SPANGLE LAKES: AN INVESTIGATION OF LATE ARCHAIC HUMAN LAND-USE WITHIN THE SAWTOOTH MOUNTAINS

by

Kaitlyn Mansfield

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of the thesis submitted by

Kaitlyn Mansfield

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The following individuals read and discussed the thesis submitted by student Kaitlyn Mansfield, and they evaluated her presentation and response to questions during the final oral examination. They found that the student passed the final oral examination.

Pei-lin Yu, Ph.D.	Chair, Supervisory Committee
Mark G. Plew, Ph.D.	Member, Supervisory Committee
Samantha H. Blatt, Ph.D.	Member, Supervisory Committee

The final reading approval of the thesis was granted by Pei-lin Yu, Ph.D., Chair of the Supervisory Committee. The thesis was approved by the Graduate College.

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ABSTRACT

Recent high altitude archaeological research has provided evidence for seasonal utilization of high mountain landscapes during the Late Archaic era. Sites in the Western United States display varying patterns of land use suggesting that during the Late Archaic, mountain landscapes were used differently based upon unique environmental conditions. Hypotheses about land-use in the Spangle Lakes area of the Sawtooth Mountains, Idaho, were compiled from regional Late Archaic high elevation sites, regional ethnographic data, and a Binfordian database that utilizes environmental and ethnographic measurements to develop projections on hunter-gatherer behavior. Through a reinvestigation of the Spangle Lakes area, it was determined that Late Archaic sites are characterized by smaller surface areas with little to no depth. It was also determined that lithic flakes at these sites were crafted entirely from expedient use of locally available quartz but tools that were curated and constructed from materials sourced in other areas. Overall, it is suggested that this difference in characteristics may stem from the dynamic environment in which the sites are located, affecting the way in which people utilize their environment as well as the overall densities of components found there and relocated over time.

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INTRODUCTION

In the last two decades, research relating to land-use patterns during the Late Archaic in mountain landscapes has increased within the western United States. In the Great Basin, Thomas (1983) and Bettinger (1991) have demonstrated that these landscapes were being utilized much more frequently than previously thought with evidence of multiple occupations over time occurring seasonally. More recently and outside of the Great Basin, seasonal use of high elevation landscapes has been recorded by Adams (2010), Morgan, Losey, and Adams (2012) in Wyoming and Stirn (2014) in Colorado. All these sites were discovered above 8,500 feet in elevation in what are now alpine settings. Notably, however, as evidenced in Utah's Pahvant range (Morgan et al. 2012), the use of high elevation environments is not uniform across areas.

Despite research interest in these environments, little has been done to investigate possible use of mountain environments within Idaho. The exception to this are excavations at Redfish Overhang and Sheepeater Battleground reported by Sargent (1973) and surveys conducted by the Boise National Forest Service in 1999 (Corn and Vrem 1999). Sheepeater Battleground produced evidence of antelope butchering though little else has been done to understand what these landscapes were utilized for within Idaho.

To develop a better understanding of how these landscapes were used during the Late Archaic, this study proposes to re-evaluate the sites identified within the Spangle Lakes survey conducted by the Forest Service (Corn and Vrem 1999) with the intent of testing two alternative hypotheses developed from frames of reference information assembled from multiple different sources including a database compiled by Binford and Johnson (2014). Frames of reference are particularly useful when working assessing an area like Spangle Lakes, where only limited research has been conducted. Information that is well known in a specific area can be used in reference to an area that is similar, allowing certain expectations or predictions to be developed (Binford 2001). Projections are beneficial in that they entail using information on behaviors, patterns, and conditions that have been thoroughly observed and researched to extrapolate what behaviors can be expected in an area that has little research (Binford 2001: 48). These expectations can then be tested.

In this study, the null hypothesis suggests that hunter-gatherers used the Sawtooth Mountains seasonally for short periods of time, moving across the landscape and using the Spangle Lakes area for logistical hunting camps. Expectations for this hypothesis were derived from information compiled from multiple sites recorded as Late Archaic era in similar environments in the western United States, ethnographic reports, and environmental and human behavioral ecological projections developed from a database created by Binford and Johnson (2014). The alternative hypothesis was advanced by archaeologists who conducted the initial survey (Corn and Vrem 1999). They surmise that the area was utilized as a lithic raw material source to produce quarzitic tools.

The results of this re-evaluation summarized a distinct difference in Late Archaic land-use patterns within the Sawtooth Mountains as compared with two other archaeological sites recorded in the Western United States. The size of the study, coupled with the unique, dynamic environment that constitutes the Sawtooth Mountains suggest that more surveys need to be conducted in the area as well as more consistent monitoring of these sites over time.

Study Area

Physiography and Environment

The Sawtooth Mountain range represents one of the highest ranges in the region, rising more than 10,000 feet in elevation (Thackray et al. 2004) with some of the widest variation of topography within the Northwest (Reid 1963). In addition to dramatic topographical variability, the Sawtooth Mountains also lack large river drainages, resulting in reduced resources. After the melting of the last glaciers in the area around 10,000 years ago, multiple glacial lakes developed lacking fish until federal programs stocked them and designated the area as a Wilderness Range (Thackray, Lundeen, and Borgert 2004). Thus, for this study, the Sawtooth Mountain Range is considered to be a marginal environment. This idea will also be expanded later on in the paper, using an environmental database of the area compiled by Binford and Johnson (2014).

Access to the study area occurs by one of two ways: an intense ten-mile hike that expands over three separate mountain ranges, or a seventeen-mile hike following the Middle Fork of the Boise River. Neither route is accessible to vehicles and must be accessed on foot. Depending on one's health, experience, and determination, the trip can take anywhere from one to two full days accessing the area.

The Sawtooths are also subject to dynamic environmental conditions that depend primarily on annual weather conditions. Depending on snow levels, Spangle Lakes is not accessible until August, however, by September, fresh snow begins to fall again making the area inaccessible. Through the later summer months, this snowpack can melt often increasing surrounding lake levels. Within the recent decade, this snowpack has melted entirely increasing lake levels and plant ground cover (Luce and Lute 2016). Warmer conditions have also encouraged beetle infestations in the pine, resulting in an increase in dead wood and unmanageable forest fires in the area (Halofsky 2016).

Geologically, the Sawtooths are composed of the Idaho batholith (granodiorite, a granite-like material) (Johnson et al. 1989) and the Sawtooth batholith (leucocratic quartz, a granite-like material) (Reid 1963). In addition, other materials from the Challis Volcanics (Moye et al 1989) and portions of the sedimentary Migillian Form (Turner and Otto 1989) have also been recorded. The Spangle Lakes area lies between the Idaho batholith

Figure 1 Map of study area, including Spangle Lake, Little Spangle lake, and Lake Ingeborg.

and the Sawtooth Batholith where quarzitic materials having been observed during fieldwork.

The Spangle Lakes area (Figure 1) is located 17 miles north of the town of Atlanta, Idaho, within the Sawtooth National Forest. A series of paternoster glacial lakes was formed after the end of the Pleistocene (10,000 years ago), resulting in Spangle Lake, Little Spangle Lake, and Lake Ingeborg (Reid 1963; Breckenridge et al. 1989). These lakes form the headwaters of the Middle Fork Boise River. Outside of the lakes, the wilderness area supports a variety of game, including ungulates and a wide array of fish species (Reid 1963). There are also flora species available that were ethnographically recorded being used by local native populations, including conifer species, sage and numerous berry species. Due to the batholiths (Reid 1963), hot springs are also within the area and are located in numerous spots throughout the Sawtooth Mountain range and have been recorded at a range of temperatures (Foley and Street 1989).

Previous Archaeological Work In Idaho And Western United States

Idaho and the Sawtooth Mountains

Within Idaho, Late Archaic human land use patterns have been viewed as transitional periods of both technological and behavioral change (Plew 2016). During this time, there was a marked increase in fishing intensity across the Snake River plain (Plew 1980; Plew and Gould 2001; Pavesic, Follett, and Statham 1987), evidence of greater sendentism in the form of more permanent residential features (see Green 1993), a rise of hunting activities represented within faunal collections (Plew 1980, 1981,1987; Henrickson 2003) and the increased presence of hunting blinds, walls, and rim rock enclosures (Plew 1978, 1979; Butler 1978), and plant processing (Metzler 1976; Plew 1976, 1980).

While limited in its temporal scope, upland land use has also been recorded for the Late Archaic within Idaho. Evidence of hunting activities above 7,000 feet has been reported by Sargent (1973) in Redfish Overhang and Sheepeater Battleground. Both sites are about 25 miles northeast of the study area and demonstrate a consistent use of the Sawtooth Mountains through hunting activities from the Late Pleistocene throughout the Archaic with a high frequency of hunting tools in the form of projectile points, knives, and scrapers identified in the layers of stratum excavated at both sites. Within Sheepeater Battleground (Figure 2) site, faunal evidence of antelope butchering and hunting related tools were identified

Other sites, such as the Owyhee Uplands (6,000-7,000 feet above elevation), have

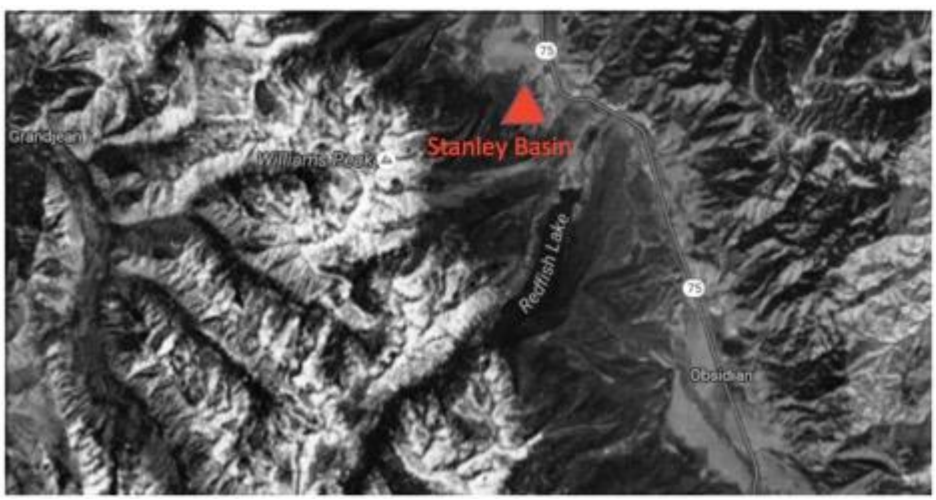

Figure 2. Image of Redfish Lake and Stanley Basin were both Redfish Overhang and Sheppeater Battelground are located. Both of these sites are about 20 miles northeast of the study area.

demonstrated a wide range of activities including the hunting of deer (Plew 1980; Plew and Woods 1985) and plant intensification (Plew 1980; Plew and Woods 1985). The area was resource rich, including multiple variations of plant species ranging from wild onions to berries (Plew, 2008) and habitat for varying species of game, such as deer and pronghorn, which have been represented within the faunal archaeological record of the area (Plew 1980; Plew and Woods 1985).

Green (1972) and Plew and Woods (1985) demonstrated upland use within the South Hills south of Twin Falls, Idaho. Both the Rock Creek site (Green 1972) and the Kueney site (Plew and Woods 1985) are Middle Archaic and contained few faunal remains but numerous lithic artifacts including points and groundstone. Plew (2008) suggests that a number of activities could have been occurring within the two sites, particularly hunting, butchering and processing of animals along with plant processing, however the presence of red ochre and an abundance of mussel shells suggest that these sites had multiple functions. There is also evidence of upland use near Boise, Idaho at the Danskin Rockshelter (Hale and Plew 1989) that contained Middle and Late Archaic diagnostic points along with incised bone fragments. Hale and Plew (1989) note that deer was a primary resource with burnt mussel shell common in the faunal record although there was a complete lack of fish remains. Plew (2016: 85) suggests that this demonstrates optimality ranking and procurement costs of artiodactyls and fish during the time.

In the transition from the Middle Archaic to the Late Archaic within Idaho, there was a distinct shift within the archaeological record indicating the intensification of resources across the area. Currently, few upland sites in the Late Archaic time period have been documented within Idaho, providing evidence of short-term mobility settlement with hunting being a primary subsistence pattern. What is not known, however, is whether this same pattern of settlement and subsistence was utilized within the Sawtooths.

Spangle Lake Survey, 1999

Surveys were conducted within the Sawtooths during the summer of 1999 by the Forest Service. In 1999, Boise National Forest conducted a Passport in Time survey project within the south portion of the Sawtooth National Recreation Area (SNRA). During six days, a crew composed of two forest personnel and two volunteers followed the Middle Fork Boise River upstream eighteen miles north to the Spangle Lakes area.

A total of 23 prehistoric sites were located and documented based upon lithic flake density. Using the IMACS (Intermountain Antiquities Computer System), an area composed of ten flakes or fewer was recorded on a short form, whereas ten or more were recorded on long forms, eleven sites recorded using the long form and twelve using the short. Lithic source density (established by actual and estimated flake counts) resulted in sites being shown to be composed of 77.1% quartz crystal, 18.9% obsidian, 0.02% basalt, 0.008% jasper, 0.005% chert, and 0.004% chalcedony.

The most prominent diagnostic points collected from grab samples—samples of artifacts collected for further analysis—were identified as Desert Side-Notched, which have a relative date from 1000-100 B.P., Elko points (4500-1500 B.P.), and Rosepring (1350-850 B.P.) (Plew 2016) were also identified within collection samples, suggesting that use of Spangle Lakes sites occurred throughout the Late Archaic period. These sites were recorded at elevations of more than 8,000 feet above sea level as falling within the sub-alpine zone, among the first sub-alpine sites to be recorded within Idaho.

Previous archaeology in the Sawtooths demonstrates that the area was used around the Late Archaic consistently for about 3500 years. Sites appear to be located relatively close to water sources, on top of the Idaho batholith, and near the Sawtooth batholith, both of which could be used as local raw material sources. Spangle Lakes provides an opportunity to understand land use behaviors in high-altitude environments within Idaho.

<u>Western United States</u>

The Great Basin is made up of a multitude of different environments that have been utilized in varying ways across time (Bettinger 1993). In particular, the usage of sub-alpine and alpine regions (8,000 to 10,000 feet in elevation) within the Great Basin during the Late Archaic period have been examined detailing different adaptive strategies that cater to the unique environments in which they are located (Figure 3).

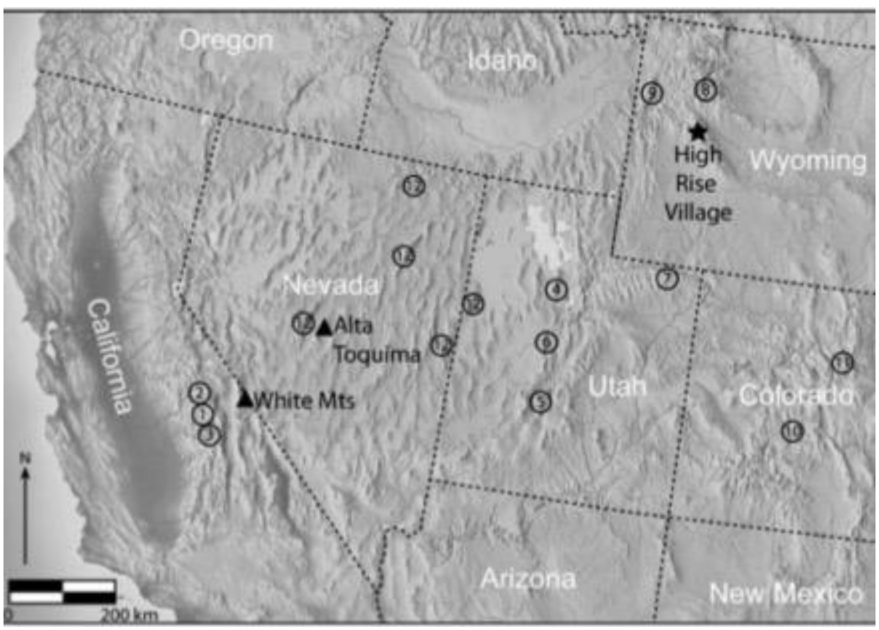

Figure 3. Map of documented high altitude archaeological sites within the Western United States. (1) Summit Lake; (2) Piute Pass; (3) Kings Canyon; (4) Oquirrh Mts; (5) Fishlake Plateau; (6) Pahvant Range; (7) Uinta Mts; (8) Absaroka Mts; (9) Teton Mtns; (10) Gunnison Basin; (11) Colorado's Parks/Front Range; (12) Canaday Surveys. Figure pulled from Morgan, Losey, and Adams 2012.

Sites have recorded in these environments sharing some characteristics. These sites, including Alta Toquima in Nevada (Thomas 1983, 2014a), sites in the White

Mountains, California (Bettinger 1991), and the Wind River Range, Colorado (Adams, 2010;Stirn, 2014), are all beyond 10,000 feet above sea level (above the modern tree line within the alpine zone) and functioned as summer camps for hunting bighorn sheep during the Late Archaic period. Each site area demonstrates two phases in land use. The first is a transhumant strategy that demonstrates limited site occupation with specific resource allocation (primarily prey such as bighorn sheep) while the second, later strategy demonstrates a more intensive usage of the environment with more permanent residential bases (Thomas 1983; Bettinger 1991; Adams 2010; Stirn 2014; Morgan et al. 2012b; Trout 2015). These sites also include dense lithic scatters, an abundance of lithic tools, and remnants of formal structures (Stirn 2014; Bettinger 1991; Morgan et al. 2012b. Outside of these, many other sites being are recorded that demonstrate similar increased land-use patterns within the Sierra Nevada in California (Stevens 2005), Utah's Pahvant Range (Morgan et al. 2012a), and Wyoming's Absaroka Mountains (Kornfeld 2001).

Morgan et al. (2012b) describe these sites as having broad similarities in growth of land use. More sedentary structures are being constructed with increased variety of lithic tools, including groundstone (mortar, pestles, etc.). In addition, they all fall within the same broad category of time during the Late Archaic. Black (1991) conducted an intensive study to test the development of a new tradition within the northeastern Great Basin. Testing multiple sites discovered by survey in the Southern Rocky Mountains, he identified similarities between components that are known from other Great Basin sites located in the lower valleys. Black concluded that these similarities in components provided evidence of Great Basin populations utilizing alpine terrains during short periods of summer months for hunting purposes just as were Alta Toquima, White Mountains, and Wind River Range.

However, Morgan et al. (2012b) argue that this conclusion is questionable due to the ethnic variability that is seen across the Great Basin. In addition, Thomas (2014b) cautions that it is important to recognize that despite similarities, there is an equifinality problem with high altitude sites in the west. This means when considering each of these high altitude sites, it should be acknowledged that numerous unknown combinations of factors developed each case independently. As such, despite broad similarities among the previous sites listed, there are also distinct differences detailing how each population adapted to its surrounding environment. Alta Toquima, for example, demonstrates an emphasis on hunting practices in addition to processing piñon and juniper, however lacks evidence for root collection (Thomas 1983, 2014a). The White Mountains sites demonstrate similar evidence suggesting that hunting and piñon nut processing was occurring, however expresses evidence for root collection (Bettinger 1991). In High Rise Village, instead of piñon nut, whitebark pine nut and biscuitroot were the preferred plant resources (Morgan et al. 2012). So, high altitude sites do not appear to have been selected or used for simply similar resource procurement.

Although it is important to understand that there are distinct differences between these high altitude sites, this study focuses on the broad similarities that are found across these sites. In particular, these broad similarities help to develop presumptions for the Spangle Lakes area, which has only undergone preliminary surveying. These sites not only demonstrate that alpine settings were utilized for short, seasonal periods of time in the Late Archaic, but also that these sites were used repeatedly across time. In the beginning, most of these sites were utilized for hunting purposes then transitioned to a growing use of plant resources as more extended residencies occurred.

Ethnographic Usage Of High Mountain Environments

Depending on which factors are being measured—such as water, geology, or ecosystem—southern portions of the Snake River Plain may or may not be included within the Great Basin region. This is partially due to the natural provinces in which the map is referencing, such as hydrographic, physiographic, or floristic; however, culture boundaries often are more fluid than defined geographic regions (D'Azevedo 1978). This is in part due to the fact that "[t]opography determined the flora, fauna, and location of encampments, largely through its effect upon precipitation and temperature, which are closely correlated" (Steward 1938: 11). Thus despite the Snake River Plain often being excluded from Great Basin geologic boundaries, environments were similar, producing similar cultural behaviors. In this, it is possible to use current high elevation research in Late Archaic human land use to develop some understanding of behaviors occurring within the Sawtooth Mountains.

The greatest challenge within Great Basin high mountain archaeology is the overall lack of available ethnographic information. Specifically, within Southern Idaho, for example, only two sources are known to discuss traditional high mountain usage by native populations. However, Steward's (1938) and Murphy and Murphy's (1960) ethnographic accounts are limited and poorly detailed. Steward (1938) notes that individual groups within both the Boise River and Snake River areas used the Sawtooth Mountains on occasion, however preferred to remain in the lower valleys where fishing and hunting of small prey were more productive. Murphy and Murphy (1960) assert similar conclusions, however mention that informants uniformly agreed that the Sawtooths were being used by a group called *Tukurika* or *Dukarika*. In both accounts, Steward and Murphy mention this group having established villages along the Salmon River; however, only general location and size were discussed in detail (Steward 1938: 187-188; Murphy and Murphy 1960: 323).

Sawtooth Mountains

In southern Idaho, there were three prominent Numic speaking groups: The Northern Shoshone, the Western Shoshone, and the Bannock (Murphy and Murphy 1960). Ethnographic records show that the Shoshone-Bannock primarily resided within the area that traditionally encompassed Northern Utah and Southern Idaho (Arkush, 2008). Holmer (1990) suggests that the presence of Northern Shoshone within central Idaho extends throughout a 3,000-year period of time based on archaeological data collected from the Dagger Falls site and the Wahmuza site. Steward (1938) details different groups of Shoshone-Bannock residing primarily within the lower, riverine areas within the basin; however, certain bands were recorded as utilizing the pinyon-juniper zones (4,000-8,000 feet in elevation) for a variety of gathering and hunting activities (Hyde 1959; Hultkrantz 1956; Murphy and Murphy 1960).

The Northern Shoshoni, in particular, have been documented as using the Sawtooths during their seasonal rounds (Holmer 1990). They would spend the winter months in the lowlands and then follow the availability of game animals to higher elevations in the summer (Steward 1938). In addition to game, camas root was recorded as a staple resource to the Northern Shoshoni and was available in the lower zones within the Sawtooths. These important ethnographic plant species, such as pinyon-juniper and camas, have not been shown to grow within the Sawtooths at elevations above 8,000 feet.

Western United States

Ethnographic accounts document usage of high mountain environments in the study region as two encompassing types of activities. The first, and least common, is the use of mountain passes to access bison resources within Montana. After 1700, the Nez Perce described taking short annual trips across mountain passes, such as Lolo Pass, in order to hunt bison during the late fall. These trips were often not made alone but with multiple other tribes (Umatilla, Cayuse, and Yakima) noted as joining in the hunting parties (Anastasio 1972). Often, all these groups would reside within the plateau area for some years, suggesting that the trip was made by all group members across the mountains (Walker 1973). The Eastern Shoshone made use of bison more often, their hunting seasons ranging from mid-October to early February with a short hunting season from March to April (Shimkin 1947: 279) in which both men and women helped in the massive butchering event for these animals (Shimkin 1986: 317). In addition, the Coeur d' Alene broke into smaller groups where "...most families were absent from early fall to late spring" (Palmer 1998: 315) in order to hunt buffalo in Montana after crossing the Bitterroot Mountains.

Since it is suggested that family groups made the passage through the mountains, were these types of sites archaeologically represented within the Sawtooth Mountains, it is likely that multiple activities were occurring within one given area. These sites are expected to be moderate in size, around 30-40m^2 with concentrated debris areas within a fire hearth feature. In addition, sites should not be incredible deep due to the quick pace in which individuals are traveling.

Multiple individuals responsible for different jobs within a family correspondingly needed different tools. Thus, varying tool categories should be expected, including points, scrapers, perforators, and others. This is especially relevant if a family group is committed to residing in a location for an extended period of time. Tools composed of non-local material are also expected due to individuals curating the tools necessary for such trips. Due to the curated material, it is expected that the majority of lithic evidence should suggest minor retooling activities rather than tool construction and there should be a higher frequency of lithic flakes less than or equal to 1cm in size.

The most common description of high mountain usage is hunting activities during late summer and early fall. Multiple ethnographic accounts from the Nez Perce (Walker 1999; Spinden 1908; Moultan 1983), Northern Shoshone and Bannock (Murphy and Murphy 1960, 1986; Steward 1938), Western Shoshone (Wheat 1967; Steward 1938; Thomas 1983), and Kootenai (Schaeffer 1935; Turney-High 1941) detail the use of high mountain landscapes for some form of hunting. During mid-summer, the Nez Perce described traveling to the highlands where multiple activities, including the intensification of hunting, were practiced. For the Northern Shoshone and Bannock, mounted groups frequently entered the Sawtooth Mountain range (Murphy and Murphy 1986), but the area was also utilized more intensely by a group denoted as the *Sheep-eaters* who hunted bighorn sheep as a main staple (Steward 1938). Both Kootenai and Blackfeet made annual hunting trips within the mountains where families resided for a majority of the year in semi-permanent villages, particularly through the winter where the majority of hunting bighorn sheep occurred (Thomas 2014a).

These sites are expected to be smaller in size than the previous site type (less than $30m^2$) and should be task specific where specific tool types are expected to be homogeneous in form rather than vary. Primarily, then most sites give evidence for hunting and/or butchering activities (arrow points, knives, and/or scrapers) where tools are curated and composed of non-local materials. It is also expected that site debris should be primarily composed of evidence for retooling and should not extend in depth due to inconsistency in overall use across time.

It is important to note that in the ethnographic present, the introduction of the horse contributed to a change in behavior within these groups. As populations steadily increased over time, groups were becoming more restricted in mobility and resources. It is through this, that an intensification of resources, such as shifts from high-ranked resources to low and/or processing of geophytes and seeds or nuts, begins. However, horse use disrupted this normal behavioral pattern by allowing groups to increase their overall mobility and thereby expand their resources (Haines 1970; Walker Jr. 1978). Due to this, areas and resources that were once inaccessible to groups, such as the bison herds, became accessible to the Shoshone-Bannock and other tribes (Steward 1938).

There is, however, some value within this information in helping to understand use of these high elevations. While the ethnographic present demonstrates a more intensified use of mountain landscapes within and around Idaho after the introduction to the horse—particularly in usage of mountain passes to access bison as stated above—there are still multiple ethnographic accounts that suggest mountain landscapes were being utilized prior to the introduction of the horse for short-term hunting purposes. Among the Blackfeet and Kootenai, tribal sources describe their use of mountains and mountain passes extending back generations before the introduction of both horses and Europeans (Thompson 2015).

While increased access of high-mountain landscapes through the use of horses occurred during historic times, it is important to acknowledge that some seasonal travel across mountain passes by foot also occurred prehistorically. Due to the consistency of groups using high-mountain landscapes for short-term hunting purposes over time, this behavior was determined to be the most common way in which these landscapes were used and shall be a focus of this study.

Use Of Binford Database On Environment And Hunter-Gatherer Projections

The Effect of High Mountain Environments on Human Use

Environmentally, high mountain landscapes have been viewed in two ways. The first is that these environments are marginal and cause a set of behavioral and physiological responses that are unique adaptive strategies in these landscapes. In particular, high mountain landscapes are risky environments, particularly above 8,200 feet in elevation (Aldenderfer 2006), where oxygen levels begin to drop significantly and animal, plant, and water resources become scarce (Morgan 2010). Across the world, there are only a few examples of these environments being utilized consistently across time, primarily within the Himalayas and the Andes. In order to maintain proper function, the human body's main caloric function must increase its demands for both food (Barnholt et al. 2006) and water. As stated previously, high altitude environments typically have reduced overall resources for human consumption. When there are not enough resources to compensate for these physiological demands, or the body is not given enough time to adjust, this commonly leads to acute mountain sickness (Hackett et al. 1981; Imray et al. 2010).

This evidence suggests that at least some human land-use of these environments resulted from being “pushed” into these settings due to resource availability being restricted in lower elevations. Subsequently, there is evidence for resource intensification during the Late Archaic within the Great Basin. This can be represented by an increase in ground stone plant food processing technology (Dubreil et al 2016) which is noted in Plew’s (2000) work in Idaho across the Snake River Plain and in Monitor Valley within Nevada (Thomas 1983), as well as a shift from high-ranked prey resources to low-ranked prey resources represented in the northern Great Basin (Broughton et al. 2011). This suggests the possibility that individuals moved toward these marginal environments in order to further intensify resources, which is demonstrated in Alta Toquima (Thomas 1983), Bettinger (1991), and Morgan et al (2010) with evidence of large amounts of groundstone present as well as intensified processing of bighorn sheep, nuts, and geophytes.

In contrast, the second view suggests that high mountain environments vary in marginality (Morgan 2010), and that some of these habitats could in fact be attractive to humans. Kornfeld (2013) argues that despite elevations rising above 10,000 feet, the Rocky Mountains have multiple riparian environments that were conducive of habitation. These environments included multiple major river drainages that support fish, deer, big horn sheep, and wild plant resources that are abundant enough to support annual use of the area (Constanz 2014). In addition, Bender and Wright (1988) and Walsh (2006) argue similar findings, asserting that enough wild resources were available to support multiple occupations of these areas. In addition, Scheiber (2015) holds that mountain resources became particularly popular due to the extended growing season of plant resources in comparison to those of lower elevations.

From these examples, it becomes necessary to understand how the Sawtooth Mountain ranges fit within this dichotomy. To achieve this, variables were pulled from a data base compiled by Binford and Johnson (2014). This database uses latitude, longitude, elevation, temperature, rainfall, and other environmental properties to calculate plant and animal biomass and more (Binford and Johnson 2014) with the purpose of developing a frame of reference for a variety of questions. Due to its incorporation of multiple different environmental factors from locations around the world, the Binford database is helpful for developing and understanding of basic environmental conditions in different altitudinal environments for which there is no substantial collection of data. Each of these variables is pulled from separate databases compiled from weather station data collected by agencies like the Forest Service, which has kept records over decades giving a fairly detailed understanding of climactic and environmental changes.

Frames of Reference on Climate

Basic determinates for climate include annual rainfall and effective temperature. Annual rainfall data (CRR= mm per annum) information can be assessed directly from weather stations across the world and filtered by location and elevation (Binford 2001). The data for this study were compiled from Idaho, Oregon, Utah, Nevada, and Washington as the most areas relevant to the Snake River Plain and adjacent Sawtooth Mountains. Effective temperature (ET) is a variable that calculates the ambient warmth, i.e., temperature that best sustains plant growth, based on temperature readings from weather stations (ET= [(18*MWM) -(10*MCM)]/(MWM-MCM+8)). The scale of ET varies from 10 being cold and dry with plant growth contained within a period of just under a month to 18, where temperatures are warm and humid and plant growth is continuous throughout the year (Binford 2001).

From these two variables it is possible to demonstrate whether high altitude areas within Idaho—including the Sawtooth Mountain range—fit along a scale from marginal environments or resource-rich environments through climate indicators. Weather station elevations were arbitrarily divided into lowland, mid-altitude, and high altitude groupings. This will help to form predictions in how land was used, what type of residential pattern to expect, and how long individuals could be expected to reside within these environments. To do this, a scatter plot was developed comparing these two variables using SPSS (Statistical Package for the Social Sciences) programming to examine at data pulled from Idaho, Oregon, Washington, Utah, and Nevada. These states were selected to provide comparison of similar and different environments within a specific geographic location (i.e., Northwest United States). Each of these weather station points were further filtered into arbitrary elevation ranges labeled *lowland* (0-1,000 feet), *mid-altitude* (1,000-6,000 feet), and *high altitude* (6,000 plus feet). These levels were used in order to compare and contrast the different environments located at different elevations.

Figure 4, indicates a clear distinction between lowland environments and mid/high altitude environments. Lowland environments sit comfortably within the middle range of the effective temperature scale, receiving on average of around 1,000 mm of annual rain per year and/or having an effective temperature that fits within a seasonal pattern. At mid/high altitudes, however, is seen a seasonal pattern, with less than 500 mm of rain per year. This pattern suggests that in the selected region, mid/high altitude environments are dryer with shorter plant growth periods.

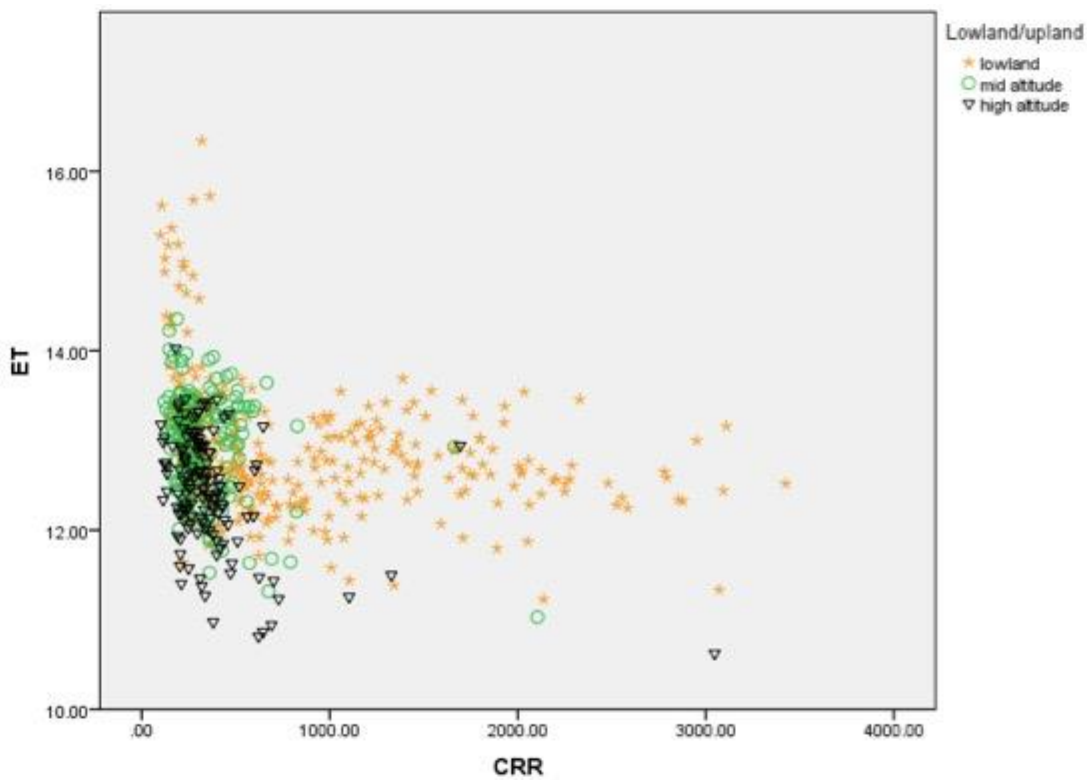

Figure 4 Binford's effective temperature (ET) and annual rainfall (CRR, measured in mm) weather station data for Idaho, Oregon, Washington, Utah, and Nevada. Marked by Altitude

While Figure 4 demonstrates a general pattern between climate variations between lowlands and mid/high altitude environments, these variables can be compared on a state level as well. In Figure 5, the same variables were applied to SPSS to develop another scatterplot graph. This graph looks at how high altitude environments are represented in individual states. There is similar patterning where states that have lowlands that have an annual rainfall of around 2,000 mm, Oregon and Washington, branch out to the right. In particular, Idaho (red circles), appears to demonstrate low annual rainfall (less than 1,000 mm) and falls between 10 and 14 in effective temperature range, suggesting short growing seasons overall.

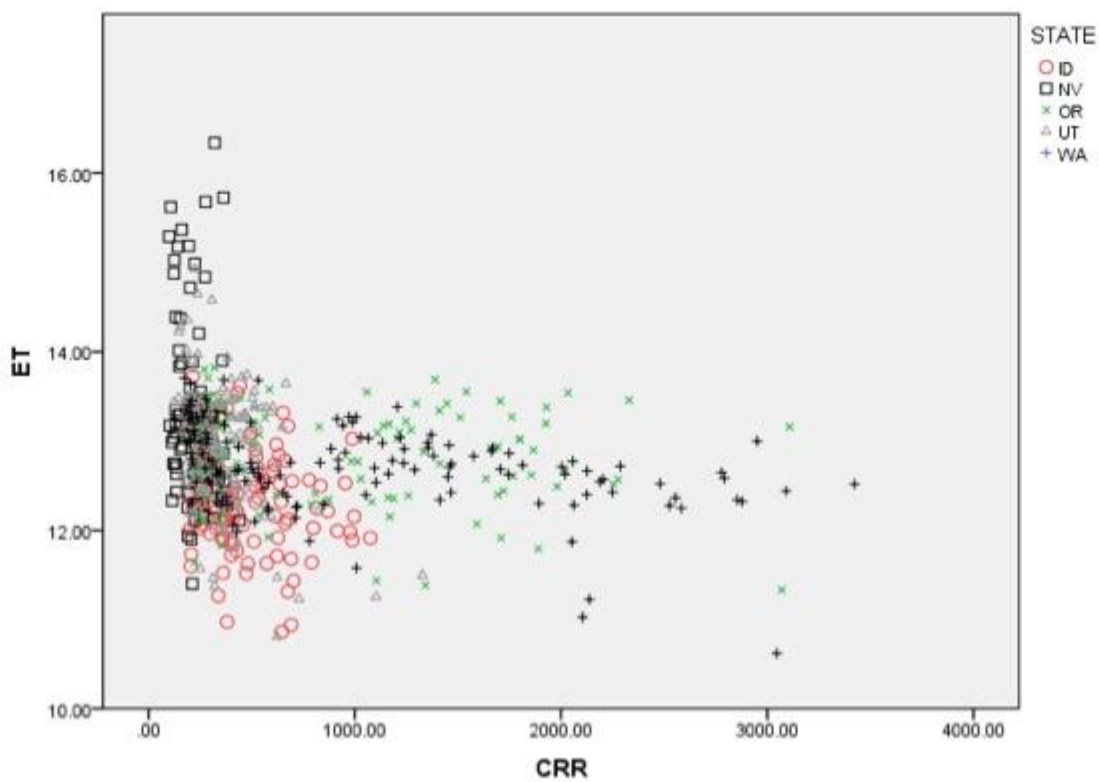

Figure 5 Binfor's effective temperature (ET) and annual rainfall (CRR, measured in mm) weather station data for Idaho, Oregon, Washington, Utah, and Nevada. Marked by state.

From both graphs, Idaho's environments coincide with that of climactically marginal environments. These, however, are not the only two variables considered when determining marginality. Plant and ungulate biomass were used to also determine Idaho's available resources in high altitude environments.

Frames of Reference for Plant and Ungulate Biomass

Using the same database and weather station data collected from Idaho, Oregon, Washington, Utah, and Nevada, were used to form predictions for plant and ungulate biomass. Net Above Ground Productivity (NAGP) calculates the overall plant growth based on photosynthesis and growth, measuring grams grown per square meter per year (Binford 2001: 478). Ungulate biomass is calculated through EXPREY, which uses other variables such as elevation and Net Above Ground Productivity, to predict the expected biomass, in kilograms, of moderate-sized ungulates within a square kilometer (Binford 2001: 109).

Both plant and ungulate biomass are strong determinants of environmental marginality and available resources and it is expected that similar patterns demonstrated using effective temperature and annual rainfall will be represented. In essence, it is expected that areas with high marginality for human occupation should demonstrate low densities of both plant and ungulate biomass due to short growing seasons and minimal annual rainfall (less than 1,000 mm/year). In comparison, areas that are more resource rich with denser plant and ungulate biomass/ km^2, should be expected to have climates that have longer growing seasons and higher amounts of rainfall.

Figure 6, compares another scatterplot developed through SPSS comparing NAGP and EXPREY in Idaho, Oregon, Washington, Utah, and Nevada. As in Figure 1, this graph looks at altitude across the states. Figure 6 suggests that overall, high altitude areas within these states appear to have low plant biomass per km^2 ($\geq$ 500 g/m^2) along with low ungulate biomass ($\geq$400 kg/km^2). This suggests that within high altitude landscapes in these states, environments lack abundant resources. When comparing this data to expected environmental conditions, high altitude landscapes within Idaho appear to be marginal environments that are colder, dryer, and lack an abundance of resources that would support extended stays in these landscapes.

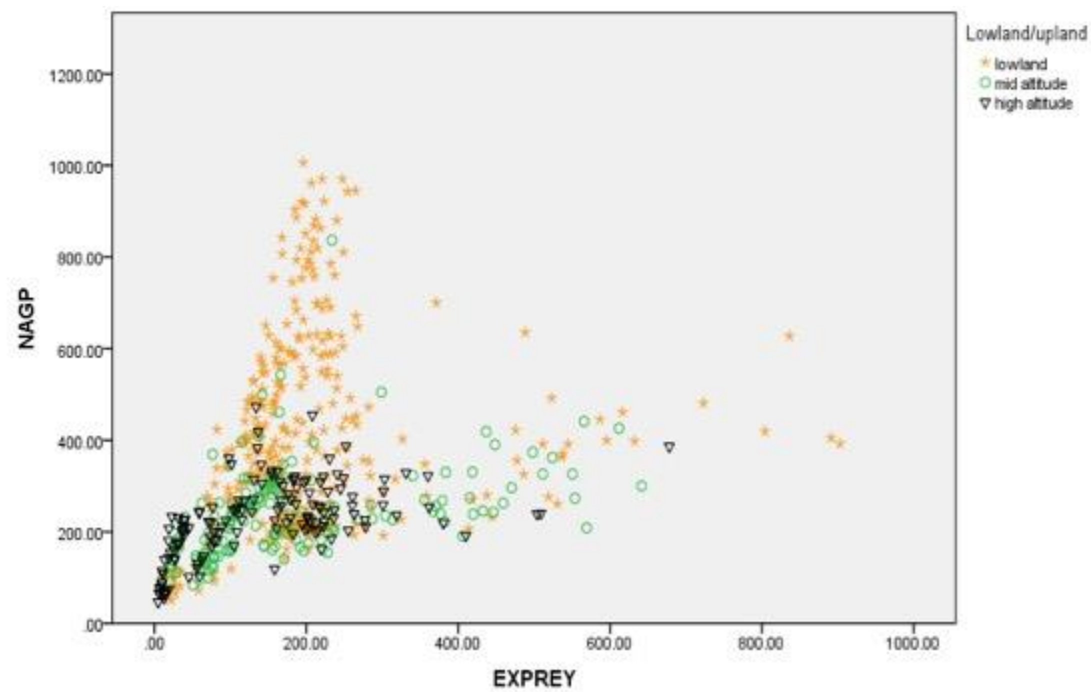

Figure 6 Binford's Net Above Ground Productivity (NAGP, plant biomass) and ungulate biomass (EXPREY) from weather station for Idaho, Oregon, Washington, Utah, and Nevada. Marked by state.

Based purely on current environmental data, this information suggests that high altitude landscapes were used as marginal environments in Idaho. Thus it is expected that these areas should only have been used for short seasonal trips that extend no longer than a few days. It should also be noted that NAGP only accounts for all plant biomass including woody growth that is not readily edible for humans. Thus, it is safe to assume that there is even less edible plant material available in these landscapes than ungulates, suggesting that a majority of archaeological sites should contain more evidence of hunting activities (arrowheads, scrapers, evidence of retooling) than of any other activity.

Binford's Hunter-Gatherer Database Projections

As stated previously, in other high altitude sites like Alta Toquima in Nevada (Thomas 1983), Late Archaic sites are composed of ungulate faunal remains and evidence of plant intensification from ground stone. It is expected that if there were a similar patterning within Idaho, there would be ungulate populations located in alpine areas along with enough edible plants to support a logistical residential pattern.

Although we do not know Late Archaic ungulate population density in alpine zones, the physiographic relationship between Idaho mountains and lowlands has changed little since the melting of the last glacier 10,000 years ago (Reid 1963). Thus, projections from data collected within the last decade could help see whether this pattern is demonstrated or not. Again, Binford's (2014) database is particularly useful in this regard. Stated previously, as collected across the United States and other parts of the world, Binford's database uses global information about latitude, longitude, elevation, temperature, rainfall, and other environmental properties to calculate plant and animal biomass and more (Binford and Johnson 2014). To make informed projections about the ways that humans interact with their environments, he then used information from more than 400 known hunter-gatherer groups to develop expectations on mobility, subsistence, demographics, and social organization for areas where foragers no longer reside.

This approach is particularly useful in science since it allows us to assume that the way the world works is likely to remain the same over time. Binford (2001) advocates that "The logic of projection is one of the fundamental tools of scientific research…. [and that] Science as a learning strategy relies on the disciplined use of this projective capacity" [my own edits] (2001, 49). Using Binford and Johnson's (2014) projections helps visualize patterns in how humans interact with their landscapes in order to develop questions and predictions that can be assessed archaeologically. These projections are particularly helpful in areas that contain limited background research literature like the Sawtooth Mountains.

As discussed above, high altitude elevations in Idaho are relatively marginal environments that are cooler, dryer, and lack the overall abundance of resources that would sustain extended residence periods over time. Based on these projections, it was anticipated that individuals should be expected to only when other resources in lower elevations become scarce. Due to the short seasonality, this behavior should also coincide with frequent mobility in these landscapes. By using specific variables within Binford and Johnson's database (2014), it is possible to develop projections of how these expectations compare with ethnographic information compiled from across the world

This was done by looking at two variable detailing hunter-gatherer movement. EXNOMOV1 projects the number of moves, scaled for subsistence type, for groups with year-round camp to camp mobility pattern or task groups foraging from a central place, while EXDMOV1 projects the total distance moved (measured in kilometers), scaled for subsistence type, can be calculated for groups with year round camp to camp mobility pattern or task groups foraging from a central place total distance moved (Binford and Johnson 2014). The projection variables were then used to demonstrate how mobile foragers moved across a given landscape. These variables are then filtered to lowland, mid-altitude, and high-altitude elevations within the states of Idaho, Oregon, Washington, Utah, and Nevada.

Figure 7 compares the expected number of moves for foraging task groups in comparison with the expected distance moved. These are further categorized by how this behavior should be expected within different elevations. This figure suggests that just as predicted, foraging groups within high elevations are projected to move often (at least 10 times/year) and travel long distances between each move (between 300-400 km/year). These projections appear to support both the expectations developed from environmental conditions as well as ethnographic information gathered on the area.

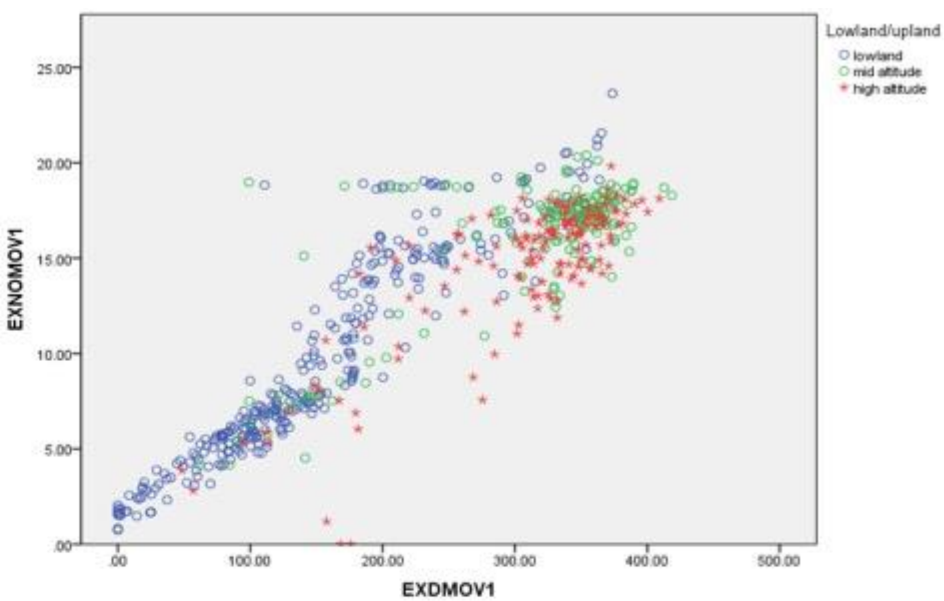

Figure 7 Binford's expected number of moves/year for foraging task group (EXNOMOV1) with expected distance moved/year for foraging task groups for Idaho, Oregon, Washington, Utah, and Nevada. Marked by altitude.

In addition to projections of movement of foraging task groups within the given area, the database also contains estimates that calculate likely types of subsistence activities within a given area based on a compilation of ethnographic reports collected from across the world. These projections are compiled to extrapolate the expected percentage of gathering (WGATHP) or hunting (WHUNTP) using ethnographically known hunter-gatherer cases. These variables project expected percentage of dependence on hunting or gathering if the landscape were ‘packed’, e.g., c. 9.1 persons/km^2 (Binford 2001), the density at which foraging groups are projected to influence or compete with each other. Based on ethnographic cases, it is expected that for high altitude landscapes, hunting activities would be more common forms of subsistence than gathering. This expectation is also supported by Figure 6, which suggests that there are larger amounts of overall expected ungulate biomass than edible plant biomass within high altitude areas.

Figure 8 compares expected percentage of gathering in comparison to hunting in the states of Idaho, Washington, Utah, Oregon, and Nevada and is marked by altitude, further sorted in four arbitrary categories 0-1000 feet, 1001-5000 feet, 5001-6000 feet and 6000 feet or more above sea level. This supports both the expectations based on environmental and ethnographic information presented previously whereas in environments above 6,000 feet or more, slightly more hunting activities than gathering activities are projected to occur. In addition, there is a negative relationship that indicates hunting is replacing gathering behaviors at high altitudes.

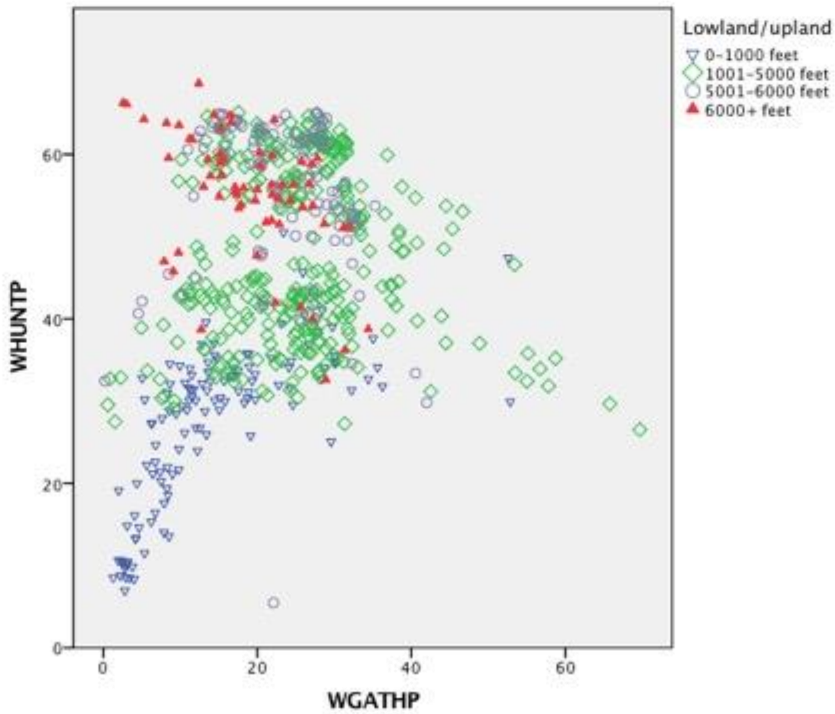

Figure 8 Binford's expected percentage of hunting in ethnographically known locations (WHUNTP) and expected percentage of gathering in ethnographically known locations (WGATHP) in Idaho, Washington, Utah, oregon, and Nevada. Marked by Altitude.

Based on the data compiled from previous archaeological work, ethnographic accounts, and projections developed from the use of Binford and Johnson's data, archaeological expectations can now be developed. These expectations can further then be used to formulate testable hypotheses.

Developing Expectations For Land-Use In The Sawtooth Mountains And Working Hypotheses

Developing Expectations

Table 1 summarizes the expectations derived from previous sections which more detailed archaeological expectations can be developed to test data collected from the Spangle Lakes area. In general, usage of these areas is expected to occur between spring and fall. Overall site size should vary depending on group size and site type; however, site depth for both "Mountain Passes" and "Logistic Hunting" are expected to be minimal to non-existent primarily due to the lack of consistent use of such areas. It is not expected that site areas were used habitually over long periods of time to develop any site depth. In addition, less soil is deposited and is minimal in such cold, dry areas. Both site types are expected to contain a high frequency of non-local lithic material and hunting related tools. In contrast, however, "Mountain Passes" is expected to house a greater variety of tool types than to "Logistic Hunting" due to group composition. "Mountain Passes" is expected to be composed of multiple individuals of different genders as well as different age groups demonstrating a more diverse pattern, whereas "Mountain Passes" is expected to be composed of individuals carrying out specific tasks.

Table 1 Expectations of Usage of Mountain Environment

Table 1: Expectations of Usage of Mountain Environments			
Type of Use	**Seasonality**	**Residential Pattern**	**Tools**
Utilized as Mountain Passes	Early Spring Late Fall	Short Term	Non-local/curated Materials Greater Variety of Toolkit
Utilized for Short-term, Logistic Hunting	Later Summer Early Fall	Short Term	Non-local/curated Materials Minimal Variety of Toolkit
Utilized for Raw Lithic Material	Early Spring to Late Fall	Short Term	Local Materials Minimal Variety of Toolkit

These expectations will be expanded below in order to develop testable hypotheses. Ethnographic reports indicate that “Logistic Hunting” is the most likely usage of the Spangle Lakes area, primarily because the type of environment and overall resources are not expected to sustain larger sized groups.

The original survey team hypothesized that this area could have been used as procurement and lithic reduction areas for quartz raw material. The area falls within the boundaries of the Sawtooth batholith, which produces large amounts of quartz material. Specific sites (BS-1912, BS-1883, and BS-1884) indicated reduction events containing dense concentrations of such quartz material. Although ethnographic information does not mention such activities occurring within the Sawtooths for this purpose, observations were made by the original crew and were further explored below as a possible type of activity.

Working Hypotheses

Although the Sawtooths rise to over 10,000 feet in elevation (Thackray et al. 2004), this mountain range topography is not consistent and lacks the resource richness and density to support the intensive patterns described by Thomas (1989), Bettinger (1991), and Morgan et al. (2012). Ethnographic information collected by Steward (1938) and Murphy and Murphy (1960) describe populations using the area only for short seasonal periods for hunting purposes. This is a pattern similar to that demonstrated by Plew (1980), Plew and Woods (1985), and Green (1972) in the upland archaeological sites recorded within Southern Idaho.

One way to develop expectations about human land use within alpine settings in Idaho is to gather information about what factors constitute other high altitude sites and compare these with similar information collected from Idaho. As stated previously, in other high altitude sites, such as Alta Toquima (Thomas 1983) in Nevada, Late Archaic sites are composed of ungulate faunal remains and evidence of plant intensification from groundstone. Were there a similar patterning within Idaho, ungulate populations would likely be located in alpine areas along with enough edible plants to support a logistics-based residential pattern. Based on these expectations, I have developed my null hypothesis.

Null Hypothesis: High mobility logistical hunting task camps

Human land-use within Idaho mountain habitats has not been explored. However, using frames of reference developed from both Binford and Johnson's database (2014) as well as ethnographic records of the area, with all other things being equal, it is possible this information can be applied to the Spangle Lakes area in order to form testable hypotheses. Based on this information, I predict that similar patterning will be shown to have occurred on the Snake River Plain during the Late Archaic (Plew 2016), where high altitude areas were only utilized for short seasonal periods of time as hunting camps, thus the following expectations:

1) Sites should be composed of curated lithic tools. Within short-term, transhumant patterns, lithic tools are curated, or maintained and inherited, primarily due to lack of access to primary material as a band migrates through its seasonal rounds (Black 1991). Any tools collected are expected to be exhausted, since those still useful would have been taken along and stored for later use (Sillitoe and Hardy 2003). These temporary sites are also expected to house a low diversity in tool assemblages (Bettinger 1977) due to the homogeneous level of activity that is expected.
2) Sites should be composed of debitage at the second or third reduction stages. Debitage is lithic fragments left over after a reduction of a lithic tool occurs and is composed of many different reduction stages that vary in size, shape, and appearance (i.e. percentage of cortex) and result from specific types of re-tooling activities (Crabtree 1972). Typically, within short-term sites with a

high percentage of curated tools in use, middle and late stage debitage is expected from maintenance and re-sharpening (Swanson 1975).

3) Sites should be composed of multiple lithic raw material types. No pressure restricts band mobility in acquiring preferred raw materials; thus, this area is also expected to demonstrate a high frequency of non-local lithic materials from various locations (Trout 2015).
4) Sites should be located near areas in which game is easily accessible, such as saddle passes or watering holes.

Overall, sites should be composed of curated tools that are exhausted and/or discarded, demonstrating late stage reduction debitage and a diversity of high quality raw material (Table 1).

Alternative Hypothesis: Utilization for Lithic Raw Material

An alternate hypothesis advanced by the original survey team at the US Forest Service (Corn and Vrem 1999) is that this area was used as a lithic raw material source during the Late Archaic. In this, it can be expected that:

1) Sites should be composed primarily of local lithic raw material. Due to the batholiths, the area lacks the common materials utilized for stone tool production, such as obsidian (Reid 1963). However, quartz crystal is common (Johnson et al. 1989) and can be utilized as a tool material (Corn and Vrem 1999).
2) Sites should be composed primarily of early and middle stages of debitage (Beck et al 2002). These sites should not contain any formal tools, as illustrated with Binford and O’Connell’s (1984) work with the Aborigines of

Australia. Most often, these preforms, or blanks, are flaked off from cores and then transported back to camp to be later constructed into formed tools.

3) Sites should be composed of early stage primary and secondary levels of debitage with high proportions of artifacts showing cortex. Quarry sites should primarily be those utilized in extracting lithic material from a source directly. Given this, we can expect only one raw material to be collected within the site and since nodules are being broken down to form smaller pieces, there should be evidence of primary and secondary debitage (Bamforth 2006).
4) Sites should be located near local raw material sources.

Overall, I expect that sites will be composed of few formal tools with flakes that are in the early stage reduction. In these, there should be lots of cortex upon the flakes as evidence of these early stages of reduction and the debitage should be composed of a low diversity of raw material that is mostly local quartzite.

Table 2 Summary of Hypothesis Expectations

Hypothesis	Expectations
High mobility hunting task camps	- Sites should exhibit of a high frequency of different lithic materials from different localities. - Sites should exhibit a higher frequency of hunting related tools. - Sites should exhibit a high frequency of debitage at middle and late stages. - Sites should cover less than $900m^2$. - Sites should be close to mountain saddles and water sources.
Utilization for Raw Material	- Sites should exhibit a high frequency of a local lithic material. - Sites should exhibit of a high frequency of expedient tools. - Sites should contain of a high frequency of early and middle stages of debitage. - The site should cover less than $900m^2$. - Site should be close to local lithic sources.

Methods

To evaluate alternative options for Late Archaic mobility and settlement, I collected data on the following:

Table 3 Expectations and Hypothses

Table 3: Expectations and Hypotheses	
Site size	**Null hypothesis**: small **Alternate hypothesis**: small
Location	**Null hypothesis**: within a 100m radius to mountain saddles which are prime areas for hunting as well as to water sources which will attract prey **Alternate hypothesis**: be close to local raw lithic sources which are prime areas for abstracting raw material
Raw material source	**Null hypothesis**: non-local materials **Alternate hypothesis**: local materials
Debitage and tools	**Null Hypothesis**: middle or late stage debitage with exhausted hunting related tools **Alternative hypothesis**: early or middle stage debitage with expedient lithic tools

To examine site function, characteristics of lithic artifacts indicative of reduction stage and use contexts (see below) were examined. For the purposes of this study, two different data collection stages were arranged. The first occurred within the field during the month of August of 2016. The second, examining lithic collections curated by the

USFS, was conducted using the curated items collected by the Forest Service in the original survey.

Field Methods

During the first week in August, this project conducted an intensive survey of the area originally surveyed by the Forest Service in 1999. A pedestrian survey was conducted with a crew consisting of myself and Keana Wininger, an undergraduate volunteer. All backcountry protocols and procedures as provided by the Forest Service were followed to the letter. Site condition assessment forms were completed during the survey; all new cultural resources being photographed at a single point location as well as mapped using a Trimble Device. Mapping methods, as well as photography methods, were derived from IMAC protocols using IMAC site forms.

The purpose of this survey was 1) relocation and re-evaluation of the sites recorded by Corn and Vrem in the summer of 1999, 2) assessment of the condition of these sites, and 3) collection of non-ground disturbing data for research purposes. Lithic stages were assessed by documenting the presence or absence of cortex, the rough percentage of cortex on lithics, maximum length, and maximum width. Any finished tools were assigned basic typology in the field (e.g., biface, scraper, etc.) These measurements were captured by digital calipers, as well as through a digital scale, and the artifacts were photographed against a standardized grid. For the purposes of this study, no artifacts were collected, and there was no ground disturbance in accordance with Forest Service requirements.

Lab methods

The purpose of lab analysis was 1) assessment of the lithic collections within the Forest Service collection, 2) gathering of non-destructive data for research purposes, and 3) analysis and comparison with supplement data collected from the field. Lithic artifacts were assessed by typology to document the presence, or absence of cortex, the rough percentage of cortex upon lithics, maximum length, and maximum width. These measurements were captured by digital calipers, as well as through a digital scale, and artifacts were catalogued and photographed against a standardized grid. XRF samples were forwarded to Northwest Research Obsidian Studies Laboratory in Corvallis, Oregon.

To compare this data, statistical analysis with SPSS was used. In this, a Pearson's correlation was used in order to establish any correlations that occur and an ANOVA was conducted to determine significant differences between flakes with and without cortex, maximum length of flakes, and maximum width of flakes. A post-hoc test was ran to determine which variables are significantly different from one another, if there are any, and a One-Way ANOVA was run to identify any trends in the data.

Results

Field Results

Fieldwork was conducted from August 1st through the 6th of 2016. One undergraduate student, Keana Wininger, helped in the relocation of sites as well as the collection of data once a site was found. Hiking out from Yellowbelly Lake, south of Stanley, Idaho, camp was established August 2nd and relocation of sites began. Each site form had a Universal Transverse Mercator (UTM) coordinate for the datum which was used to relocate sites. GPS units were used to relocate the original UTM coordinates of each site.

Once an original site datum was found, each site datum was recorded using a Trimble device. This device works as a complex GPS unit using multiple satellite readings to record exact locations of items. Corresponding to this GPS coordinate each item was recorded as to size, weight, color, material, type, and form. This information is stored in a single file and can later be transposed onto GIS system maps to form a complete digital record of the area. This information was also recorded in Write-in-the-Rain notebooks as well as on paper forms. After the site datum was recorded, photos were taken of the cardinal directions at the datum point so as to provide current site detail.

Of the 11 sites previously recorded by the original survey team in 1999, only eight site datums were able to be catalogued using the Trimble device (Table 2). Two sites were submerged in lake water during the time fieldwork was being conducted, BS-1883 and BS-1866, and one site, BS- 1876, was not relocated due to time constraints place on the project. Out of the eight site datums catalogued, only one site, BS-1881, was relocated in its entirety and data was able to be collected.

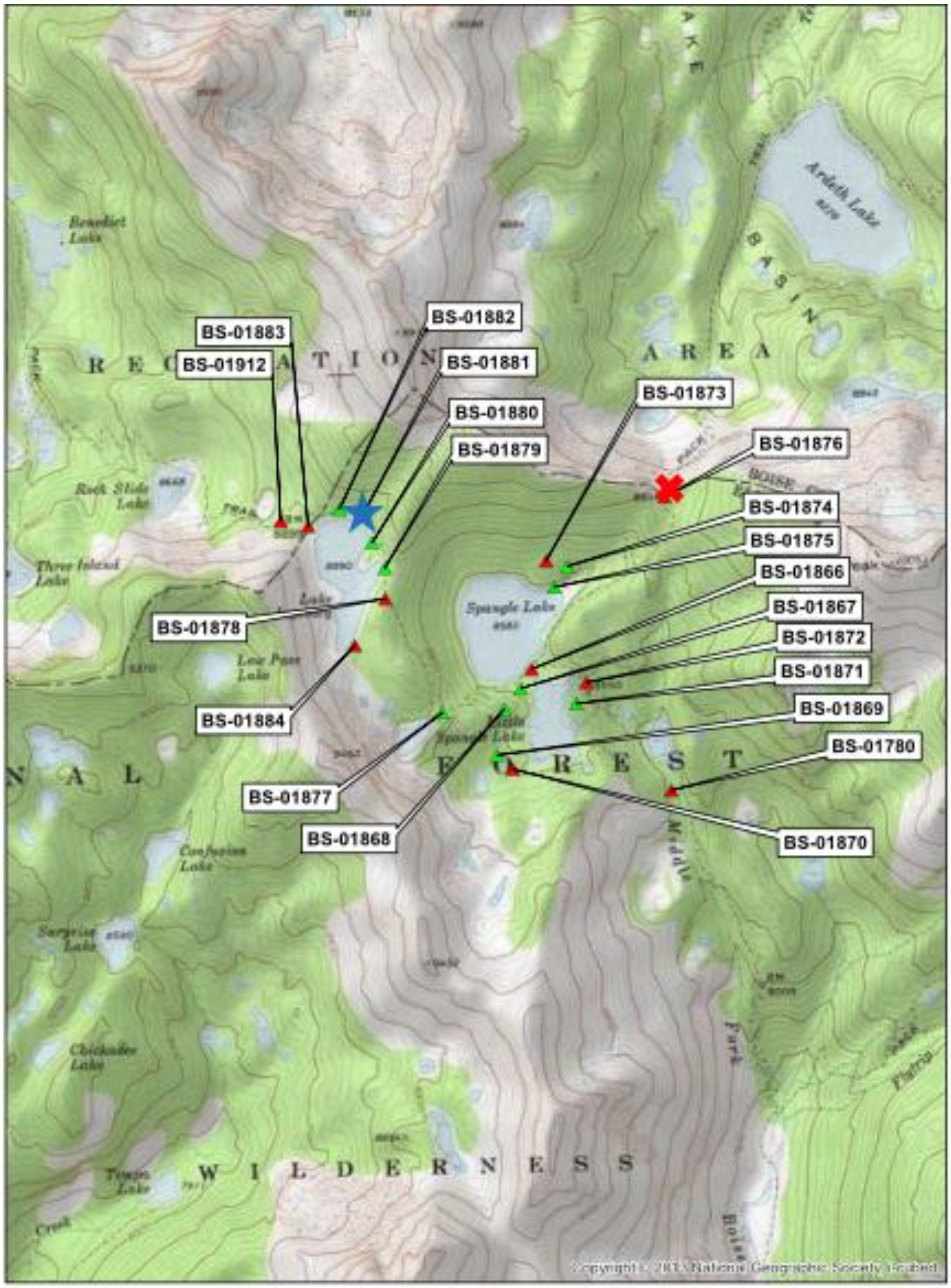

Figure 9 Topographic map of Spangle Lakes study area with associated sites. Sites marked in red were relocated for the purpose of this study (Bergstrom 2012). Site BS-1881 is marked by a blue star, site BS-1876 is marked with a red "X."

Table 4 Spangle Lakes Site Details

Site Number	**Site Description***	**Associated Artifacts***	**Recorded Datum**	**Recorded Site**
BS-1865	Size: 50 x 25 m 70 flakes identified: 40 quartz and 30 obsidian	16. Qz secondary flake 17. Qz Biface flake 18. Qz Biface midsection 19. Ob biface midsection	YES	NO
BS-1866	Size: 20 x 12 m 2 flakes (material unknown)	1. Ob DSN base 2. Js RG side-notched projectile point	NO; submerged	NO
BS-1870	Size: 5 x 8 m 25-100 flakes (exact total unknown): 1 flake chalcedony and the rest obsidian	NONE	YES	NO
BS-1872	Size: 10 x 20 m 7 flakes; 4 being obsidian, 2 basalt, and 1 chalcedony	9. Bs RG projectile point 10. Bs Elko projectile point	YES	NO

BS-1873	Size: 30 x 20 m 7 flakes; 5 being obsidian, 1 jasper, and 1 chalcedony	(11) Ob DSN base (12) Ob RG base	YES	NO
BS-1876	Size: 12 x 25 m 4 flakes; 1 being obsidian and 3 being quartz	(13) Ob corner-notched base (14) Ob RG projectile point 15. Bs uniface	NO; time constraint	NO
BS-1878	Size: 12 x 40 m 56 flakes; 6 being obsidian and 50 being quartz	(8) Ob RG projectile base	YES	NO
BS-1881	Size: 10 x 15 m 22 flakes; 2 being obsidian and 20 quartz	(3) Ob projectile point tip 4. Qz DSN projectile point	YES	YES
BS-1883	Size: 40 x 60 m 138 or more (exact total unknown); 30 being obsidian, 2 chert, 6 basalts, and	(7) Ob DSN notch corner	NO; submerged	NO

	100 or more quartz			
BS-1884	Size: 1 x 2.3 m 200 or more (exact total unknown); all quartz	NONE	YES	NO
BS-1912	Size: 1.5 x 1 m 200 or more (exact total unknown); all quartz	NONE	YES	NO

**Those collected or determined by the original survey team in 1999. Qz= quartz, Ob= obsidian, Js= jasper, Bs= basalt, #. = catalogue number, (#) = obsidian sample sent off to Northwest Research Obsidian Studies Laboratory.*

At BS-1881, site datum was established and clearly marked with flagging, and cardinal photos were taken. Following this, a thirty-meter radius was searched and any subsequent cultural material was flagged as well. Once all cultural material was clearly marked, the Trimble device was used to record the datum, record the site perimeter, and record GPS locations of all cultural material marked, attaching descriptive information for each item recorded. No cultural material was removed from the area and corresponding photos were also taken of all cultural material flagged for later reference.

A total of 53 flakes were recorded at BS-1881, 96.67% of them being composed of quartz material (Figure 10). Only two other flakes were recorded one of which was composed of an unknown cryptocrystalline material and the other appeared to be granitic. Flakes were identified by the best characteristics identified at the time in the field.

General morphological shape, presence of a platform, and presence of a bulb of percussion were features that composed a flake. Material identified as similar in composition to that of the flakes that lacked general morphological shape along with what may have demonstrated the appearance of a platform, were labeled as shatter.

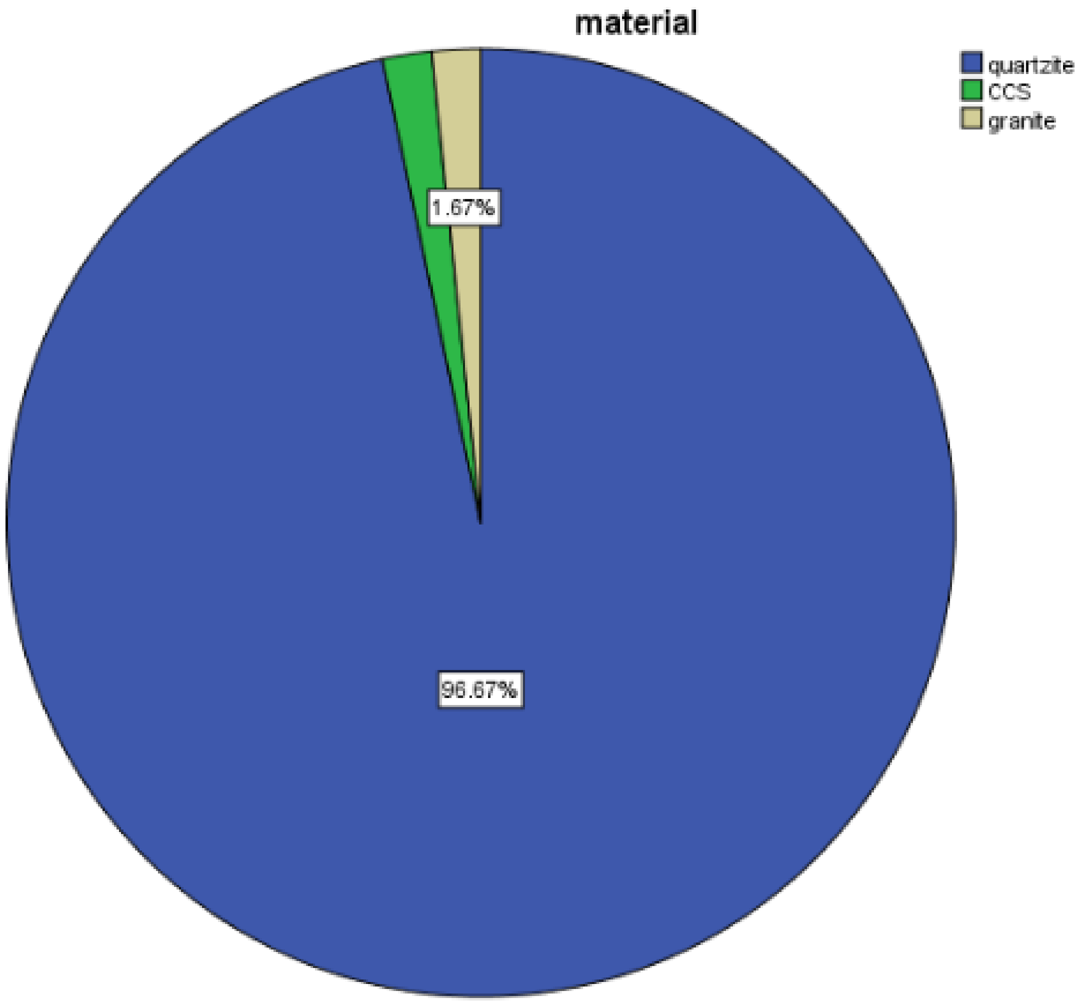

Figure 10 Lithic material composition for site BS-1881.

Lithic reduction stage was catalogued and measured using a standardized lithic area scale chart. On average, the sizes of the lithics were catalogued as $2.25cm^2$, followed closely behind by 1cm^2 in size and .25cm^2. Lithics catalogued rarely exceeded 6.25 cm^2 or more (Figure 11).

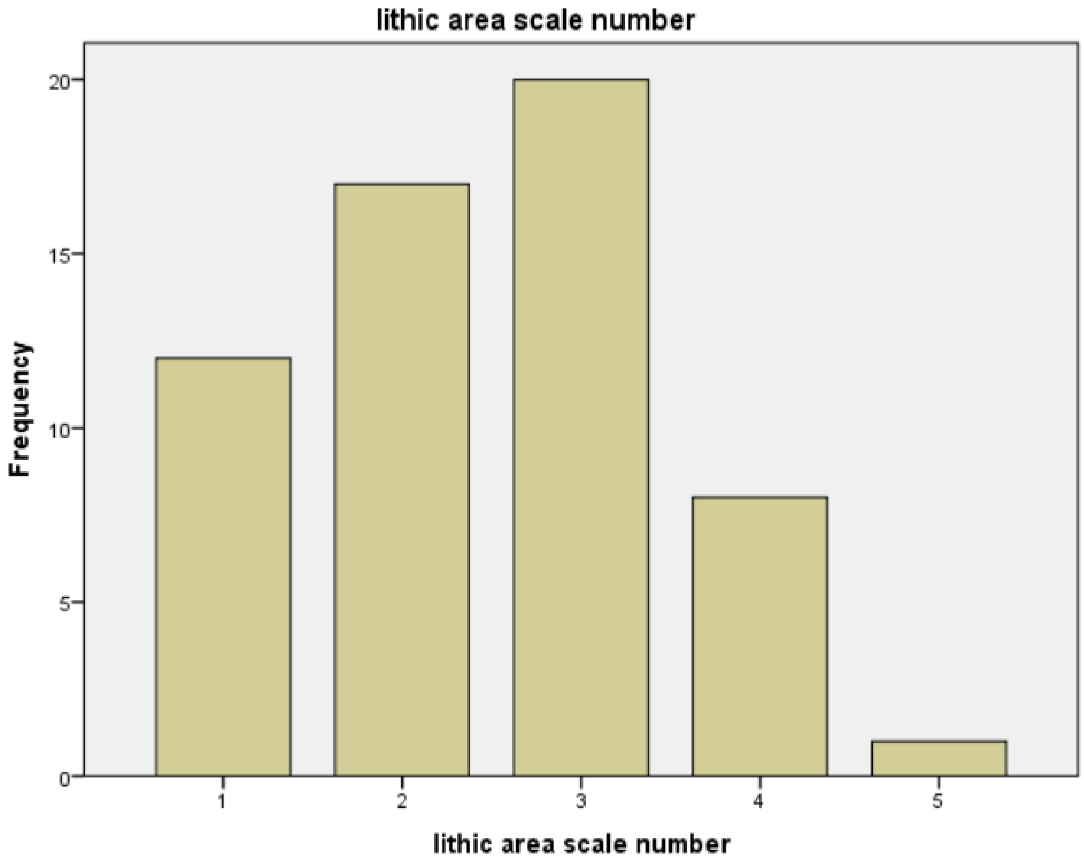

Figure 11 Total number of individual lithic reduction stages recorded from site BS-1881. Lithics flakes were measured on a standardized scale from sizes 1-5. (1)=late stage, (2,3)= middle stage, and (4,5)=early stage.

At BS-1881, four artifacts were catalogued. Two were typed as projectile points while one was catalogued as a scraper and the last being catalogued as an apparent core. Artifacts were catalogued in the same way as flakes and photographed using a centimeter scale for size reference. One projectile point and the core were composed of local quartz material whereas the other projectile point appeared to be composed of some form of basaltic material. The scraper was composed of basalt. In contrast with the original site report, no flakes of obsidian or basalt were found at the site.

Lab Results

In the 1999 survey, 21 artifacts were collected as grab samples. Rosespring (RS) and Desert Side-Notched (DS-N) points were the most commonly identified forms, accounting for 19.05%, respectively, of the total artifacts collected (Figure 12). Broken biface midsections were categorized as unidentifiable constituted the majority of artifacts collected at 33.33%.

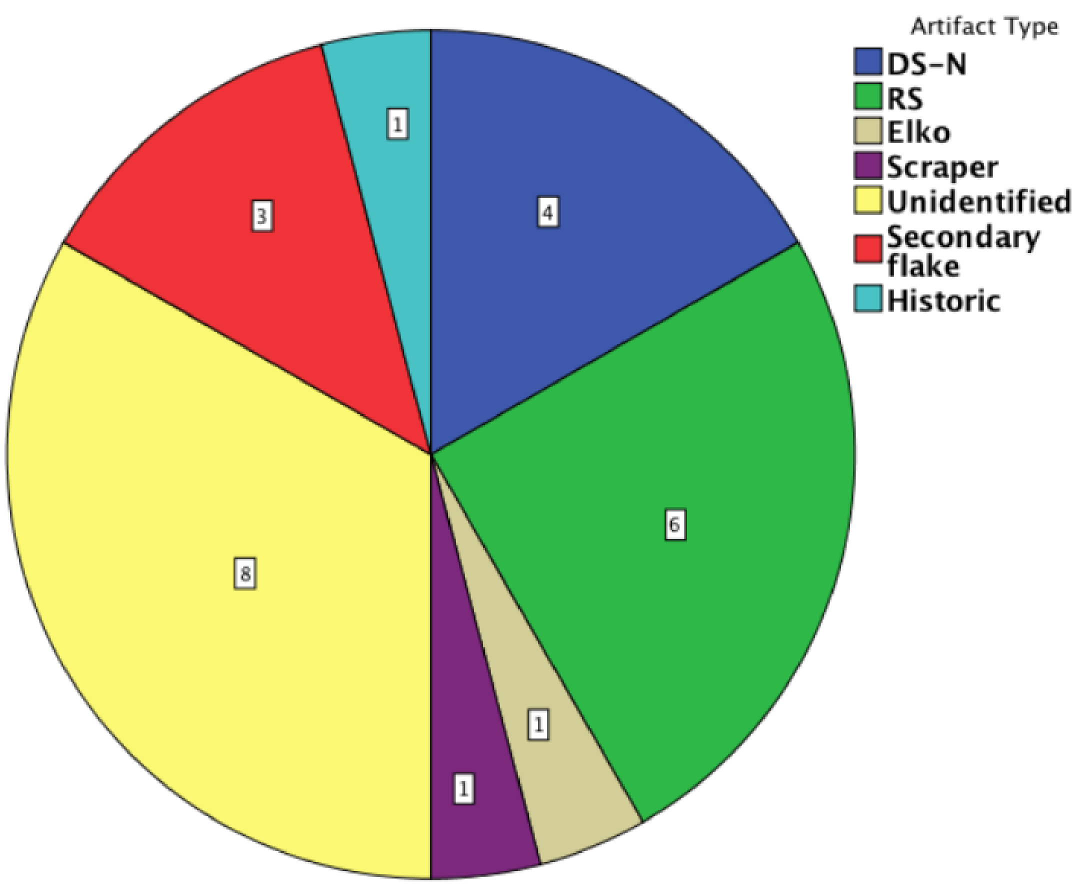

Figure 12 Percentage of projectile point types recorded from artifacts collected during the original survey in 1999.

Due to the small sample size, statistical analysis results of artifacts collected were unobtainable. Due to this, no statistical results were presented in this analysis. Of the 21 artifacts, nine are manufactured from obsidian and were sent off for XRF analysis to Northwest Research Obsidian Studies. Results indicate that the bulk of the obsidian came from Timber Butte source in Idaho, though two samples were identified from both Brown's Bench/ Butte Valley Group A and Cannonball Mountain in Idaho (Figure 13 and Table 4). One sample was not identified.

Table 5 Total amount of artifacts identified from each source identified by XRF analysis.

	SITES ANALYZED - SPANGLE LAKES, ELMORE COUNTY, IDAHO							
GEOCHEMICAL SOURCE	BS-1780	BS-1866	BS-1873	BS-1876	BS-1878	BS-1881	BS-1883	TOTAL
Browns Bench/Butte Valley Group A	1	-	-	1	-	-	-	**2**
Cannonball Mountain, ID	-	1	-	-	-	1	-	**2**
Timber Butte, ID	-	-	2	1	-	-	1	**4**
Unknown	-	-	-	-	1	-	-	**1**
Total	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**9**

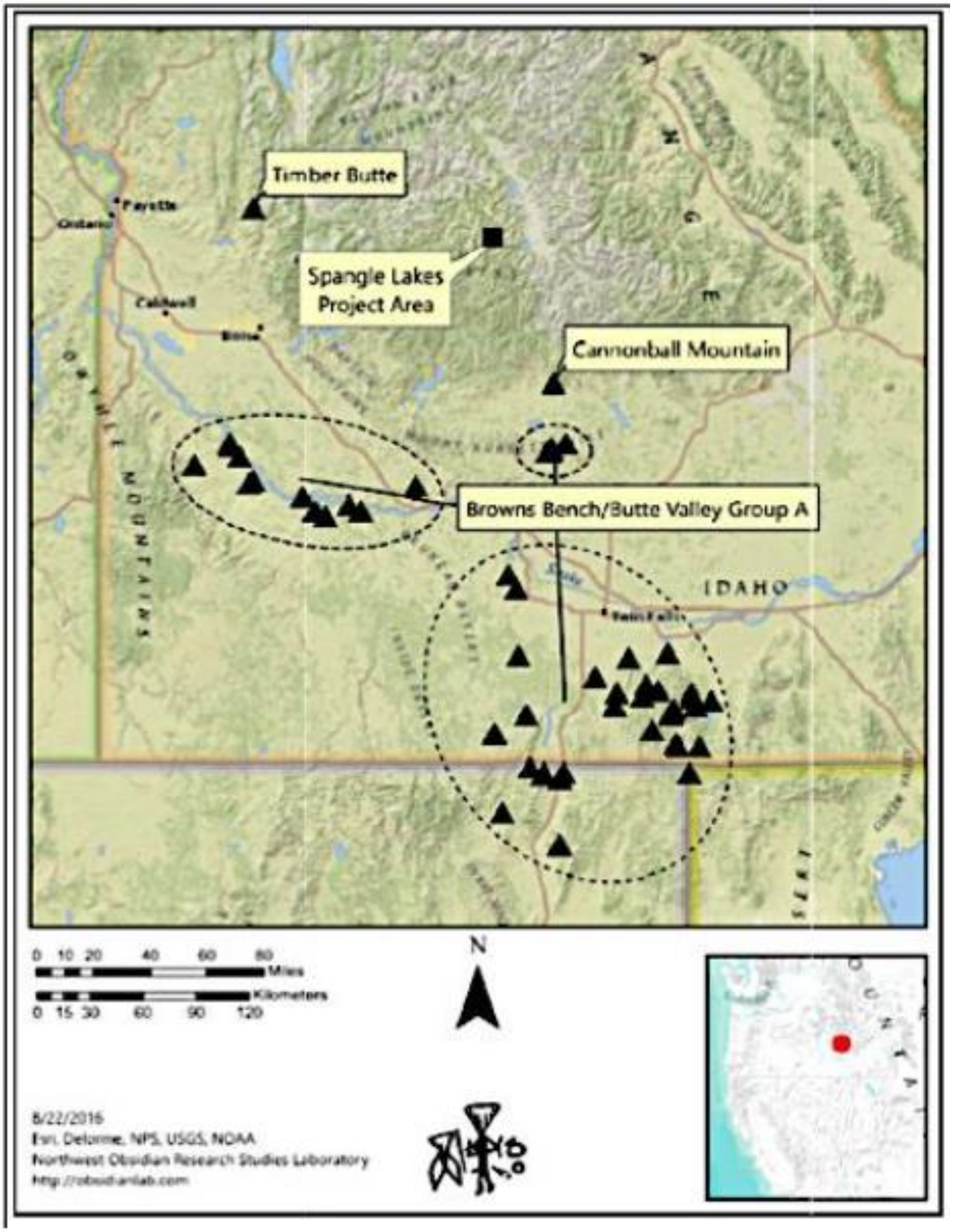

Figure 13 Map of general locations of lithic sources identified from XRF analysis from artifacts collected from the original survey in 1999.

Discussion And Conclusion

Spangle Lakes is one of the first land-use studies conducted within the Sawtooths. Owing to this, the Binfordian frames of reference approach was particularly useful in helping to build parameters for this study. This approach uses information well known for a specific area of knowledge as a reference for a similar area, allowing certain expectations or predictions to be developed and tested that are relevant to localized behaviors, organizational patterns, and habitat conditions (Binford 2001).

Archaeological data from regional Late Archaic high elevation sites in the Western United States suggest that sites were used in different ways and with varying degrees of frequency. This is due in part to the unique landscape of each mountain environment. However, these archaeological data were not wholly representative of ethnographically derived expectations in where the majority of accounts suggested that seasonal hunting activities were the primary reason for utilizing high mountain landscapes.

The Binford and Johnson's (2014) database was used to develop a more detailed picture of environmental conditions in the Sawtooth mountains, including annual rainfall, effective temperature measures, and available resources. The data suggests that this area is relatively marginal for human occupation and that growing season are relatively short. In addition, annual rainfall is minimal when compared with to lower elevation habitats. These conditions affect both plant and animal presence, which is minimal as well.

My primary hypothesis incorporates expectations derived from these frames of reference: a) if Spangle Lakes were utilized as short-term, hunting task camps, sites should be composed of varying lithic materials not local to the area, with similar tool varieties; and b) any debitage should be late stage debris, indicative of re-working activities. In addition, site size should be relatively small and located next to prime areas for hunting, such as mountain saddles and water sources which will attract prey. Cultural deposits should be shallow. An alternative hypothesis followed observations by the original team of surveyors who recorded the Spangle Lakes sites. They proposed that the Spangle Lakes sites reflected acquisition of local lithic material (quartzite) (Corn and Vrem 1999). In this regard, sites were expected to be consist primarily of local quartzite material. Tools were expected to be expediently manufactured with the presence of primary stage debitage. Sites were predicted to cover small surface areas and be located close to local raw lithic sources which are prime areas for procuring raw material.

The expectations of the null hypothesis that the Sawtooths were used for camping for short periods of time are partly supported by ethnographic data and overall results of this study. In addition, the majority of artifacts collected are composed of non-local material found outside of the Spangle Lakes area, and which were primarily projectile points. This suggest that Spangle Lakes was used for task-specific activities, most likely hunting.

Results were inconclusive regarding the alternate hypothesis. The majority of material catalogued throughout BS-1881 was primarily local quartz, rather than non-local material suggesting that quartz-reducing activities were being conducted. Most material, however, measured less than 2.25 cm^2 square (0.75-1 cm^2) across BS-1881, suggesting that only minor reduction was occurring rather than primary stage reduction, which is expected in the alternative hypothesis. It is expected that the high frequency of middle stage reduction observed in sites relates to the way quartz fractures. There is no identifiable cortex found on quartz, which is a clear indicator of early stage reduction in obsidian; this makes identifying early stage difficult with quartz material. It is also possible that early stage reduction was occurring in unknown locations within the study area. In addition, only a small percentage of formal artifacts is composed of quartz material, thus contradicting the alternative hypothesis.

Based on both field data and lab analysis, both hypotheses are inconclusive. Artifacts are predominantly composed of curated materials, although lithic debitage appears to be composed predominantly of local materials from the Spangle Lakes area. Expectations derived from both hypotheses suggest that for reasons unknown, curated tools of non-quartzite materials were left on-site, and expedient quartzite tools were possibly carried to other locations.

Although the samples for these results are exceedingly small, they provide some information about high mountain use and residential pattern in the Sawtooths. More importantly, further research is needed to develop a greater understanding of these behaviors. Further research into the available resources in the Sawtooth Mountains may also help to understand land-use patterns. In particular, looking into the plant resources available as well as their nutritional value. Piñon nut is a common staple among Great Basin and Snake River Plain hunter-gatherers (Steward 1938) had has been found at Alta Toquima (Thomas 1983), White Mountains (Bettinger 1991), and High Rise Village (Morgan et al. 2012). This resource, however is not located in the Sawtooth Mountains nor is camas root—another important plant resource in the Snake River Plain. It is expected that other plant resources could have been used, but these plant resources are unknown.

Studying ungulate behaviors in the Sawtooth Mountains may clarify expectations on seasonality of land-use. In particular, further exploring seasonal data on numbers and movement of ungulates in the Sawtooth Mountains could build a frame of reference to similar behaviors in the past. While faunal evidence was recovered in Alta Toquima (Thomas 1983) and other sites across the Western United States, no such evidence was observed or recorded in both the original survey and this study. A number of factors could contribute to the lack of faunal evidence observed, however it is likely that the environment is not conducive to preserve bone.

Monitoring these archaeological sites and others recorded in the Sawtooths on a recurring basis is recommended, paying particular attention to environmental conditions change their impact on sites over time. In example, annual temperature has increased melting the snow pack (Luce and Lute 2016) and encouraging beetle infestations in the pine (Halofsky 2016). This climactic change can impact site conditions through floraturbation and sweeping forest fires that alter the landscape.

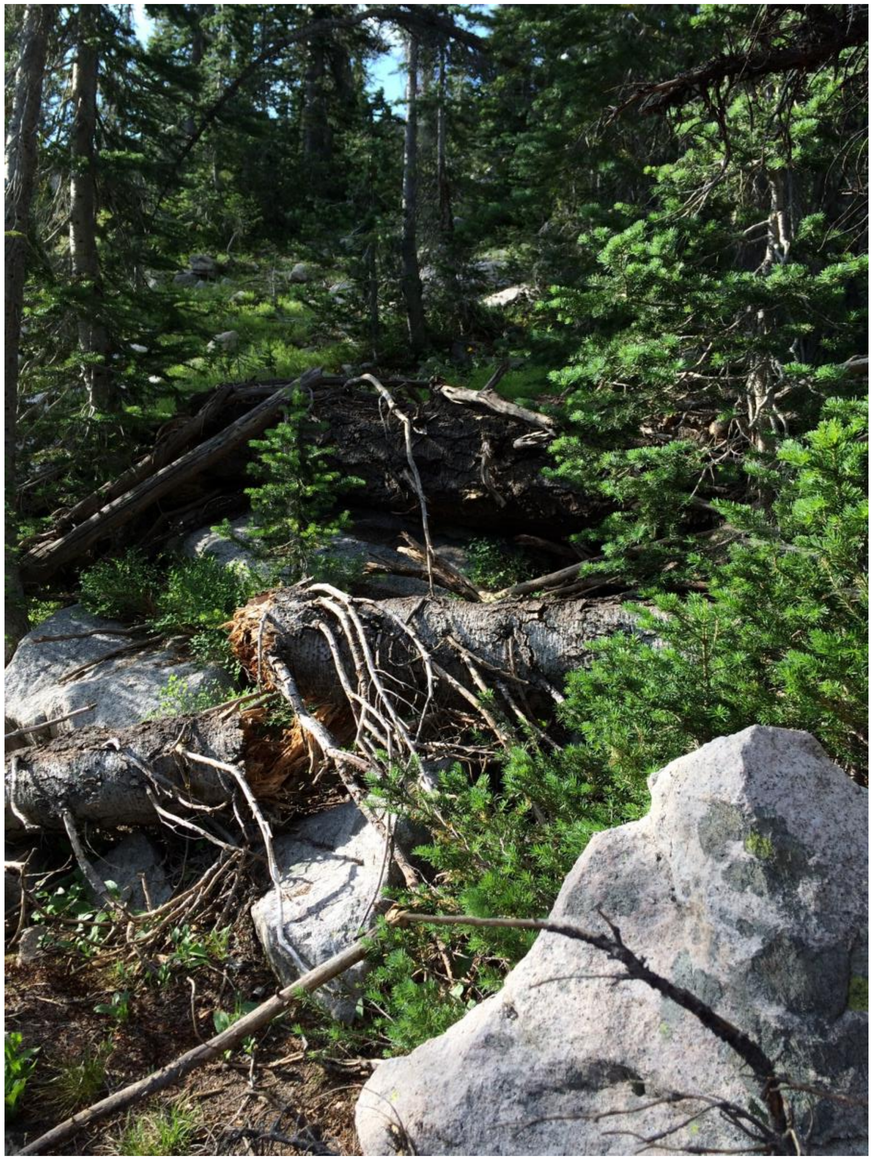

Figure A Photo of site BS-1870 where ground cover was too dense to be able to re-locate.

As such, it is predicted that the information collected will 1) provide further insight into land-use patterns in the Sawtooths such as how past environments could have affected land-use of the Sawtooth Mountains, and 2) develop an understanding of changing climatic patterns affecting archaeological sites within dynamic mountain environments (and incidentally provide useful data about soil, water, snow, and timber conditions). In particular, recording sites under similar conditions of season and environment (i.e. unusually dry, such as in 1999), would provide consistency in the data that is collected.

Limited land use during the Late Archaic of the Sawtooth Mountains is most likely due to the extremely dynamic depositional environment. The environmental data compiled in Binford and Johnson's (2014) database demonstrates that Idaho mountain habitats (and by implication, the Sawtooth Mountain range) are relatively marginal. Effective temperature, a measurement that outlines optimal growing seasons for plants, indicates that seasonal growth periods are very short. In addition, annual rainfall for the area averages less than 500 mm/year, suggesting a rather cold and dry climate. With some peaks rising more than 10,000 feet above sea level, the Sawtooth Mountains demonstrate (Thackray et al. 2004) some of the greatest variation of topography within the Northwest (Reid 1963).

In terms of human access and occupation, areas like Spangle Lakes are only accessible for extremely short periods—primarily late summer/early fall. Wild plants growing during this period are not conducive to sustaining human subsistence needs of individuals. The rugged topography makes accessing Spangle Lakes difficult and increases the chances for erosion and landslides that could drastically change the topography of the environment and alter routes of access.

Figure B Demonstrated the effect of a landslide that occurred between 1999 and 2015 covering up site BS-1912. New tree growth is evident on both sides. Image 1 shows north, Image 2 shows south. Picture was taken on the west side of Lake Ingeborg, northwest of Spangle Lakes.

Furthermore, the dynamic landscape has affected site preservation and visibility. In conducting fieldwork observations associated with this study, it was clear that the environment in which the sites had been originally recorded had changed drastically over the past sixteen years. In 1999, the area was subjected to lower than average rainfall; by contrast, 2016 had been an unusually wet year. This affected multiple archaeological sites such as BS-1866 and BS-1883, which were both submerged under lake water and therefore inaccessible. Additionally, sites that would have been easy to identify were hidden under thick plant cover (Figure a). Site BS-1872 was severely affected by the erosion from a creek that had developed down the middle of the site since 1999 (Figure b). Also, erosion had caused a dramatic landslide that apparently obliterated Site BS-1912 (Figure c). All other things being equal, it can be assumed that similar environmental changes were occurring during the Late Archaic and may have impacted the way individuals could have used the area over time.

These observations demonstrate that the Sawtooth Mountains changed over the past sixteen years, and most likely throughout the past as well. The dynamics of their environment would have had a substantial effect on seasons when the area could be utilized by foragers—or even accessed. This would also explain why BS-1881 demonstrated evidence of short-term residence and suggests that other archaeological sites would be similar had we been able to relocate them. These observations, however, also suggest that the Sawtooth Mountains could have been used more frequently, or for longer periods of time than the evidence currently suggests.

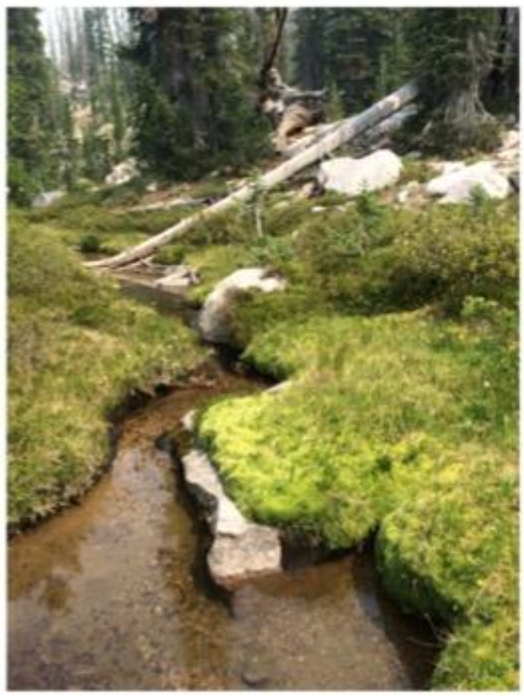

Figure C Photo of site BS-1872 where a creed had developed through the middle of the site from when it was originally recorded in 1999.

In conclusion, Spangle Lakes archaeological sites differs from those of western high mountain archaeological sites in both size and composition. Sites are smaller, lack large structural features, and have minimal tool variability. In general, the environment is also dissimilar, with extremely variable topography and dramatic climatic changes affecting landscape configuration. Overall, Spangle Lakes were utilized as short-term, high mobility task camps during the Late Archaic. Most material analyzed is composed of localized material from the Spangle Lakes area, and completed tools are made of non-local cryptocrystalline material. This suggests an as-yet unexplained bimodal pattern of using local material to ‘gear up’ and depositing non-local lithic tools being deposited at these high elevation sites, which opens up an interesting area for further exploration.

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