryn Anne Toepel
1979 *Cultural Resource Overview of the BLM Lakeview District, South-Central Oregon: Archaeology, Ethnography, History.* University of Oregon Anthropological Papers 16. Eugene, Oregon.

Minor, Rick, and Thomas Connolly
1979 *An Archaeological Evaluation Of Site 35DS55, Deschutes County, Oregon.* Oregon State Museum of Anthropology, Eugene, Oregon. Submitted to Northwest Ranch Brokers. Redmond, Oregon.

Mitchell, Janet M., and Robert U. Bryson
1995 Lithic Specimen Data. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume V: Technical Studies*, edited by Michael J. Moratto, pp. 3-1 - 3-80. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Moratto, Michael J., Susan K. Goldberg, John Holson, Thomas L. Jackson, Richard M. Pettigrew, Barry A. Price, Randall F. Schalk, Robert Bryson, Melissa Darby, Jeff Hall, Clayton G. Lebow, Gordon Lothson, Christian Miss, Melinda Romano, Kristina Roper Wickstrom, Rae Schwaderer, Dwight D. Simons, Lou Ann Speulda, Gerald Weber, Brian Wickstrom, and Judith Willig

1991 *Archaeological Testing and Evaluation Report, 1990 Field Season, and Historic Properties Treatment Plan for 1991 Field Season, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California. Volume I: Synopsis of Testing and Evaluation and Historic Properties Treatment Plan.* INFOTEC Research, Inc., Fresno, California. Submitted to Pacific Gas Transmission Company, San Francisco.

Moratto, Michael J., Richard M. Pettigrew, Barry A. Price, Lester A. Ross, and Randall F. Schalk

1994 *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume I: Project Overview, Research Design, and Archaeological Inventory.* INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Murdock, George Peter

1938 Notes on the Tenino, Molala, and Paiute of Oregon. *American Anthropologist* 40:395-402.

1958 Social Organization of the Tenino. *Miscellanea Paul Rivet: Octogenario Dicata*, pp. 299-315. Mexico City, Mexico.

Oregon State Water Resources Board

1961 *Deschutes River Basin*. Oregon Water Resources Board. Salem, Oregon.

Osborne, Douglas

1950 An Archaeological Survey of the Benham Falls Reservoir, Oregon. *American Antiquity* 2:112-120.

1956 *Evidence of the Early Lithic in the Pacific Northwest.* Washington State College Research Studies 24:38-44. Pullman, Washington.

Peterson, N.V., E.A. Groh, E.M. Taylor, and D.E. Stensland

1976 *Geology and Mineral Sources of Deschutes County, Oregon*. Bulletin 89, Portland, Oregon: Department of Geology and Mineral Industries.

Pettigrew, Richard M.

1982 *Archaeological Investigations in Mill Creek Valley, Crook County, Oregon.* University of Oregon Anthropological Papers 26. Department of Anthropology, University of Oregon, Eugene.

Pettigrew, Richard M., Sandra Barnes, Janet M. Mitchell, Patricia Mikkelsen, and William Hildebrandt

1995 Appendix A: Projectile Point Data. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume V: Technical Studies*, edited by Michael J. Moratto, pp. A-1 - A.3-21. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Pettigrew, Richard M., William Hildebrandt, and Patricia Mikkelsen

1995 Projectile Point Typology. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume V: Technical Studies*, edited by Michael J. Moratto, pp. 1-1 - 1-72. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Pettigrew, Richard M., William Hildebrandt, Judith A. Willig, Pat Mikkelsen, and Kurt T. Katsura

1995 Environmental Overview. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume I: Project Overview, Research Design, and Archaeological Inventory,* edited by Michael J. Moratto, pp. 2-1 - 2-31. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Pettigrew, Richard M., and Charles M. Hodges

1995a Site 35-JE-51B (The Johnson Site). In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume IIB, Book 1 of 2, Summary Reports: Prehistoric Sites, Oregon*, edited by Randall F. Schalk, Richard M. Pettigrew, Clayton G. Lebow, Michael J. Moratto, and Ricky G. Atwell, pp. 8-1 - 8-87. INFOTEC Research, Inc., Fresno, California. Submitted to Pacific Gas Transmission Company, San Francisco.

1995b Prehistoric Hunter-gatherer Land-use Systems: Pacific Northwest. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume IV: Synthesis of Findings*, edited by Randall F. Schalk, pp. 2-1 - 2-70. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Pettigrew, Richard M., and Clayton G. Lebow

1989 *An Archaeological Survey of the Trout Creek-Oregon Canyon Uplands, Harney and Malheur Counties, Oregon.* INFOTEC Research, Inc., Eugene, Oregon (IRI Report PNW89-2). Submitted to the U.S. Department of the Interior, Bureau of Land Management, Vale District, Vale, Oregon.

Pettigrew, Richard M., and Robert L. Spear

1984 *Archaeological Investigations of Two Sites (35DS56 and 57) on the Cascade Lakes Highway, Deschutes County, Oregon.* Oregon State Museum of Anthropology, University of Oregon, Eugene (Survey Report 84-2). Submitted to Oregon Department of Transportation, Highway Division, Salem.

Price, Barry A., Timothy W. Canaday, Richard M. Pettigrew, Robert U. Bryson, Lou Ann Speulda, Ricky G. Atwell, and Michael Ostrogorsky

1993 *Archaeological Testing and Evaluation Report, 1991 Field Season, and Historic Properties Treatment Plan for 1992 Field Season, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California. Volume I: Synopsis of Testing and Evaluation and Historic Properties Treatment Plan.* INFOTEC Research, Inc., Fresno, California. Submitted to Bechtel Corporation, San Francisco.

Price, T. D., and J. A. Brown

1985 Aspects of Hunter-Gatherer Complexity. In *Prehistoric Hunter-Gatherers, The Emergence of Cultural Complexity*, edited by T. D. Price and J. A. Brown, pp. 3-20. Academic Press, Orlando.

Root, Matthew, Amy J. Gilreath, Robert U. Bryson, and Douglas R. Harro

1995 Definitions of Lithic Materials: Analytic Protocols. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume V: Technical Studies*, edited by Michael J. Moratto, pp. 2-1 - 2-62. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Sapir, Edward

1907 Notes on the Takelma Indians of Southwestern Oregon. *American Anthropologist* 9:251-275.

Schalk, Randall F. (ed.)
1987 *Archeology of the Morris Site (35GM91) on the John Day River, Gilliam County, Oregon.* University of Washington, Office of Public Archaeology, Seattle. Submitted to the U.S. Army Corps of Engineers, Portland District, Portland.

Schalk, Randall F., and Ricky G. Atwell
1994 Research Design for Prehistoric Archaeology. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume I: Project Overview, Research Design, and Archaeological Inventory,* edited by Michael J. Moratto, pp. 5-1 - 5-57. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Schalk, Randall F., Ricky G. Atwell, William R. Hildebrandt, Clayton G. Lebow, Patricia Mikkelsen, and Richard M. Pettigrew
1995 Mobility and Intensification. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume IV: Synthesis of Findings,* edited by Randall F. Schalk, pp. 9-1 - 9-43. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Scott, Sara
1983a *A Preliminary Cultural Resource Survey of the Newberry Crater.* Report on file at the fort Rock Ranger District, Deschutes National Forest. Bend, Oregon.

1983b *Sand Spring: A Lithic Workshop on the High Lava Plains of Central Oregon.* Deschutes National Forest Cultural Resources Report No. 1. USDA Forest Service, Deschutes National Forest, Bend, Oregon.

1984 *An Archaeological Overview of Deschutes County, Oregon.* Report on file at the Deschutes County Planning Department, Bend, Oregon.

1985a *An Analysis of Archaeological Materials Recovered During Test Excavations of Six Prehistoric Sites on the Deschutes National Forest in Central Oregon.* Report on file at the Deschutes National Forest. Bend, Oregon.

1986a *A Cultural Resource Survey of the Deschutes River, from Bend to the Deschutes/ Jefferson County Line, Deschutes County, Oregon.* Report on file at the Deschutes County Planning Department. Bend, Oregon.

1986b An Archaeological Survey of the Upper Deschutes Drainage, Deschutes County, Oregon. *Current Archaeological Happenings in Oregon* Vol. 11, No.3.

Scott, Sara, and C. M. Davis and J. Jeffrey Flenniken
1986 The Pahoehoe Site: A Biface Cache in Central Oregon. *Journal of California and Great Basin Anthropology* 8(1):7-23.

1988 Reply to Minor and Toepel: A View from Outside Lava Island Rockshelter. *Journal of California and Great Basin Anthropology* 11(3):127.

Skinner, Craig E.

1983 *An Introduction to Obsidian and an Investigation of Selected Methods of Obsidian Characterization Utilizing Obsidian Collected at Prehistoric Quarry Sites in Oregon.* Unpublished master's thesis in Interdisciplinary Studies, University of Oregon, Eugene, Oregon.

1986 *The Occurrence, Characterization, and Prehistoric Utilization of Geological Sources of Obsidian in Central Western Oregon: Preliminary Research Results.* Privately printed, Eugene, Oregon.

1995a Obsidian Characterization Studies. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume V: Technical Studies*, edited by Michael J. Moratto, pp. 4-1 - 4-54. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

1995b Obsidian Hydration Studies. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume V: Technical Studies*, edited by Michael J. Moratto, pp. 5-1 - 5-51. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

1995c Radiocarbon Age Determinations. In *Archaeological Investigations, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume V: Technical Studies*, edited by Michael J. Moratto, pp. 6-1 - 6-36. INFOTEC Research, Inc., Fresno, California, and Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Pacific Gas Transmission Company, Portland, Oregon.

Simms, Steven R.

1983 Comments on Bettinger and Baumhoff's Explanation of the "Numic Spread" in the Great Basin. *American Antiquity* 48(4):825-830.

Snyder, Sandra and Carl M. Davis

1982 A Cultural Resource Survey of the Umli Timber Sale Area, Crescent Ranger District, Deschutes National Forest. Crescent, Oregon.

Speulda, Lou Ann, Clayton G. Lebow, Tina M. McAfee, Michael Ostrogorsky, Rick G. Atwell, Judith A. Willig, David J. Conca, Richard M. Pettigrew, Robert U. Bryson, Charles M. Hodges, Karl K. Benedict, Andrew J. Bailey, Jill Onken, Fred W. Crisson, Lynda J. Sekora, Matthew J. Root, Nancy D. Sharp, Craig E. Skinner, Nancy Stenholm, and Kurt T. Katsura

1993 *Archaeological Testing and Evaluation Report, 1991 Field Season, and Historic Properties Treatment Plan for 1992 Field Season, PGT-PG&E Pipeline Expansion Project, Idaho, Washington, Oregon, and California, Volume II.C: Descriptive Site Reports and Data Compendia, Oregon.* INFOTEC Research, Inc., Fresno, California. Submitted to Bechtel Corporation, San Francisco.

Spier, Leslie

1930 *Klamath Ethnography.* University of California Publications in American Archaeology and Ethnology Vol. 30. University of California Press, Berkeley.

Steward, J. H. and E. Wheeler-Vogelein

1974 *Paiute Indians III - The Northern Paiute Indians, Volume II, Great Basin.* Smithsonian Institute. Washington D.C.

Stuemke, Scott E.

1986 The Odell Lake Site (35-KL-231): An Analysis of a Surface Lithic Scatter Assemblage. In *Contributions to the Archaeology of Oregon, 1983-1986*, edited by Kenneth M. Ames, pp. 48-61. Association of Oregon Archaeologists Occasional Paper 3. Salem, Oregon.

1987 *The Archaeology of the Peninsula I Site 35-JE-53: A Central Oregon Rockshelter.* Unpublished master's thesis, Department of Anthropology, University of Oregon. Eugene, Oregon.

1988 *Ogden Group Camp.* USDA Forest Service, Deschutes National Forest, Fort Rock Ranger District, Bend, Oregon.

Sutton, Mark Q.

1993 The Numic Expansion in Great Basin Oral Tradition. *Journal of California and Great Basin Anthropology* 15(1):111-128.

Swift, M. A.

1987 *An Archaeological Survey of Sunriver Properties to the South along the Deschutes and Little Deschutes Rivers, Deschutes County, Oregon.* Report to Sunriver Properties, Inc. and the Oregon State Historic Preservation Office.

Thomas, David H.

1989 *Archaeology.* 2nd ed. Holt, Rinehart, and Winston, Inc., Fort Worth, Texas.

Toepel, Kathryn Anne, Rick Minor and William F. Willingham

1980 *Human Adaptation in the Fort Rock Basin: A Class II Cultural Resources Inventory of BLM Lands in Christmas Lake Valley, South Central Oregon.* Report of the Department of Anthropology, University of Oregon, to the Bureau of Land Management, Lakeview District.

Toepel, Kathryn Anne and Stephen Dow Beckman

1978 *Cultural Resource Overview of the Brothers EIS Area, Prineville District, Oregon, U.S. Bureau of Land Management.* Report to the Bureau of Land Management from the Department of Anthropology, University of Oregon. Eugene, Oregon.

1981 *Survey and Testing of cultural Resources along the Proposed Bonneville Power Administration's Buckley-Summer Lake Transmission Line Corridor, Central Oregon.* Bonneville Cultural Resources Group Report No. 100-5. Eastern Washington University Reports in Archaeology and History, Cheney, Washington.

USDA Forest Service

n.d. *Crescent Lake Resort / Campground Archaeological Testing and Data Recovery.* USDA Forest Service, Deschutes National Forest, Crescent Ranger District. Bend Oregon.

1986 Draft Environmental Impact Statement: Deschutes National Forest Land and Resource Management Plan. Pacific Northwest Region.

Volland, Leonard A.

1985 *Plant Communities of the Central Oregon Pumice Zone.* USDA Forest Service, Region 6.

Zancanella, John K.

1996 New Data on Upland Occupation in the Ochoco Mountains of Central Oregon: A Preliminary Report. Paper presented at the 49th annual Northwest Anthropological Conference, University of Idaho, Moscow.

SHPO BIBLIOGRAPHY

The following pages are a compilation of studies completed by various federal and private agencies on archaeological sites within Deschutes County Boundaries. Gathered from the State Historic Preservation Office and listed alphabetically, the records include the following years: 1978 to 1980, 1984 to 1995. Records indicate that to date, 450 studies have been completed on archaeological sites in Deschutes County.

SHPO Reference Bibliography for Deschutes County

30-Jul-96

AUTHOR	DATE	TITLE	AGENCY
ANON	ND	115 KV AERIAL POWERLINE MIDSTATE ELECTRIC COOPERATIVE CORPORATION	DESCHUTES NATIONAL FOREST
ANON	ND	RED BUTTE LP SALE	
APPLEBY, REX	1984	WEST WICKIUP TIMBER SALE	DESCHUTES NATIONAL FOREST
APPLEBY, REX	1988	BUG 40 LP SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
BETTENDORF, JULIE & SCOTT STUEMKE	1988	MCKAY CROSSING	DESCHUTES NATIONAL FOREST
BORDEAUX, ALEX	ND	27TH STREET EXTENSION-BEND PINE NURSERY	DESCHUTES NATIONAL FOREST
BOURDEAU, ALEX	1993	OFF-HIGHWAY VEHICLE TRAIL SYSTEM	DESCHUTES NATIONAL FOREST
BOURDEAU, ALEX	1993	GARDEN TIMBER SALE	DESCHUTES NATIONAL FOREST
BURTCHARD, GREG	1988	PROPOSED IMPROVEMENTS TO THE MCKENZIE HIGHWAY CORRIDOR SISTERS, OREGON	ODOT
CARLSON, RICHARD	1984	COYOTE TIMBER SALE	DESCHUTES NATIONAL FOREST
CARLSON, RICHARD	1984	WAMPUS TIMBER SALE	DESCHUTES NATIONAL FOREST
CARLSON, RICHARD	1985	WAMPUS BUTTE FIRE	DESCHUTES NATIONAL FOREST
CARLSON, RICHARD	1984	DORRANCE TIMBER SALE	DESCHUTES NATIONAL FOREST
CARLSON, RICHARD	1984	WAGO C.T. TIMBER SALE	DESCHUTES NATIONAL FOREST
CARLSON, RICHARD & JIM PARKER	1985	WALOAK TIMBER SALE	DESCHUTES NATIONAL FOREST
CARUSO, JOHN	1984	SWAMPY LAKES LP SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
CARUSO, JOHN	1986	OXBOW B O PROJECT	DESCHUTES NATIONAL FOREST
CARUSO, JOHN & REX APPLEBY	1986	LOOKOUT MT SITE PREPARATION STUDY	DESCHUTES NATIONAL FOREST
CASSIDY, ELIZABETH	1994	UNCLAIMED LAVAS PROJECT	DESCHUTES NATIONAL FOREST
CHAUDET, MOLLIE	1984	NORTH TROUT TIMBER SALE	DESCHUTES NATIONAL FOREST
CHEATHAM, RICHARD	1992	PRELIMINARY RESULTS OF TEST EXCAVATIONS AT 35DS947 WITHIN THE PROPOSED R-O-W OF THE DESCHUTES RIVER-US 97 SECTION OF THE MCKENZIE-BEND	ODOT
CHEATHAM, RICHARD	1990	PRELIMINARY RESULTS OF ARCHAEOLOGICAL TEST EXCAVTIONS AT THE BON SITE (BP-1) WITHIN THE PROPOSED R-O-W OF THE BEND PARKWAY PROJECT	ODOT
CHEATHAM, RICHARD	1991	ARCHAEOLOGICAL SURVEY OF THE DESCHUTES RIVER - US 97 SECTION OF THE MCKENZIE-BEND HIGHWAY (US 20), DESCHUTES COUNTY	ODOT
CHEATHAM, RICHARD	1991	ARCHAEOLOGICAL SURVEY OF THE SISTERS-TUMALO SECTION OF THE MCKENZIE-BEND HIGHWAY (US 20)	ODOT

AUTHOR	DATE	TITLE	AGENCY
CHEATHAM, RICHARD & GUY TASA	1992	ARCHAEOLOGICAL TEST EXCAVATIONS AT THE BON SITE (35DS608) DESCHUTES COUNTY, OREGON	ODOT
CHURCHILL, THOMAS	1993	1992 CULTURAL RESOURCE INVESTIGATIONS OF THE MT BACHELOR SKI RESORT	PRIVATE
CHURCHILL, THOMAS	1987	A CULTURAL RESOURCE SURVEY FOR THE PROPOSED MT BACHELOR SKIING IMPROVEMENTS	DESCHUTES NATIONAL FOREST
CHURCHILL, THOMAS	1991	A CULTURAL RESOURCE SURVEY OF A PORTION OF THE MT BACHELOR RESORT AREA	
CHURCHILL, THOMAS	1986	A CULTURAL RESOURCE SURVEY OF THE PROPOSED RIVER MEADOWS INC. BOAT MARINA	RIVER MEADOWS INC
CHURCHILL, THOMAS	1991	A CULTURAL RESOURCE SURVEY OF THE MT BACHELOR INC NORDIC SKI AREA	
CHURCHILL, THOMAS	1994	MT BACHELOR SKI RESORT	PRIVATE
CHURCHILL, THOMAS & PAUL JENKINS	1992	A CULTURAL RESOURCE SURVEY OF VARIOUS PORTIONS OF THE MT BACHELOR SKI RESORT AREA	DESCHUTES NATIONAL FOREST
CLARK, LINDA	1989	DESCHUTES COUNTY DEPT OF PUBLIC WORKS BORROW PITS	BLM
CLARK, LINDA	1989	LINE R-O-W OR-45004	BLM
CLARK, LINDA	1989	COATS PIPELINE	BLM
CLARK, LINDA	1989	ST CLAIR ROAD R-O-W	BLM
CLARK, LINDA	1989	POWER LINE R-O-W OR-44960	BLM
CLARK, LINDA	1989	DESCHUTES TRESPASS CASES	BLM
COLE, DAVID	1977	ARCHEOLOGICAL EXPLORATIONS AT SUNRIVER	DESCHUTES NATIONAL FOREST
CONNOLLY, THOMAS	1990	PRELIMINARY REPORT OF TEST EXCAVATIONS AT ARCHAEOLOGICAL SITES ALONG THE PAULINA-EAST LAKE HIGHWAY WITHIN NEWBERRY CRATER	ODOT
CONNOLLY, THOMAS	1987	ARCHAEOLOGICAL SURVEY OF THE REDMOND-BEND SECTION, THE DALLES-CALIFORNIA HIGHWAY (US 97), DESCHUTES COUNTY	ODOT
CONNOLLY, THOMAS & MUSIL & FREIDEL	1991	ARCHAEOLOGICAL INVESTIGATIONS ALONG THE PAULINA-EAST LAKE HIGHWAY WITHIN NEWBERRY CRATER, CENTRAL OREGON	ODOT
COOPER, DAVID	ND	EAGLE ROCK PRECOMMERCIAL THINNING	DESCHUTES NATIONAL FOREST
COOPER, DAVID	ND	EAST DAVIS PRECOMMERCIAL THINNING	DESCHUTES NATIONAL FOREST
COOPER, DAVID	ND	NORTH DAVIS PRECOMMERCIAL THINNING	DESCHUTES NATIONAL FOREST
CRAYCROFT, ROBERTA	1985	STRAIGHT ROAD SITE PREPARATION	DESCHUTES NATIONAL FOREST
CROWLEY, SUZANNE	1981	TRESPASS TEMPORY USE PERMIT	BLM
CROWLEY, SUZANNE	1981	JUNIPER FIREWOOD TIMBER SALE	BLM
CROWLEY, SUZANNE	1981	MILLICAN BASIN FENCE	BLM
CROWLEY, SUZANNE	1981	DUNEGAN FENCE	BLM
CROWLEY, SUZANNE	1981	LIZARD PIPELINE	BLM
CROWLEY, SUZANNE	1981	CENTURY WEST ENGINEERING CORP DRILLING PERMIT	BLM

AUTHOR	DATE	TITLE	AGENCY
CROWLEY, SUZANNE	1981	BOZARTH AND MILLER ROAD R-O-W	BLM
CROWLEY, SUZANNE	1981	BEND SCHOOL DISTRICT #1 LAND EXCHANGE	BLM
CROWLEY-THOMAS, SUZANNE	1985	EVANS WELL PIPELINE	BLM
CROWLEY-THOMAS, SUZANNE	1983	CRENSHAW PIPELINE	BLM
CROWLEY-THOMAS, SUZANNE	1985	EAGLE CREST ROAD ROW	BLM
CROWLEY-THOMAS, SUZANNE	1983	REG HALLIGAN R-O-W	BLM
CROWLEY-THOMAS, SUZANNE	1983	YREKA FENCE	BLM
CROWLEY-THOMAS, SUZANNE	1983	THOMPSON ACCESS ROAD R-O-W	BLM
DAVIS, CARL	1982	IOOF SITE CULTURAL RESOURCE REPORT	DESCHUTES NATIONAL FOREST
DE KLYEN, MICHAEL	1991	GUY MOUNT III POWERLINE	DESCHUTES NATIONAL FOREST
DE KLYEN, MICHAEL	1991	COW CAMP SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
DE KLYEN, MICHAEL & MARK SWIFT	1991	SISTERS SCHOOL LAND PURCHASE	DESCHUTES NATIONAL FOREST
DENISON, MARJEAN & JEFF WALKER	1989	CRANE-LEMISH TIMBER SALE	DESCHUTES NATIONAL FOREST
DRESSER, GARY	1978	FOXY TIMBER SALE	DESCHUTES NATIONAL FOREST
DUMOND, DON & RICK PETTIGREW	1978	REPORT ON THE ARCHAEOLOGICAL SURVEY OF THE BEND SOUTH CITY LIMITS-MURPHY ROAD SECTION, THE DALLES-CALIFORNIA HIGHWAY	DOT
DUMOND, DON & RICK PETTIGREW	1978	REPORT ON THE ARCHAEOLOGICAL SURVEY OF THE FERGUSON ROAD-TEKAMPE ROAD SECTION, KNOTT ROAD	DOT
DUMOND, DON & RICK PETTIGREW	1979	REPORT ON THE ARCHAEOLOGICAL SURVEY OF THE EAST BOUDARY DESCHUTES N. F. SOUTHWESTERLY SECTION, OREGON FOREST HIGHWAY ROUTE 46	DOT
DYER, EDWIN S.	1979	WAGON ROAD TIMBER SALE	DESCHUTES NATIONAL FOREST
DYER, EDWIN S.	1980	BULL SPRINGS TIMBER SALE	DESCHUTES NATIONAL FOREST
DYER, EDWIN S.	1980	WOOD & POLE CUTTING	DESCHUTES NATIONAL FOREST
DYER, EDWIN S.	1980	INDIAN FORD TIMBER SALE	DESCHUTES NATIONAL FOREST
ENDZWEIG, PAMELA	1989	POWELL BUTTE JUNIPER CUT	BLM
ENDZWEIG, PAMELA	1989	CENTRAL ELECTRIC COOP ODIN FALLS DISTRIBUTION LINE	BLM
ENDZWEIG, PAMELA	1989	MIDSTATE ELECTRIC COOP R-O-W	BLM
ENNEBERG, MARCI	1987	JACKPINE LOOP COMMERCIAL FIREWOOD SALE	BLM
ENNEBERG, MARCI	1987	LAPINE SEWER COLLECTION SYSTEM	BLM
ENNEBERG, MARCI	1987	TRAINGLE COMMERCIAL FIREWOOD SALE	BLM
ENNEBERG, MARCI	1987	97 CORRIDOR COMMERCIAL FIREWOOD SALE	BLM

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ENNEBERG, MARCI	1988	MISERY GUZZLER	BLM
ENNEBERG, MARCI	1987	3 COMMERCIAL FIREWOOD SALE	BLM
ENNEBERG, MARCI	1987	LAPINE TIMBER SALE	BLM
ENNEBERG, MARCI	1987	4 COMMERCIAL FIREWOOD SALE	BLM
ENNEBERG, MARCI	1988	OR 06464 R-O-W	BLM
ENNEBERG, MARCI	1987	LAPINE WODCUTS	BLM
ENNEBERG, MARCI	1988	FOSS PROJECTS	BLM
ENNEBERG, MARCI	1987	POWELL BUTTE PERSONAL USE FIREWOOD	BLM
ENNEBURG, MARCI	1988	SAGE HOLLOW PIPELINE	BLM
ENNEBURG, MARCI	1988	HOME HOLLOW JUNIPER TIMBER SALE	BLM
ERTLE, LYNN	1986	BROWNS MOUNTAIN TIMBER SALE	DESCHUTES NATIONAL FOREST
ERTLE, LYNN & JANINE MCFARLAND	1986	SMALL TRACTS ACT-LILY CHOATE	DESCHUTES NATIONAL FOREST
ERTLE, LYNN & JANINE MCFARLAND	1987	LAB TIMBER SALE	DESCHUTES NATIONAL FOREST
FLENNIKEN, JEFFREY & TERRY OZBUN	1993	ARCHAEOLOGICAL TESTING AND EVALUATION OF THE BIG OBSIDIAN FLOW SITE, 35DS212	DESCHUTES NATIONAL FOREST
FOLLANSBEE, JULIA	ND	REPORT ON CULTURAL RESOURCES FOR THE SEWER FACILITIES PLAN: SISTERS,OREGON	EPA
FOLLANSBEE, JULIA	1977	LETTER REPORT-BEND WATER SYSTEM	EPA
FOLLANSBEE, JULIA	ND	REPORT ON ARCHEOLOGICAL RESOURCES-BEND AREA SEWERAGE FACILITIES PLAN	EPA
FOLLANSBEE, JULIA & E. FRANCES	1980	AN ASSESSMENT OF THE POTENTIAL NATIONAL REGISTER ELIGIBILITY OF THE BEND- PRINEVILLE WAGON ROAD AND ARCHEOLOGICAL SITE 35DS54	CULTURAL RESOURCE MANAGMENT, INC.
FOWLER, ED	1979	SITKUM BUTTE TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	LOOKOUT MT TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	SKYLINER SNOW-PLAY AREA	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	LOOKOUT #2 TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	C.P. POLE #1 & #2 TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	WOOD ROAD # 1 TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	LOLAH TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	ND	GREEN LODGE POLE TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	BROWN'S MTN TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	1980	BRIDGE CREEK TIMBER SALE AMENDED	DESCHUTES NATIONAL FOREST
FOWLER, ED	1990	DOILY TIMBER SALE	DESCHUTES NATIONAL FOREST

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FOWLER, ED	1980	FROLIC TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	ND	BEND QUARRY SITE SURVEY	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	BRIDGE CREEK TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	LOOKOUT OVERSTORY TIMBER SALE	DESCHUTES NATIONAL FOREST
FOWLER, ED	1979	LEMISH TIMBER SALE	DESCHUTES NATIONAL FOREST
FREED, ROBERT	1985	CULTURAL RESOURCE INVESTIGATION FOR THE DESCHUTES RIVER ICE-JAM STUDY BEND, OREGON	CORPS OF ENGINEERS
GIBSON, ERIC	1989	LETTER REPORT- EAGLE CRST LAND EXCHANGE TEST EXCAVATION AT 35DS518	BLM
GILREATH, AMY	1993	GEOTHERMAL DEVELOPMENT BY CE CORPORATION IN THE NEWBERRY CRATER VICINITY	DESCHUTES NATIONAL FOREST
GILSEN, LELAND	1990	ARCHAEOLOGICAL TESTING - 35DS316 TUMALO STATE PARK	SHPO
GOODMAN, SCOTT	1990	PANTEKOEK TRESPASS	BLM
GOODMAN, SCOTT	1990	FOSTER ROAD/LAPINE STATE PARK R-O-W	BLM
GREGORY, RON	1993	DEICE FIBER SALE #3-168	DESCHUTES NATIONAL FOREST
GRIFFIN, DENNIS & DEBI SOPER	1984	HIGHWAY 31 CORRIDOR	BLM
GRIFFIN, DENNIS & DEBI SOPER	1984	HIGHWAY 97 CORRIDOR	BLM
GRIFFIN, DENNIS & DEBI SOPER	1984	PINE MOUNTAIN PRESCRIBED BURN	BLM
GRIFFIN, DENNIS & DEBI SOPER	1984	FY85 TIMBER SALE	BLM
GRIGSBY, THOMAS	1992	NOVA ONE TIMBER SALE	DESCHUTES NATIONAL FOREST
HALLORAN, LAURIE	1992	LUNABESS RESOURCE	DESCHUTES NATIONAL FOREST
HAMILTON, CHARLES	1988	SPARKS LAKE ROAD CONSTRUCTION	DESCHUTES NATIONAL FOREST
HAMILTON, CHARLES	1988	CRANE PRARIE CAMPGROUND EXTENSION	DESCHUTES NATIONAL FOREST
HAMILTON, CHRISTINE	1988	ROCK CREEK CAMPGROUND EXPANSION	DESCHUTES NATIONAL FOREST
HAMILTON, CHRISTINE	1988	ROCK CREEK CAMPGROUND EXPANSION TESTING PROJECT OF SITE 7-BRD-87	DESCHUTES NATIONAL FOREST
HAMILTON, CHRISTINE	1988	CRANE PRARIE CAMPGROUND TESTING OF PREHISTORIC SITE 1-BRD-87	DESCHUTES NATIONAL FOREST
HAMILTON, CHRISTINE	1988	ROCK CREEK FISH CLEANING STATION	DESCHUTES NATIONAL FOREST
HASTIE, COLIN	1979	STATE PARKS-FOREST SERVICE LAND EXCHANGE	WINEMA NATIONAL FOREST
HATFIELD, DAVID & ADAM STELLMACHER	1988	TWIN LAKES TIMBER SALE	DESCHUTES NATIONAL FOREST
HEFTER, RUDY	1984	BLACK PINE SPRINGS TIMBER SALE	DESCHUTES NATIONAL FOREST

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HICKS, CATHERINE	ND	94 ROAD CLOSURES	DESCHUTES NATIONAL FOREST
HICKS, CATHERINE	ND	BLACK CRATER ROAD CLOSURES	DESCHUTES NATIONAL FOREST
HICKS, CATHERINE	ND	BLACK CRATER TRAILHEAD & TRAIL RELOCATION PROJECT	DESCHUTES NATIONAL FOREST
HICKS, CATHERINE	ND	EDGAR LAKE CLAY PIT EXPANSION PROJECT	DESCHUTES NATIONAL FOREST
HICKS, CATHERINE	ND	TRAPPER MEADOW HORSE TROUGH PROJECT	DESCHUTES NATIONAL FOREST
HICKS, CATHERINE	1993	ROADS TO TRAILS SECTION A	DESCHUTES NATIONAL FOREST
HICKS, CATHERINE & DON ZETTEL	ND	THREE CREEKS LAKE DAM	DESCHUTES NATIONAL FOREST
HICKS, CATHERINE & DON ZETTEL	1993	BROKEN RIM LODGEPOLE PINE SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
HOLM ,ARLIE	1986	QUINN MEADOW SHELTER	DESCHUTES NATIONAL FOREST
HOLM, ARLIE	1986	QUINN RIVER PARK	DESCHUTES NATIONAL FOREST
HOLM, ARLIE	1986	TRAPPER BRIDGE PARK	DESCHUTES NATIONAL FOREST
HOLM, ARLIE	1986	RIVER PARKS	DESCHUTES NATIONAL FOREST
HOLM, ARLIE AND ED FOWLER	1980	TUMALO CHIP TIMBER SALE	DESCHUTES NATIONAL FOREST
JACOBS, GREG	ND	CLOVERDALE UNDERGROUND CABLE	DESCHUTES NATIONAL FOREST
JENKINS, PAUL	1991	TOPSO TIMBER SALE	DESCHUTES NATIONAL FOREST
JENKINS, PAUL	1986	ARCHAEOLOGICAL TESTING OF THE LANCER RELOG SITE FORT ROCK RANGER DISTRICT DESCHUTES NATIONAL FOREST	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1985	EDISON SNOWMOBILE TRAIL CONSTRUCTION	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1985	WICKIUP PLAIN TRAILS RELOCATION PROJECT	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1984	SOUTH FORK TRAIL	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1984	STAND 997 TIMBER SALE	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1984	PIT POWERLINE	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1984	EDISON SNOWMOBILE TRAIL	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1985	SMOMOBILE TRAIL 4	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1985	TUMALO MTN TRAIL RELOCATION	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1986	KWOHL BUTTE SNOWMOBILE TRAIL CONSTRUCTION	DESCHUTES NATIONAL FOREST
JOHNSON, DWIGHT	1984	PRINGLE O.R. TIMBER SALE	DESCHUTES NATIONAL FOREST
KNOKEY, JUDY	1986	MOCK #2 FIREWOOD SALE	BLM

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KNOKEY, JUDY	1986	CHADWELL FIREWOOD SALE	BLM
KNOKEY, JUDY	1986	HUNTINGTON ROAD/SUNSET RANCH FIREWOOD SALE	BLM
KNOKEY, JUDY	1986	POWELL BUTTE JUNIPER FIREWOOD TIMBER SALE	BLM
KNOKEY, JUDY	1986	CENTRAL ELECTRIC AERIAL POWERLINE TAP TO EAGLE CREST	BLM
KNOKEY, JUDY	1986	OTTENI FIREWOOD SALE	BLM
KNOKEY, JUDY & SUZANNE CROWLEY THOMAS	1986	STATE CLEAN-UP EXCHANGE CULTURAL RESOURCES SURVEY AND SITE EVALUATION REPORT	BLM
LEBOW, CLAYTON & ERIC GIBSON	1990	EVALUATION OF THE EAGLE CREST SITE (35DS518) DESCHUTES COUNTY, OREGON	BLM
LEE & PORTER	1988	SWEDE THIN TIMBER SALE	DESCHUTES NATIONAL FOREST
LINDH, CHRISTINE	1988	SOUTH TUMALO TIMBER SALE	DESCHUTES NATIONAL FOREST
LINDH, CHRISTINE	1985	LUCKY TIMBER SALE	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1991	RAY ATKINSON MEMORIAL TRAIL	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1992	JINGLE THINNING PROJECT	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	ND	1992 ENGINEERING ROADS	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	ND	FUELS TREATMENT FOR BEND CITY WATERSHED	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1992	BEND PINE NURSERY'S YEOMAN FIELD	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1992	DEVILS FLAT PUMICE MINE #2	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1989	SIBURN-FROLIC TIMBER SALE	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1992	TIE/PINE BLACK BARK TIMBER SALE	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1992	SOUTH END THINNING	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1995	FOUR CORNERS FIRE TIMBER SALE	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1992	JINGLE SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1990	DILLWICK SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1992	1992 HUNT'S ROAD PROJECTS	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1991	WICKIUP RESERVOIR WOODY DEBRIS PLACEMENT	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1994	1995 PRESCRIBED BURN: PRINGLE FALLS NATURAL AREA	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1994	NORIDC TO BIKE TRAIL CONVERSION	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1989	CARETATER TIMBER SALE	DESCHUTES NATIONAL FOREST

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LIPSCOMB, CHRISTINE	1992	COLT AND BLUE COLT TIMBER SALE	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1992	FALL RIVER GUARD STATION SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE	1994	SWAMPY LAKES TRAIL REROUTE	DESCHUTES NATIONAL FOREST
LIPSCOMB, CHRISTINE & DANIEL NEWSOME	1991	PRINGLE FALLS EXPERIMENTAL FOREST FUELBREAK	DESCHUTES NATIONAL FOREST
LISLE, SPARKY	ND	PINE MOUNTAIN TRICK TANK NO. 2	DESCHUTES NATIONAL FOREST
MASTEN, RUTH	1987	A CULTURAL RESOURCES SURVEY OF PHASE 1 OF THE BPA'S PROPOSED LAPINE PROJECT, DESCHUTES COUNTY, OREGON	BPA
MATTSON, DANIEL	1985	STATE PARK TIMBER SALE	BLM
MATTSON, DANIEL	1985	DODDS ROAD SEEDING	BLM
MATTSON, DANIEL & S C THOMAS	1985	EVANS WELL PIPELINE EXTENSION	BLM
MATZ, STEPHAN	1989	EAGLE CREST-RATTRAY PRIVATE LAND EXCHANGE	BLM
MATZ, STEPHAN	1989	CABLE LINE	DESCHUTES NATIONAL FOREST
MATZ, STEPHAN	1992	PAULINA LAKE GUARD STATION FUEL TANK REPLACEMENT	DESCHUTES NATIONAL FOREST
MATZ, STEPHAN	1989	UNKAS TIMBER SALE	DESCHUTES NATIONAL FOREST
MATZ, STEPHAN & DANIEL FOWLER	1989	NORTH QUARTZ UNDERBURN	DESCHUTES NATIONAL FOREST
MATZ, STEPHAN & SCOTT STUEMKE	1990	HUMBUG BLACK BARK THINNING PROJECT	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1985	SOUTH TWIN CAMPGROUND HAZARD TREE REMOVAL	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	ND	BUG 80 LP SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1988	EDISON SNOWMOBILE/NORDIC TRACK COMPLEX	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1985	LOOKOUT MTN FIRE TIMBER SALE	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1985	WEST CULTUS LAKE CAMPGROUND ACCESS ROAD	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1985	SIRE TIMBER SALE	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1985	LOOKOUT MTN ELECTRONICS SITE	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1985	WICKIUP FIBRE TIMBER SALE	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1985	INDIAN CREEK PROJECT	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1987	TEST EXCAVATIONS AND EVALUATIONS OF THE FALL RIVER PREHISTORIC SITES	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1988	INN OF THE SEVENTH MTN REHABILITATION	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1990	TEST EXCAVATIONS AND EVALUATIONS AT THE FOREST CAMP (87-5) AND LITTLE LAVA LAKE (35DS61) PREHISTORIC SITES	DESCUTES NATIONAL FOREST

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MCFARLAND, JANINE	1988	QUINN RIVER NIGHT TOILET	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE	1989	SIAH TIMBER SALE	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE & ADAM STELLMACHER	1988	SPARKS LAKE ROAD RELOCATION TESTING PROJECT OF PREHISTORIC SITE 10-BRD-87 (35DS991)	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE & ADAM STELLMACHER	1988	END TABLE TIMBER SALE	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE & CHRISTINE LINDH	1985	KANOGA TIMBER SALE	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINE RUTH	1989	AN ANALYSIS OF TWO POST-MAZAMA PREHISTORIC FLAKED STONE SCATTERS IN THE UPPER DESCHUTES RIVER BASIN OF CENTRAL OREGON	OSU
MCFARLAND, JANINE, STELLMACHER & BETTENDORFF	1991	STOCKING LEVEL CONTROL IN SECOND GROWTH PONDEROSA PINE: 1988 BLACK BARK	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINIE & CARL DAVIS	1985	1983 RECONNAISSANCE SURVEY OF SELECTED FOREST SERVICE LANDS ALONG THE DESCHUTES RIVER, BEND RIVER DISTRICT, DESCHUTES NATIONAL FOREST	DESCHUTES NATIONAL FOREST
MCFARLAND, JANINIE & CHRISTINE LINDH	1985	SPRING RIVER ROAD CONSTRUCTION PROJECT	DESCHUTES NATIONAL FOREST
MCKAY, IAN	1988	SOUTH BUG SLAVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
MENEFEE, CHRISTINE	1992	RED BUTTE & RED BUTTE #2 CINDER PIT EXPANSION	DESCHUTES NATIONAL FOREST
MENEFEE, CHRISTINE	1992	MECHANICAL SLASH PROJECT	DESCHUTES NATIONAL FOREST
MENEFEE, CHRISTINE	1992	KATSUK HORSE TRAIL	DESCHUTES NATIONAL FOREST
MENEFEE, CHRISTINE & EILEEN SPENCER	1992	SLASH PILING/PINE 88	DESCHUTES NATIONAL FOREST
MILLER, HILARY & LUCY HAMILTON	1992	EAST BUTTE LOOKOUT	DESCHUTES NATIONAL FOREST
MINOR, RICK & KATHRYN ANNE TOEPEL	1984	LAVA ISLAND ROCKSHELTER: AN EARLY HUNTING CAMP IN CENTRAL OREGON	NATURAL HISTORY NUMBER 34
MINOR, RICK & THOMAS CONNOLLY	1979	AN ARCHAEOLOGICAL EVALUATION OF SITE 35DS55, DESCHUTES COUNTY, OREGON	BLM
NEWMAN, TOM & MAUREEN MCNASSER	1977	ARCHEOLOGICAL-HISTORICAL SURVEY FOR THE TUMALO DOMESTIC WATER DISTRICT PROPOSED WATER LINE EXPANSION PROJECT	EPA
NEWSOME, DANIEL	1990	LAST RESORT TIMBER SALE	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL	1990	PK2 TIMBER SALE	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL	1990	TUMALO CREEK FISH HABITAT RESTORATION	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL	1990	FALL RIVER TRAIL	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL	1991	AWBREY HALL FIRE REHABILITATION	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL	1991	LABRIDGE-LOOKOUT TIMBER SALE	DESCHUTES NATIONAL FOREST

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NEWSOME, DANIEL	1990	CAMPGROUND SANITATION PROJECT	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL	1991	BENCHMARK-APPLEJACK PROJECT	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL	1990	BEND SEWER LINE PROJECT	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL & CHRISTINE LIPSCOMB	1991	TUMALO REEK FISH HABITAT REHABILITATION	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL & CHRISTINE LIPSCOMB	1991	CHA-CHA TIMBER SALE	DESCHUTES NATIONAL FOREST
NEWSOME, DANIEL & JEFF WALKER & MARCIA BUNNELL	1991	BAIT TIMBER SALE	DESCHUTES NATIONAL FOREST
NEWSOME, DAVID	1990	BULL BEND CAMPGROUND IMPROVEMENT	DESCHUTES NATIONAL FOREST
O'NEILL, BRIAN	1991	CULTURAL RESOURCE INVENTORY OF THE BEND HYDROELECTRIC PROJECT, DESCHUTES COUNTY, OREGON	PP & L
O'REILLY, BRIAN	ND	S. KURINA LP SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
O'REILLY, BRIAN	1985	MOKST-LAVA LP FIBRE TIMBER SALE	DESCHUTES NATIONAL FOREST
O'REILLY, BRIAN	ND	FALL RIVER JCT L.P. SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
OETTING, ALBERT	1994	CULTURAL RESOURCES SURVEY OF FIVE PARCELS IN A PROPOSED SURFACE MINING PROJECT, DESCHUTES COUNTY, OREGON	DESCHUTES NATIONAL FOREST
OLSON, BARBARA	1992	DUTCHMAN PIT ENLARGEMENT	DESCHUTES NATIONAL FOREST
OLSON, BARBARA	1992	BEAR WALLOWS ELECTRONIC REPORT	DESCHUTES NATIONAL FOREST
OSBORN, JILL	1988	LETTER REPORT-PAULINA HIGHWAY SECTION	OCHOCO NATIONAL FOREST
OWENS, DONNA	1987	ROAD 1801 RELOCATION	DESCHUTES NATIONAL FOREST
OWENS, DONNA	1986	GEOTHERMAL PROSPECTING	DESCHUTES NATIONAL FOREST
OWENS, DONNA	1987	GEO NEWBERRY CRATER TEMPERATURE GRADIENT HOLE	DESCHUTES NATIONAL FOREST
OWENS, DONNA	1987	MIDSTATE ELECTRIC INC POWERLINE R-O-W	DESCHUTES NATIONAL FOREST
OWENS, DONNA	1987	MIDSATE ELECTRIC COOP INC 115 KV TRANSMISSION LINE - LAPINE SUBSTATION TO FINLEY BUTTE ROAD	DESCHUTES NATIONAL FOREST
OWENS, DONNA	1987	PACIFIC GAS TRANSMISSION CATHODE WIRE	DESCHUTES NATIONAL FOREST
OWENS, DONNA	1985	SW SANITARY LANDFILL	DESCHUTES NATIONAL FOREST
PARKER, JIM	1985	DORRANCE SPEC. ROADS	DESCHUTES NATIONAL FOREST
PASTOR, ROBERT	1988	LA PINE TIMBER SALE	BLM
PAUL, WALT	1979	LANCER TIMBER SALE	DESCHUTES NATIONAL FOREST
PETTIGREW, RICHARD	1985	REPORT ON THE ARCHAEOLOGICAL SURVEY OF THE TWELFTH STREET BEND-POWELL BUTTE JUNCTION SECTION, CENTRAL OREGON HIGHWAY, DESCHUTES COUNTY	DOT

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PETTIGREW, RICHARD	1985	REPORT ON THE ARCHAEOLOGICAL SURVEY OF THE MURPHY ROAD-LAVA BUTTE SECTION, THE DALLES-CALIFORNIA HIGHWAY, DESCHUTES COUNTY	DOT
PETTIGREW, RICHARD & ROBERT SPEAR	1984	ARCHAEOLOGICAL INVESTIGATIONS OF TWO SITES (35DS56 & 57) ON THE CASCADES LAKES HIGHWAY, DESCHUTES COUNTY, OREGON	DOT
PORTER, NANCY	1985	GALES THIN	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1988	RYAN THIN TIMBER SALE	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1986	TRILUCK THIN TIMBER SALE	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1985	CRANE LP TIMBER SALE	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1986	CRANE LP TIMBER SALE	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1984	KIWA SPRING TIMBER SALE	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1986	OXBOW, CO-OP & TWIN LAKES THINNING	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1986	KLAK, FALL RIVER & PRINGLE THINNING	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1985	ADDENDUM TO WAMPUS TIMBER SALE	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1985	HWY 46 THIN	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1988	APPLEJACK SITE PREPARATION	DESCHUTES NATIONAL FOREST
PORTER, NANCY	1988	PINE 88 COMMERCIAL THIN	DESCHUTES NATIONAL FOREST
PRICE, BARRY	1992	LETTER REPORT-ARCHAEOLOGICAL SURVEY OF WILBROS WAREHOUSE SITE, BEND	FERC
PRICE, BARRY	1992	LETTER REPORT-ARCHAEOLOGICAL SURVEY COMPRESSOR STATIONS 12 AND 13 AND MICROWAVE TOWER LINE CHANGE (MP 472.3)	FERC
RAHARSON, DWIGHT	1986	KETCH 22 TIMBER SALE	DESCHUTES NATIONAL FOREST
REIMANN, BARBARA	1992	CALIFORNIA ENERGY POWER PLANT	DESCHUTES NATIONAL FOREST
REIMANN, BARBARA	1991	DILWICK KV FISH PROJECT	DESCHUTES NATIONAL FOREST
REIMANN, BARBARA	1992	VULCAN WELL PADS PROJECT	DESCHUTES NATIONAL FOREST
REIMANN, BARBARA & EILEEN SPENCER	1991	PRINGLE/JINGLE FISH PROJECT	DESCHUTES NATIONAL FOREST
RITCHIE, IAN	1986	PUMICE BUTTE TIMBER SALE	DESCHUTES NATIONAL FOREST
RITCHIE, IAN	1987	NEWBERRY EXPLORATORY WELL (GEO FY88)	DESCHUTES NATIONAL FOREST
RITCHIE, IAN	1986	TAGHUM BUTTE TIMBER SALE	DESCHUTES NATIONAL FOREST
RITCHIE, IAN	1987	PAULINA HIGHWAY PROJECT	DESCHUTES NATIONAL FOREST

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ROULETTE, BILL	1993	REPORT OF AN ARCHAEOLOGICAL SURVEY OF PROPOSED BORING PIT AND MONITORING WELL LOCATIONS ON BLM LANDS, DESCHUTES COUNTY, OREGON	BLM
ROULETTE, BILL	1993	AN ARCHAEOLOGICAL SURVEY OF PROPOSED MONITORING WELL LOCATIONS ON BLM LANDS	BLM
ROULETTE, BILL	1994	RESULTS OF AN ARCHAEOLOGICAL SURVEY OF THE CITY OF REDMOND'S PROPOSED EFFLUENT INFILTRATION BASIN SITE, DESCHUTES COUNTY, OREGON	CITY
ROULETTE, BILL	1994	REPORT OF AN ARCHAEOLOGICAL SURVEY OF THE PROPOSED INFILTRATION BASIN, BORING PIT, AND MONITORING WELL LOCATIONS ON BLM AND CITY OF RED	BLM
RUMBLE, BETTY & ED DYER	1984	BLACK BUTTE GRAVEL PIT EXPANSION	DESCHUTES NATIONAL FOREST
RUSHMORE, PAUL & MICHAEL BURNEY	1992	ARCHAEOLOGICAL SITE TESTING OF PRINCESS CREEK (35KL882) AND SUNSET COVE (35KL884)	DESCHUTES NATIONAL FOREST
SCHMIDT, CHESTER	1991	HICKMAN R-O-W & BURIED CABLE	BLM
SCHMIDT, CHESTER	1993	LONG BEND RECREATION REHABILITATION	BLM
SCHMIDT, CHESTER	1993	LOWER DESCHUTES SPRING PROJECTS	BLM
SCHMIDT, CHESTER	1992	CHRIS CRINGLE MINE	BLM
SCOTT, SARA	1988	CULTURAL RESOURCE REPORT FOR THE CENTURY DRIVE IMPROVEMENT PROJECT DESCHUTES COUNTY, OREGON	ODOT
SCOTT, SARA	1984	A PRELIMINARY CULTURAL RESOURCE SURVEY OF THE NEWBERRY CRATER	DESCHUTES NATIONAL FOREST
SCOTT, SARA	1983	NORTH MCKAY CONTRACT ROAD	DESCHUTES NATIONAL FOREST
SCOTT, SARA	1986	THE O'NEIL JUNCTION HIGHWAY 97 EXPANSION PROJECT, DESCHUTES COUNTY, OREGON	DOT
SCOTT, SARA	1984	AN ARCHAEOLOGICAL OVERVIEW OF DESCHUTES COUNTY, OREGON	
SCOTT, SARA	1986	A CULTURAL RESOURCE SURVEY OF THE DESCHUTES RIVER, FROM BEND TO THE DESCHUTES/JEFFERSON COUNTY LINE, DESCHUTES COUNTY, OREGON	SHPO
SCOTT, SARA	ND	GEOTHERMAL PROJECT NOS. 1-3	DESCHUTES NATIONAL FOREST
SCOTT, SARA	ND	SURFACE MINING AREAS-DOT	DESCHUTES NATIONAL FOREST
SCOTT, SARA	ND	KELSEY BUTTE SEED ORCHARD	DESCHUTES NATIONAL FOREST
SCOTT, SARA	ND	FINLEY WEST TIMBER SALE	DESCHUTES NATIONAL FOREST
SCOTT, SARA	ND	PROPOSED BURIED CABLE LINE IN THE NEWBERRY CRATER	DESCHUTES NATIONAL FOREST
SCOTT, SARA & CARL DAVIS	ND	HUNTER-COMPANY BUTTE TIMBER SALE	DESCHUTES NATIONAL FOREST
SCOTT, SARA, CARL DAVIS & JEFFREY FLENNIKEN	1986	THE PAHOEHOE SITE: A LANCEOLATE BIFACE CACHE IN CENTRAL OREGON	IN ANTHROPOLOGY VOL 8, NO 1
SILVERMOON, JON	1990	ARCHAEOLOGICAL SURVEY OF THE BEND PARKWAY, THE DALLES-CALIFORNIA HIGHWAY (US97), DESCHUTES COUNTY	ODOT
SILVERMOON, JON	1989	FY 1990 LA PINE TIMBER SALE	BLM

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SINCLAIRE, ELIZABETH & STEPHAN MATZ	1992	BITTER SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
SINCLAIRE, ELIZABETH, STEPHAN MATZ & DANIEL FOWLER	1992	KO TIMBER SALE	DESCHUTES NATIONAL FOREST
SMITH, ANTHONY	ND	PINE MOUNTAIN TIMBER SALE	DESCHUTES NATIONAL FOREST
SMITH, ANTHONY	ND	FOXY TIMBER SALE	DESCHUTES NATIONAL FOREST
SNYDER, SANDRA	1983	NORTH DAVIS CRREK TIMBER SALE	DESCHUTES NATIONAL FOREST
SNYDER, SANDRA	1983	BOOT TIMBER SALE	DESCHUTES NATIONAL FOREST
SOPER, DEBORAH	1984	KEMPLE PUBLIC LAND SALE	BLM
SOPER, DEBORAH & DENNIS GRIFFIN	1984	BUTTE PASTURE PRESCRIBED BURN	BLM
SOPER, DEBORAH & DENNIS GRIFFIN	1984	LA PINE 84+ TIMBER SALE	BLM
SOPER, DEBORAH & DENNIS GRIFFIN	1984	LAPINE AIRPORT POST SALE	BLM
SOPER, DEBORAH & DENNIS GRIFFON	1984	KELLUM RANCH R-O-W	BLM
SOPER, DEBORAH & DENNIS GRIFFON	1984	REDMAN CEMETERY TIMBER SALE	BLM
SPENCER, EILEEN	1992	DESCHUTES RIVER TRAILS CULTURAL RESOURCE MANAGEMENT PLAN	DESCHUTES NATIONAL FOREST
SPENCER, EILEEN	1992	PRELIMINARY ANALYSIS OF TEST EXCAVATIONS AND PROPOSED MANAGEMENT PLAN FOR 35DS61-LAVA LAKES	DESCHUTES NATIONAL FOREST
SPENCER, EILEEN	1992	BORDER TO BORDER	DESCHUTES NATIONAL FOREST
SPENCER, EILEEN	1992	TUMALO TRAIL PROJECT	DESCHUTES NATIONAL FOREST
SPENCER, EILEEN	1992	FISHERIES ROAD CLOSURES	DESCHUTES NATIONAL FOREST
SPENCER, EILEEN	1993	BAIT/SNOWCONE TIMBER SALE	DESCHUTES NATIONAL FOREST
SPENCER, EILEEN	1992	BURCHETT/SPENSER LAND EXCHANGE	DESCHUTES NATIONAL FOREST
SPENCER, EILEEN & CHRISTINE LIPSCOMB	1993	CONTORTA TIMBER SALE	DESCHUTES NATIONAL FOREST
STEECE, LEROY	1986	TEEPEE DRAW TIMBER SALE	DESCHUTES NATIONAL FOREST
STEECE, LEROY	1987	PUMICE SALVAGE PROJECT	DESCHUTES NATIONAL FOREST
STEECE, LEROY	1987	TIKTOC SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
STEECE, LEROY	1985	DAVIUP #2 PROJECT	DESCHUTES NATIONAL FOREST
STEECE, LEROY & SHANE STEECE	1987	EAGLE SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
STEGGELL, NORM	1979	VARCO WELL PASTURE FENCE	BLM

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STEGGELL, NORM	1979	PIPELINE R-O-W FOR BEND SEWERAGE PLANT	BLM
STEGGELL, NORM	1979	OLEN COX R-O-W	BLM
STEGGELL, NORM	1979	PACIFIC NORTHWEST BELL TELEPHONE LINE	BLM
STEGGELL, NORM	1979	LAND LEASE/SALE ADMIN SCHOOL DISTRICT NO 1	BLM
STEGGELL, NORM	1979	BABLER BROS R-O-W	BLM
STEGGELL, NORM	1979	PP&L R-O-W	BLM
STEGGELL, NORM	1979	SETTLING POND	BLM
STEGGELL, NORM	1979	R-O-W	BLM
STEGGELL, NORM	1979	R-O-W	BLM
STELLMACHER, ADAM	1988	PRINGLE FALLS HIGHWAY WIDENING PROJECT	DESCHUTES NATIONAL FOREST
STELLMACHER, ADAM	1988	TANGENT NORDIC TRAILS COMPLEX	DESCHUTES NATIONAL FOREST
STELLMACHER, ADAM	1988	KATSUK HORSE AND SKI TRAIL	DESCHUTES NATIONAL FOREST
STELLMACHER, ADAM	1988	SOUTH SISTER CLIMB TRAIL	DESCHUTES NATIONAL FOREST
STEPHENSON, GARRY	1979	FURTHER CULTURAL RESOURCE INVESTIGATIONS OF BUREAU OF LAND MANAGEMENT UNITS E AND F, PRINEVILLE DISTRICT, OREGON	BLM
STEPHENSON, GARRY & DRAPER, JOHN	1978	A CULTURAL RESOURCE INVENTORY OF THE BUREAU OF LAND MANAGEMENT UNITS C,E AND F	BLM
STUEMKE, SCOTT	1987	NEWBERRY CRATER FISH CLEANING FACILITIES MONITORING REPORT	DESCHUES NATIONAL FOREST
STUEMKE, SCOTT	1987	TEST EXCAVATION AND EVALUATION OF THE SUGAR CAST SITE 364-FRD-86 (35DS752)	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	1986	FINLEY EAST LP SALE	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	1986	NOSE MITTEN LP TIMBER SALE	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	1986	KELLY BUTTE LP SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	ND	US 97 PASSING LANE PROJECT	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	1988	SUGAR CAST ASSESSMENT AREA	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	1987	NORTH BUG SLAVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	1989	SAND SPRING LP SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	1989	OGDEN GROUP CAMP (35DS473) AND MCKAY CROSSING (35DS122) CULTURAL RESOURCE TESTING REPORT	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	1988	OGDEN GROUP CAMP	DESCHUTES NATIONAL FOREST
STUEMKE, SCOTT	1989	PRARIE CAMPGROUND WATERLINE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	GLAZE TIMBER SALE	DESCHUTES NATIONAL FOREST

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SWIFT, MARK	1987	TROUT CORDWOOD SALES	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	CLAY PIT EXPANSION	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1990	GRAHAM CRACKER TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	PASS-EM-UP TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1987	UPPER 16 CORDWOOD TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	PARK LP TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1987	AN ARCHAEOLOGICAL SURVEY OF SUNRIVER AND PROPERTIES TO THE SOUTH ALONG THE DESCHUTES AND LITTLE DESCHUTES RIVERS	SUN RIVER PROPERTIES
SWIFT, MARK	1986	HIGH STUMP CORDWOOD TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	WILLOWS RANCH SURVEY	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1987	TWIN SWAMP TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1985	CAMP SHERMAN EXCAVATION OF PIT FOR RESTROOM VAULT	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	CUTOFF TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	POLE SWAMP TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1985	WALLA BEAR TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	VARMIT TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	GLAZE MEADOWS POND IMPROVEMENT	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1987	SEED TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	SISTERS CITY SEWER LAND ACQUISTION	DESCHUTES NATIONAL FOREST
SWIFT, MARK	1986	HIGHWAY 20 RELOCATION	DESCHUTES NATIONAL FOREST
SWIFT, MARK & BILL JONES	1987	MCARTHUR AND WISHBONE CORDWOOD SALES	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1991	GREEN RIDGE RESTORATION PROJECT	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1989	SISTERS ONE WAY GRID PROJECT	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1991	CROSSOVER SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1991	STEVENS CANYON FORAGE BURN AND CRUSH PROJECT	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1992	WALLA BEAR TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1990	CANAL 16 TIMBER SALE	DESCHUTES NATIONAL FOREST

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SWIFT, MARK & MICHAEL DE KLYEN	1989	SQUAW CREEK DEBRIS DIVERSION	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1991	WHITE FIR REMOVAL PROJECT	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1989	1988 POWERLINE EMPLACEMENT	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1990	DELICIOUS FIRE TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1989	BLUEGRASS SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1990	CROSS DISTRICT SNOWMOBILE TRAIL RELOCATION	DESCHUTES NATIONAL FOREST
SWIFT, MARK & MICHAEL DE KLYEN	1991	WINDY POINT AND MCKENZIE GRAVEL PIT PROJECT	DESCHUTES NATIONAL FOREST
SWIFT, MARK & OTHERS	1992	DYER POWERLINE	DESCHUTES NATIONAL FOREST
SWIFT, MARK, MICHAEL DE KLYEN & DONALD ZETTEL	1992	UNDERLINE TIMBER SALE	DESCHUTES NATIONAL FOREST
TASA, GUY	1992	ARCHAEOLOGICAL SURVEY OF THE CROOKED RIVER GORGE BRIDGE, THE DALLES-CALIFORNIA HIGHWAY (US 97), JEFFERSON AND DESCHUTES COUNTIES	ODOT
TASA, GUY	1992	ARCHAEOLOGICAL SUPPLEMENTAL SURVEY OF THE BAKER ROAD INTERCHANGE IN THE MURPHY ROAD TO LAVA BUTTE SECTION OF THE DALLES-CALIFORNIA HWY	ODOT
THOMAS, SCOTT	1994	LAPINE STATE PARK FISH HABITAT IMPROVEMENT	BLM
THOMAS, SCOTT	1994	MASTON FENCE AND PIPELINE	BLM
THOMAS, SCOTT	1992	COSSA SHOOTING RANGE	BLM
THOMAS, SCOTT	1993	GOLDEN BASIN PRESCRIBED BURN	BLM
THOMAS, SCOTT	1993	CENTRAL ELECTRIC CO-OP HINSHAW SERVICE	BLM
THOMAS, SCOTT	1994	DON SMITH R-O-W AND TRESPASS	BLM
TODD, MARCI	1988	CANARY DIVISION FENCE	BLM
TODD, MARCI	1989	AVION WATER R-O-W	BLM
TODD, MARCI	1989	BUCKHORN CANYON MINING TRESPASS	BLM
TODD, MARCI	1991	OREGON MOONBASE GEOTECHNICAL STUDY	BLM
TODD, MARCI	1990	WHISKEY FLAT FENCE CONSTRUCTION	BLM
TODD, MARCI	1988	HAUGHTEN-BROTHERS PIPELINE EXTENSION	BLM
TODD, MARCI	1989	COMMUNICATIONS BURIED TELEPHONE CABLE R-O-W	BLM
TODD, MARCI	1989	HORSE RIDGE GRAVEL PIT	BLM
TODD, MARCI	1992	LAPINE STATE IN-LIEU TRACTS	BLM
TOEPEL, KATHRYN & STEVE BECKHAM	1978	CULTURAL RESOURCE OVERVIEW OF THE BROTHERS EIS AREA,PRINEVILLE DISTRICT,OREGON	BLM
TOUSSAINT, WILDA	1991	STATE PARK TIMBER SALE	BLM
TOUSSAINT, WILDA	1991	CRENSHAW PIPELINE EXTENSION	BLM

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TOWNER & MATTSON	1985	FOSS SEEDING	BLM
TOWNER & MATTSON	1985	Z X PIPELINE	BLM
UNIDENTIFED	1989	ROSLAND CAMPGROUND WELL	DESCHUTES NATIONAL FOREST
VANDERFORD, JAY	1992	ROAD 2015 PRESCRIBED BURN	DESCHUTES NATIONAL FOREST
VANDERFORD, JAY	1989	DEICE TIMBER SALE	DESCHUTES NATIONAL FOREST
VANDERFORD, JAY	1992	POTHOLES #2 NATURAL FUELS PROJECT	DESCHUTES NATIONAL FOREST
WALKER, JEFF	1990	LUCKY THIN SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
WALKER, JEFF	1989	CALIFORNIA ENERGY EXPLORATION WELLS	DESCHUTES NATIONAL FOREST
WALKER, JEFF	1989	BEND WATERSHED TUMALO CREEK TRAIL PT 1	DESCHUTES NATIONAL FOREST
WALKER, JEFF	1990	STOCKING LEVEL CONTROL IN SECOND GROWTH PONDEROSA PINE: 1989 BLACK BARK	DESCHUTES NATIONAL FOREST
WILLARD, CYNTHIA	1978	ARCHEOLOGICAL SURVEY OF THE 80-ACRE PARCEL HAVING THE FOLLOWING DESCRIPTION:NE1/4,NW1/4,NW1/4,NE1/4SECTION 27,T17S,R12E	CITY
WILLIAMS, DOUGLAS	1986	THINBETWEEN TIMBER SALE	DESCHUTES NATIONAL FOREST
WILSON, DOUGLAS	1992	AN ARCHAEOLOGICAL RECONNAISSANCE SURVEY OF THE PROPOSED DESCHUTES COUNTY GOLF COURSE	CITY OF BEND
WILSON, ROBERTA	1988	BLACK BARK RESEARCH PLOT #2	DESCHUTES NATIONAL FOREST
WILSON, ROBERTA	1988	BLACK BARK RESEARCH PLOT #1	DESCHUTES NATIONAL FOREST
WOHLGEMUTH, ERIC	1993	CE ENERGY GEOPHYSICAL TESTING	DESCHUTES NATIONAL FOREST
YOUNGS, RICHARD	1985	CHINA HAT PIPELINE	DESCHUTES NATIONAL FOREST
YOUNGS, RICHARD	1986	SOUTH PRARIE LP SALVAGE TIMBER SALE	DESCHUTES NATIONAL FOREST
ZETTEL, DONALD	1992	TRASH DUMP CLEANUP PROJECT	DESCHUTES NATIONAL FOREST
ZETTEL, DONALD	1992	SISTERS RESERVOIR	DESCHUTES NATIONAL FOREST
ZETTEL, DONALD	1992	WILLAMETTE LAND EXCHANGE	DESCHUTES NATIONAL FOREST
ZETTEL, DONALD	1992	SISTERS HIGH SCHOOL BIKE PATHS	DESCHUTES NATIONAL FOREST
ZETTEL, DONALD	ND	INDIAN FORD ROAD CABLE	DESCHUTES NATIONAL FOREST
ZETTEL, DONALD	1992	CROSS DISTRICT SNOWMOBILE TRAIL	DESCHUTES NATIONAL FOREST

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