CONSTRUCTING ROCK CAIRNS: MODIFYING AND SIGNIFYING THE ALPINE LANDSCAPE OF SOUTHEAST ALASKA

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ABSTRACT

The existence and variability of human-made rock cairns in subalpine and alpine settings of Southeast Alaska is increasingly well documented. Where these features were constructed prehistorically and protohistorically is a fundamental component to assessing the socioecological role of these modifications to a landscape that is, for the most part, devoid of other physical manifestations of past human activities. Based on information compiled from investigations in the northern portion of Baranof Island and vicinity, we explore the physical and social environmental conditions that may underlie decisions to create the cairns, some of which are estimated to have been built approximately 500 to 1500 years before present (YBP). Exploratory spatial analyses of the locational attributes of these rock features is pursued with the goal of assessing possible Tlingit activities in this subalpine and alpine environment while embracing the evolvement of social significance attached to this setting.

INTRODUCTION

While we were there, the ocean began to pour in—the flood, the flood. Then we got into our canoes. That mountain, where it sticks out, very far from us, in our boats we got there to that mountain. It flooded around it. That is why even today it's there, this cairn, cairns. Ropes are there too. The ropes have crumbled. Maybe they were root ropes. I saw them with my own eyes, the cairn and the ropes. It's the mountain that sticks out behind Angoon. Sax'aayi Héen Shaa. It is there, it is there, these things from the time of the flood were there. (Robert Zuboff 1972)

The physical remains of past human activities are acknowledged archaeologically to be the result of the behavior of individuals and small groups coupled with natural processes inherent to an environment. Building an understanding of behavior is often the ultimate goal in social science, whereas understanding the processes by which the physical manifestations of that behavior result in the material record is a fundamental challenge for anthropological archaeology. Human-built or -induced features on a landscape and seascape reflect a behavioral dynamic different from that of spatially defined accumulations of artifacts. Constructed features, although vulnerable to being altered for functional or aesthetic purposes, are likely to endure in place through time. This relative localized and morphological stability offers anthropological archaeology a means by which to pursue temporal and spatial association of the remains of behavioral activities that can inform an interpretation of land use. Human modifications to a landscape surface are, as emphasized by Wandsnider (2004:77), introduced to the biophysical environment for the purpose, most often, of altering an ecosystem to increase its economic value. The construction of stacked loose stone to form cairns, for example, is one of "the most visible human ecosystem engineering efforts" (Smith 2013:9; see also Zedeño et al. 2014)—the placement of such features on a landscape being nonrandom. The objective of this study is to explore the potential decision-making that may have resulted in the pre- and protohistoric construction of cairns and the evolving significance assigned to their placement in the alpine settings of Southeast Alaska.

THE STUDY AREA

The landscape of interest here is that of the alpine and subalpine zones of Baranof and Chichagof islands, two of the large islands in the Alexander Archipelago of Southeast Alaska. The alpine environment above tree line at 640–850 m (ASL) within the northern portion of Baranof Island constitutes the area of focused study. This outer island is characterized by a high and extremely steep-sided mountainous divide with elevations up to 1625 m (Carrara et al. 2007:235). Mountains at the coastal margins rise directly from the water with little or no flat ground between. One mountain prominence here, locally and informally called Cross Peak at 752 m (ASL), overlooks the intersection of Peril Strait and Hoonah Sound and is readily visible from the water and adjacent landmasses (Fig. 1).

Intentionally constructed piles of loose, uncut rock in the mountainous areas of Southeast Alaska, varying in size and shape, are generically termed cairns. They are most often observed above tree line. Reconnaissance inventory in 2007 documented the existence of 22 cairns in this portion of Baranof and the adjacent Chichagof Island. Intensive inventory of the Cross Peak area in 2013 documented an additional 37 cairns on Cross Peak and 39 cairns during a brief aerial reconnaissance of surrounding coastal mountains the following year (Fig. 2). The rock cairns documented in 2007 and 2013 vary in morphology, from roughly circular to elliptical or elongated. They range in size from less than 1 to more than 14 square meters (mean = 4.82 m2) and from under one half to over a meter in height. Some are formed on or around bedrock, enhancing a natural geological feature, while others are wholly constructed (see Hunt et al. 2016). Interviews with U.S. Forest Service personnel and a literature review identified over 105 more cairns throughout the central and southern portions of Southeast Alaska and adjacent British Columbia (Howell et al. 2013; Hunt 2010; Hunt et al. 2016).

INDIGENOUS LAND USE

The ethnogenesis of the cultural group known as the Tlingit, encompassing numerous subgroups, is at the most general scale characterized by geographical delineations within central Alaska and western British Columbia. Oral histories reveal an ethnographic identity in this region possibly surpassing 4000 years. Attempts at modeling the broad-scale processes that historically characterize the cultural divisions of the central and southern Northwest Coast lead to speculation about the process and dynamics of social learning and interaction between self-identified groups that utilize and are dependent on a congruent resource base (Jordan and Mace 2006). The social organization of Tlingit at contact, especially that of clans and communities (*kwáans*),[1] are notable in that the geographical identity associated with a clan is likely the result of "the twin processes of fission and migration" through time (Thornton 2008:52).

The area in which this study is focused is ethnohistorically documented to have been used primarily by the *Sheet'ká Kwáan* and the *Xutsnoowú Kwáan*. Oral history, traditions, and accounts of place-specific subsistence activities by people from both Tlingit groups allowed Goldschmidt and Haas ([1947] 1998) to delineate customary land-use territories assigned to "both clan and family" (Davidson 1928:22–23) of each *kwáan*, prior to and in the immediate wake of the Indian Claims Commission Act of 1946 (60 Stat. 1049) (Fig. 3). The ethnogeographical information that fostered the "territory" land-use maps in Goldschmidt and Haas's government report is invaluable, in that it offers a foundation for understanding the resource availability and mobility necessary for inhabitants of this portion of coastal

Figure 1. Cross Peak mountain and survey area on Baranof Island depicted with star. Black outline represents approximate extent of aerial reconnaissance.

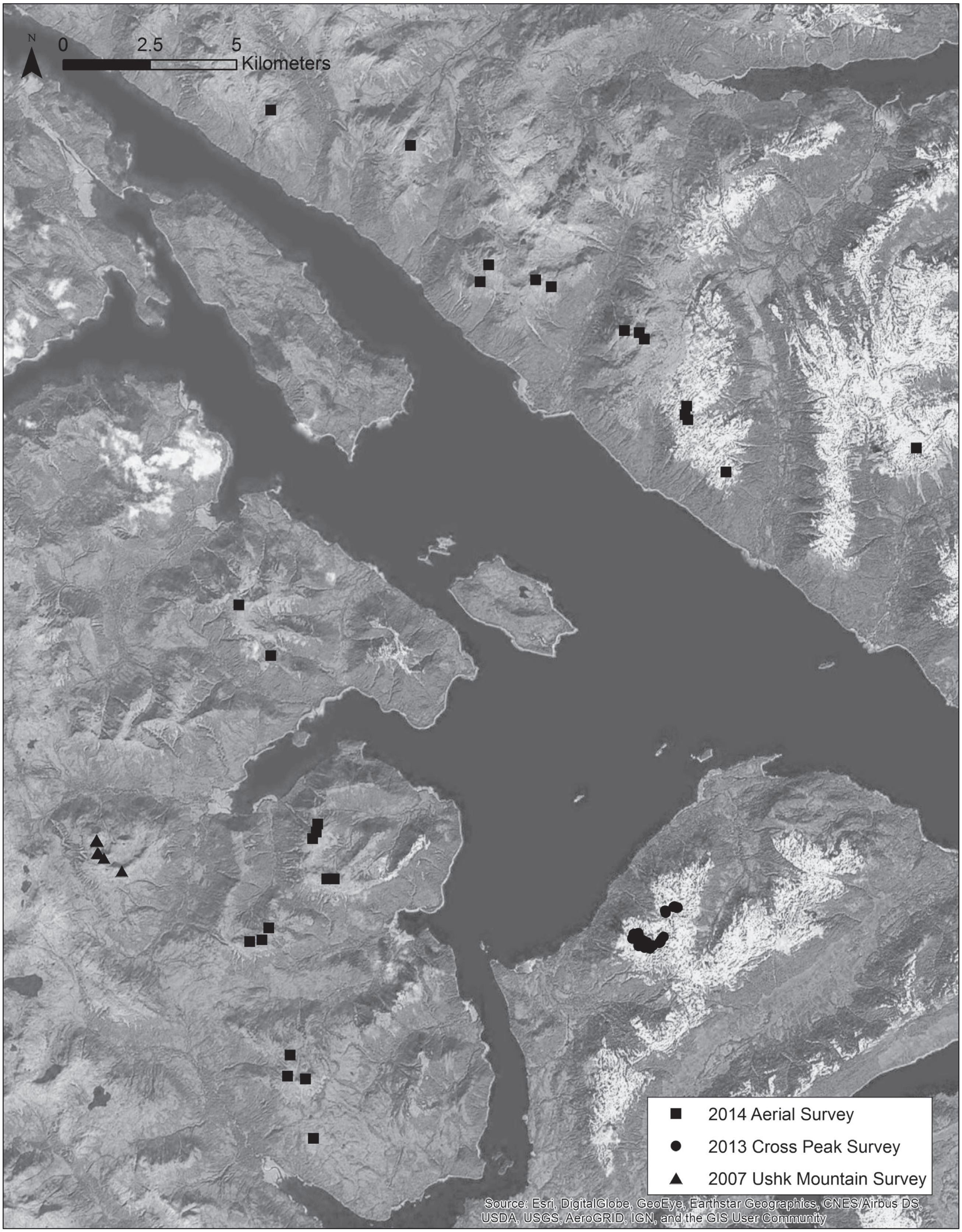

Figure 2. Black circles represent cairn sites documented on the northern extent of Baranof Island. Black squares represent locations of cairn sites observed from helicopter reconnaissance in 2014. Black triangles are locations of cairn sites recorded during Ushk Mountain survey in 2007.

Figure 3. Approximate "territory" boundaries of Sheet'ká Kwáan *and* Xutsnoowú Kwáan *(after de Laguna 1990:203). Star represents intensive survey area. Black area depicts area of aerial reconnaissance.*

Alaska. While much of the extent of land use in these territories "comes under the category of fishing-grounds," hunting "is carried on wherever profitable"; and "there are districts far back in the mountains which are used solely for the hunting of mountain-goats and other large game" (Davidson 1928:22–23). Davidson (1928:22–23) preferred to "designate them as hunting reserves which are retained for the exclusive use of the members of the owner's clan," but sometimes available for hunting "lease" "to members of other clans" or potentially anyone else, whereupon, depending on some measure of hunting success, "tribute" is "paid to the clan."

While proprietary behavior and various references to "ownership" of places (e.g., smokehouses) and named seasonally resource-rich topographical features (e.g., streambeds) are referenced throughout historic land-use accounts (Goldschmidt and Haas 1998; Thornton 2008), it is suggested that at least some of the social dynamics surrounding land and resource use permit and transfer may have been of "recent times," presumably of the late nineteenth to early twentieth century (Goldschmidt and Haas 1998:12*n*3). Depending on where and when proprietary behavior was exhibited, it may have been manifested in what Cashdan (1983) termed "social boundary defense" where access is defended, possibly by some form of communication, rather than the resource itself (e.g., Dyson-Hudson and Smith 1978:22; Turner et al. 2011:14–15). It is likely, given the modeling of hunter-gatherer land tenure and resource defense by Baker (2003), that the territories delineated by Goldschmidt and Haas (1998) and often reproduced (e.g., de Laguna 1990) reflect the approximate home range[2] of a *kwáan*, constituting a "territory of knowledge," the fluidity of which was likely conditioned by Tlingit population density dynamics throughout the Holocene, in concert with the ability of a *kwáan* or clan to respond to biophysical changes in the environment throughout the late Holocene (cf. Moss 2011:96).

THE STUDY OF ROCK CAIRNS

Cross-cultural studies of stacked rock features and their spatial distribution at high elevations have largely centered around their utility in helping manipulate the movement of ungulates, most often in the context of communal hunting (e.g., Benedict 2005; Blehr 1990; Brink 2005; Fox and Dorji 2009; Friesen 2013; Moreno 2012; Schneider et al. 2014; Zedeño et al. 2014). Small stone U-shaped structures used as hunting blinds, and circular structures used for temporary shelter, are sometimes observed in association with rock cairns (e.g., Binford 1978:182–183; Brink 2005; Dalton 2011; Grønnow et al. 1983; Labelle and Pelton 2013; Pratt 2001; Schaaf 1988:249–253). The use of portable rock stacked over and around caches of food, morphologically forming cairns, is well documented in the Arctic and Subarctic as well as in other environments (e.g., Benedict 2005; Binford 1978:55–57; Borrero et al. 2011; Grønnow 2009; Grønnow et al. 1983; Sørensen 2010; Stopp 2002:321). Cairns observed in proximity to trails and on prominent topographical features are often interpreted as reference points in spatial orientation and sometimes in association with the marking of places linked in some manner to a belief system (e.g., Caldwell and Carlson 1954; Chartkoff 1983; Haynal 2000; Jett 1994; Kuwanwisiwma and Ferguson 2009; Loendorf and Brownell 1980; Mizin 2013; O'Leary and Bland 2013:147; Weimer 2009; Wisehart 2005). The construction of cairns over or in proximity to human burials within sight of a seacoast or waterway is documented in various parts of the world (e.g., Jansson 2011; Magnin 2009; Mathews 2006; Prieto and Cardenas 2007; Smith and Fowke 1901; Thom 1995; Tuovinen 2002). Where burials are not in evidence, proximity and visibility has led to speculation upon socioeconomic and belief-system explanations (e.g., Fisher and Farrelly 1997).

ASSESSING AGE

Estimating the age of most rock cairns is problematic. Eight of the cairns on Cross Peak Mountain were examined by lichenologists with the goal of estimating the age of the features via their lichen growth. Subsequently, archaeologists selected four cairns for partial deconstruction with the objective of obtaining organic samples for radiocarbon dating. No organic materials or artifacts occurred within the cairns, leaving only the soils immediately beneath the cairns as datable material. These cairns are assumed to have been constructed subsequent to the dates derived from the soil samples. Lichen analyses, employing lichenometry and an innovative successional metric analysis, in association with C^{14} analysis of the soil samples from beneath these cairns, suggests that those features sampled arbitrarily were constructed variously within 450–1500 BP (Hunt et al. 2016; McCune et al. 2017) (Table 1). These data suggest that the body of cairns documented in 2007 and 2013 were the result of a cumulative set of activities over the course of several hundred, if not more, years.

AN EXPLORATORY APPROACH

The cairns on Cross Peak Mountain and the adjacent coastal mountain topography are positioned on the slopes and crests of high ridges and peaks. The topographical setting for these rock constructions constitutes one of the fundamental observations of these features. What we do not have is an adequate understanding of why the individual cairns or groups of cairns are placed where they are. Are the cairns positioned in these alpine settings randomly, or does the place of construction through the centuries inform us about prehistoric decisions reflecting social and biophysical environmental conditions?

Table 1. Lichenometric and radiocarbon results from sampled cairns (from Hunt et al. 2016; McCune et al. 2017).

Cairn	Lichenometric Age (years)	Successional Score	C^{14} Median Probability Soil Age (years)
Calibration	—	–1.38 (0.54)	New
9(I)	368	0.55 (0.39)	No date
39	489	0.30 (0.54)	No date
1(A)	342	0.54 (0.40)	Modern
5(E)	892	–0.03 (0.19)	625 ± 40
7(G)	892	0.13 (0.28)	1610 ± 20
3(C)	517	–0.06 (0.55)	375 ± 30
25	258	0.31 (0.36)	No date
8(H)Disturbed	187	–0.75 (0.51)	No date
8(H)Undisturbed	263	–0.03 (0.35)	No date

We approach this intentionally leading question loosely consistent with what Carr (1985:31–34, 1991:226) has termed constrained exploratory analyses, the fundamental goal here being to induce speculative interpretations about past behavioral activities in these coastal mountains (cf. Chapman and Wylie 2016:105–134; Gibbon 2014:32–33; Lewis 1989). First, we discuss briefly how relatively sudden biophysical change to an occupied landscape can, through time, be socially absorbed in support of signifying modifications to a cultural topography. Second, we use information from field observations coupled with spatial analyses and ethnohistoric accounts to frame provocative propositions about (1) the indigenous use-history of these alpine settings that may lend themselves to potential empirical research and (2) the utility of loose rock constructions in settings devoid of residential investment, that may inform an assessment of their assigned place significance within the context of dynamic social interaction.

SIGNIFYING PLACE

Ethnographic information often assists anthropological archaeology in orienting investigations into behavioral activities not readily visible in the archaeological record while guiding questions amenable to exploratory analyses. Relationships between ethnographic and archaeologically derived data are best assessed at the scale of the landscape, where the history of people's activities and the formational processes affecting material and constructed features intersect to create a cultural topography of places with varying intensity of use (Grove 2009; McGlade 1995; Wandsnider 2004; Whittlesey 1997). The historical and relational dimensions of landscapes are well conceptualized by Zedeño (1997:126) as a "network of interactions between people and landmarks," where landmarks are considered the transformation of a place or resource into a locational marker, the history of which may or may not be reflected in observable cultural or behavioral residue. Oral traditions, for example, and stories well maintained by Tlingit groups of coastal Alaska can be historically informative about not only the general identity of the creators of the landmarks but also the nature and location of constructions. In addition, oral histories can offer a modern context within which an understanding of how and why locational significance evolved (e.g., Crowell and Howell 2013).

Contemporary interviews with Tlingit elders, along with ethnographic oral history reviews, lead to a roughly consistent association of "flood" stories with the construction and placement of cairns in Southeast Alaska. Cross-cultural references to inundation due to flooding, a tsunami, or deluge in the context of mostly oral traditions of numerous small-scale societies having occupied coastal environments are well known. While historical and contemporary interpretations of such unmitigable events often reveal dramatic responses necessary for survival, the potential for social reorganization in recovery is also acknowledged (Dundes 1997:78–91; Fitzhugh 2012; Kluckholn 1959; Letham et al. 2015; Nunn 2014; Thornton 2008:53). These legendary stories reference a somewhat rapid inundation of coastal residential sites and camps due primarily to isostatic depression during the Little Ice Age (ca. AD 1350–1850), resulting in people accessing much higher elevations. The erection of cairns as "flood markers," used to assess and measure the rising water levels and/or as markers to commemorate earlier flood events as referenced in Raven flood stories is a common interpretation in indigenous Tlingit oral history of mountain ridges and peaks near the study area (Hunt et al. 2016). The likely inundation of shoreline villages of the Huna Tlingit in the Glacier Bay area of Southeast Alaska during the Little Ice Age peaking ca. AD 1850, for example, is considered in oral tradition focusing on the Raven flood stories to be the rationale for the construction of cairns near at least three mountaintops adjacent to the coastline (Crowell and Howell 2013:7; Crowell et al. 2013). All are interpreted as having been built by the Tlingit over the last several hundred years as monuments or memorials commemorating the story of the "flood."

Although it is an ongoing research challenge to understand the complex processes through which people form meaningful relations with places, it is broadly acknowledged that an attachment to place facilitates social relationships and reinforces group identity (Lewicka 2011:226; Scannell and Gifford 2010:4). Thornton's (2008:7) emphasis on specific places and landscape settings being integral in the process of "binding and rebinding" the culture of Tlingit identity is highly analogous and exemplary of that of many indigenous groups throughout the world (e.g., Århem 1998; Rössler 2009; Taha 2013; Whitridge 2004).

The resilience necessary for a homogeneous group to absorb the environmental degradation, if not the temporary destruction, of a coastal resource base is a phenomenon that has influenced social organization for millennia (e.g., Fitzhugh 2012; Kohler 2012). An attempt to respond to disturbance events or episodes within even longer-term ecosystem change does not imply that of returning to a previous way of using a biophysical environment. The structure of resources, both mobile and nonmobile, on a landscape may change, if only slightly, creating opportunities for shifts in exploitation (Folke 2006). Or, as emphasized by Nelson et al. (2012), the optimal goal is likely to be that of creating a balance among miscellaneous vulnerabilities that might reduce and help manage the cost of future extreme disturbance of the local environment. Thus, the "traditional environmental knowledge" maintained through generations by an indigenous group such as the Tlingit continued to evolve, preserving well-functioning local and regional sociological systems (Berkes 2008:176–178; Janssen et al. 2007). The capacity to adapt in these coastal environments incorporated concepts of social learning, social memory, and self-organization along with fundamental perseverance. Intragroup cooperation was required to build resilience, especially under conditions where ecological disturbance fostered or enhanced intergroup competition.

The accounts of people's experiences, both historic and contemporary, with a place can result in narratives that produce interpretations of the relationships of complex events and social behavior. Resource procurement and resource collapse due to some form of alteration in biophysical conditions are phenomena that often become the subjects of narrative and oral tradition. Information transmitted within these media deal with resource crises of varying periodicity and severity, the resulting hardship and strategies of coping being encoded in such a manner as to meld into group memory, transcending an average human life span and representation of experience (e.g., Minc 1986; Ohmagari and Berkes 1997; Scalise Sugiyama 2001; Sobel and Bettles 2000). Given the place-specific nature of the efficient procurement of nonmobile as well as mobile resources, stories and legends can help orient cognitive vision in a biophysical setting that is intimately familiar to both storyteller and listener. Narratives referencing the construction and placement of cairns under what can be considered cataclysmic conditions reflect the environmental knowledge, cooperative behavior, and perseverance of a group, communicated orally so as to influence contemporary members about group cohesion and resilience in the face of adversity:

> It's more philosophical. It's very, very, very spiritual. And I know that most scientists don't want to deal with spirituality, but it's something that we strongly believe. There's a great flood that's coming. Our people have survived this. But the greatest challenge that we have today is a flood of pride, of self-centeredness, of ego, and really in a way, a flood of a different culture that has come upon us. And the elders would say, remember we survived that flood a long time ago. This is why we've been here all these years. This will not overtake us. *Tlingit di ya oha.* We're Tlingit people. (Katseek 2013)

The bonding or attachment to a specific place or set of places occurs at variable scales, from that of the individual—often conceptualized in self-esteem—to that of a self-identified group. The assignment of "meaning" to a place can be complex, in that meaning may not be derived from physical features but rather from collective memories, legends, and beliefs of those signifying the place. While theoretical constraints and empirical research about the attachment to meaningful "place" are transdisciplinary, it's noteworthy that this affective, proximity-oriented bond for individuals and groups is most often expressed without an underlying purpose of control. Territoriality, or ownership manifested in proprietary behavior, is not a prerequisite of an individual or social dimension to place attachment (Patterson and Williams 2005; Scannell and Gifford 2010).

A physiographic change, as emphasized by Zedeño and Bowser (2009:9), can "drastically alter people/place interactions" and, as a result of differential experiences through time, foster alternative meanings assigned to a place. In the historical context of the *Xutsnoowú* and *Sheet'ká* Tlingit, the emotional and social toll of the response to a natural environmental event or episode is paramount to the significance of a place or places where stone cairns are observed. Bernardini et al.'s (2013) emphasis on the importance of accounting for the population distribution on a landscape to assess the significance of prominent peaks is tempered with the acknowledgment that we should not expect to fully reconstruct "meaning" assigned by pre- and protohistoric actors in these populations. Nevertheless, it is within our purview to identify places that may have been loaded with meaning(s). Contemporary research on whether the attachment and emotional bonds to a place enable or obstruct adaptive response to relatively sudden change in a biophysical environment is constrained by studies that are, for the most part, limited to no more than a year. Ethnohistorical research and anthropological archaeology, while primarily nonquantitative in this realm of study, can help evaluate the decision-making of a group that was confronted with biophysical change for which they were unprepared.

Of relevance to cairns on or near the prominent peaks of Baranof, Chichagof, and adjacent mountains is not only the relatively consistent significance attributed to these alpine settings, but especially how the cairns have become anchors in the collective memory of Tlingit groups encompassing "shared cultural experience" (Dods 2004:551) that encourage "moral lessons needed to maintain social cohesion" (Zedeño and Bowser 2009:8). Of interest here is the collective response, through metaphysical and physical memorialization, narrative, and storytelling oriented toward commemoration, to a biophysical shock to a socioeconomic system—the goal of which is to make the event and response unforgettable, reinforcing cooperative social relationships and therefore the identity and survivability of a homogeneous group. The sociohistorical significance of the alpine landscape through well-communicated narrative reveals an intimate knowledge of this environmental setting that suggests the potential for past investment in the procurement of resources that supplement the Tlingit coastal and estuarine biophysical habitat.

ALPINE HUNTING

Much of the focus on resource-acquisition activities of fisher-hunter-gatherers in coastal south and central Alaska has been, for reasons of high residential density, oriented toward the availability of marine and riverine fauna and lowland flora of coastal seascapes (Moss 2011:134). Places of long-term group residence, as well as short-term or highly seasonal camps on or adjacent to the coastline, are the most well-documented and archaeologically investigated sites in the region. The rugged interiors of islands and inland coastal environments were, based on ethnohistoric and historic accounts and archaeological investigations, less used for subsistence purposes.[3] As Moss (2011:134–137) emphasized, "the extent to which terrestrial landscapes away from the coast figure into Northwest Coast pre-contact history is an open question," but she also noted that "the dense forests and steep mountains presented more of a barrier to social interchange than did marine waters."

Thomas Thornton notes that throughout his extensive interviews with myriad Tlingit elders and informants, there exists very little mention of an association of hunting with the placement of the cairns in the study area (Hunt et al. 2016). While artifactual evidence of hunting, or any type of resource procurement, has yet to be observed there, hunting activity in the alpine and subalpine settings of Southeast Alaska is documented in ethnohistoric accounts. Krause ([1885] 1956:125), for example, in observations during the late nineteenth century, suggests that Tlingit hunting "offers nothing exceptional"—but he describes the Chilkat Tlingit pursuit of mountain goat and sheep being "similar to caribou hunting," requiring that hunters climb "high in the mountains" while "others chase the timid game toward them" (see also Anell 1969:23; de Laguna 1990:210; Emmons 1907:333). Ambush hunting in these alpine settings is not referenced; however, Hare et al. (2004:262) suggest that in the ice patch zone of southern Yukon, where well-identified U-shaped hunting blinds are not found, hunters likely used the protection of existing boulders for concealment. The construction of piles of loose rock could likewise offer concealment while blending into the rocky, treeless landscape, including those cairns constructed on exposed bedrock (Figs. 4 and 5) (cf. Binford 2009:218–219; Grønnow et al. 1983:41; Moreno 2012; Schneider et al. 2014:188–191).[4]

PURSUING MOUNTAIN GOAT

Mountain goat (*Oreamnos americanus*) have historically inhabited alpine and subalpine zones, descending into forested areas when snowpack is high. Seasonal migration ranges from 5 to 10 km in the fractured landscape of central and Southeast Alaska, while upslope migration occurs around early to mid-May (Festa-Bianchet and Côté 2008:57; White et al. 2011).[5] Portions of Baranof Island were free of ice during the late glacial maximum, and a genetically distinct subpopulation of goat is currently considered endemic to what is sometimes called this "sky island" (Carrara et al. 2007; Shafer et al. 2010; Shafer et al. 2011).

The recovery of mountain goat remains in archaeological assemblages of Southeast and central coastal Alaska is not common (Moss 2012:16). However, we suggest that the pre- and protohistoric procurement of mountain goat be considered an infrequent activity that required the investment of individuals in pursuit of a social as well as a subsistence net payoff. The use of mountain goat hides, wool, horn, hooves, meat, and fat in Tsimshian, Squamish, and Tlingit ethnohistoric accounts likely reflects the recovery

Figure 4. Cairn 18, on bedrock with tree line in background. View west. Photo 8/10/13.

Figure 5. Potential stacked rock concealment, Cairn 14. View east. Photo 8/11/13.

of pendants, awls, and bracelet fragments recovered from two prehistoric (AD 200–1300) sites on the southwestern coast of Kaien Island, near the harbor of Prince Rupert, British Columbia (Crockford 2016; Reimer 2003:49–50). While to date rarely recovered in the archaeological record of central Alaska, these types of artifacts may be manifestations of the prized procurement of mountain goat, obtained either by resident hunters or through trade.[6]

Although mountain goat and sheep were highly valued targets of small hunting parties, an opportunistic strategy was likely employed, especially given the costs of getting into the high country. While alpine resource patches in the Northwest can be a seasonal setting in which indigenous procurement activities and resultant archaeological sites are known, the cost-benefit ratio of foraging in distant high-country environments likely required substantial planning and investment (Mierendorf and Baldwin 2015:100).

Acquisition of mountain goat would likely indicate the quality of an individual's skill or that of a small group of hunters acting cooperatively, where all might obtain credit, albeit differentially, in procurement success. As aptly stated by Henrich and Gil-White (2001:178), "hunting returns are hard to fake—and if they bring prestige, they will be advertised," especially by males (see Huberman et al. 2004). The pursuit of prestige and status is considered to be an increasingly valued investment as a population grows and its social fabric becomes more complex (Plourde 2008, 2010). Among the Salish, for example, hunting mountain goat was considered dangerous and the animals difficult to stalk. A young Salish male could use the pelts of mountain goat as a tribute to the family of a woman he desired to marry (Reimer 2003:49–50).[7] The wool of mountain goat necessary for quality Chilkat blankets, required as regalia by chiefs, was best acquired in the fall, potentially increasing the effort and risk in high-altitude hunting excursions (Crockford 2016).[8] The costs of time and energy in acquiring and transporting mountain goat or other game animals in the high alpine environments may have exceeded the caloric and protein return.[9] If so, the social value of success in hunting in these biophysical conditions is not to be discounted; for whatever the actual or perceived benefit might be to individuals pursuing mountain goat and other difficult-to-acquire animals, the activity was likely grounded in the collective norms of the group (Verhagen and Whitley 2012:87).

MODELING ACCESS AND ACTIVITY

As viewed within the contemporary landscape, linking pre- and protohistoric hunting activities with rock cairns constructed over the course of several hundred years is highly conjectural. Nevertheless, scenarios can be created that focus on the possible pre- and protohistoric activity with contemporary topography, landscape, and cairn placement on Baranof Island. Here, we explore spatial relationships between landscape features and existing cairn locations in the context of cooperative hunting. This modeling is to be construed as one of pursuing previously unperceived patterns within the cultural topography of the study area, not of answering archaeological questions (cf. Aldenderfer and Maschner 1996). When constructing associations in space, we endorse an analytical geographer's tenet that spatial "patterns are only abstractions, because time never stops . . . there are only processes" (Taylor 1977:134; cf. Turner 1989). We have no illusion that exploratory spatial analyses will, with accuracy, explain the human and biophysical processes that result in the static archaeological record. Modeling can, however, provide input for speculative interpretations of the behavioral processes that underlie contemporary observations on the landscape of northern Baranof Island.

ACCESS AND PROXIMITY

It is assumed here that pre- and protohistoric hunting in the alpine landscape was conducted with bow and arrow, given its accuracy and effectiveness relative to other projectile technology (e.g., atlatl) (Bettinger 2013; Whittaker 2013; cf. Grund 2017). The effective range of this weapon technology is variable but generally considered within the range of 11–20 m. The cooperative activity of a small group of individuals pursuing large game that herd or can be somewhat densely packed could permit one or more arrows to be aimed at the cluster, where an arrow had a good chance of impacting at least one among a group of ungulates. Mountain goat and to some extent Sitka deer, however, would likely be either singular targets or not normally in proximity to others.[10] Relying on ethnographic and historic information, an optimum shooting range of 18 m is used in previous archaeological modeling analyses (Benedict 2005:428; Blehr 1990:306–307; Dalton 2011:50–53; Labelle and Pelton 2013:59; Whittaker

2013:106). In this analysis, we assume a similar estimated maximum effective range (18 m) in an attempt to create a unit of measure that might reflect the advantages of cooperative hunting by a small group of skilled and technologically equipped hunters. Creating proximity to a target is, without question, a variable important to success in the hunting of game, especially on a treeless landscape. We suggest that the utility of a single rock cairn for concealment is not as effective in cooperative hunting as multiple stone constructions distributed strategically on the landscape. And several dispersed piles of stone might be less visually threatening to ungulates; mountain goats, especially, are very sensitive to human disturbance in a treeless landscape (Festa-Bianchet and Côté 2008:22).[11]

Using Reimer's (2003) hunting party estimate of three to four individuals, we delineated a minimum of two cairns that were in proximity to each other, permitting a potential target success within a maximum 36 m radius. This area surrounding sets of two or more cairns represents an estimate of the space within which two or more hunters might, at a minimum, severely wound a mountain goat or, potentially, other large game animal. We borrow the term "shooting coverts" (SC) as a descriptor for these sets of rock features with reference to that used by Grønnow et al. (1983:45) in discussions of caribou hunting in west Greenland.[12] Assuming the 18 m effective bow range, the "buffer" analysis tool in ArcGIS was used to create a spatial unit that encompasses an 18 m distance from each cairn location.[13] Cairns with overlapping buffers were grouped together to create 15 shooting coverts (Fig. 6) (Table 2). The mean distance from each SC group to modeled escape terrain for mountain goat is approximately 33 m (Fig. 7). A total of nine cairns were outliers, that is, those not spatially associated with the SC groups based on the overlapping buffers. These seemingly isolated cairns are not unusual in rugged landscapes where an accumulation of stacked rock features used in ambush hunting is observed. Those cairns not in proximity to the designated SC groupings are considered the likely remnants of larger or more complexly integrated sets of cairns (e.g., Schalk et al. 2013).

Research on food resource procurement in prehistory has focused primarily on an assessment of the caloric return (kcal) in the transport of a given resource to a site of processing and consumption (Brannan 1992; Jones and Madsen 1989; Rhode 1990). While no material evidence of butchering in the study area is documented, we assume that successful hunting in the alpine study area required field processing and transport to a coastal camp or residential site.[14] Least-cost-path analysis was conducted to determine the location of potential routes from each SC group to the coast (Fig. 8). Results of this analysis create a representation of the routes of possible access to and from

Table 2. Environmental variables compiled for each shooting covert.

Shooting Covert	Aspect (°)	Slope (°)	Elevation (m)	Effective Slope	Distance to Escape Terrain (m)	Path Length (m)	Path Avg Slope (°)
A	298	22	617	23	26	2403	30
B	278	35	613	40	0	1581	43
C	289	22	669	23	51	2532	28
D	290	15	718	16	81	3279	23
E	303	23	698	24	19	2600	29
F	270	23	746	24	8	3189	25
G	292	30	742	33	9	3287	24
H	286	29	771	31	6	3415	24
I	296	17	776	17	74	3475	24
J	268	18	788	18	144	3415	25
K	345	12	801	12	45	3579	24
L	278	27	833	29	6	3903	23
M	305	26	746	28	6	2290	36
N	329	28	858	30	10	2782	34
O	56	25	862	27	9	2832	33

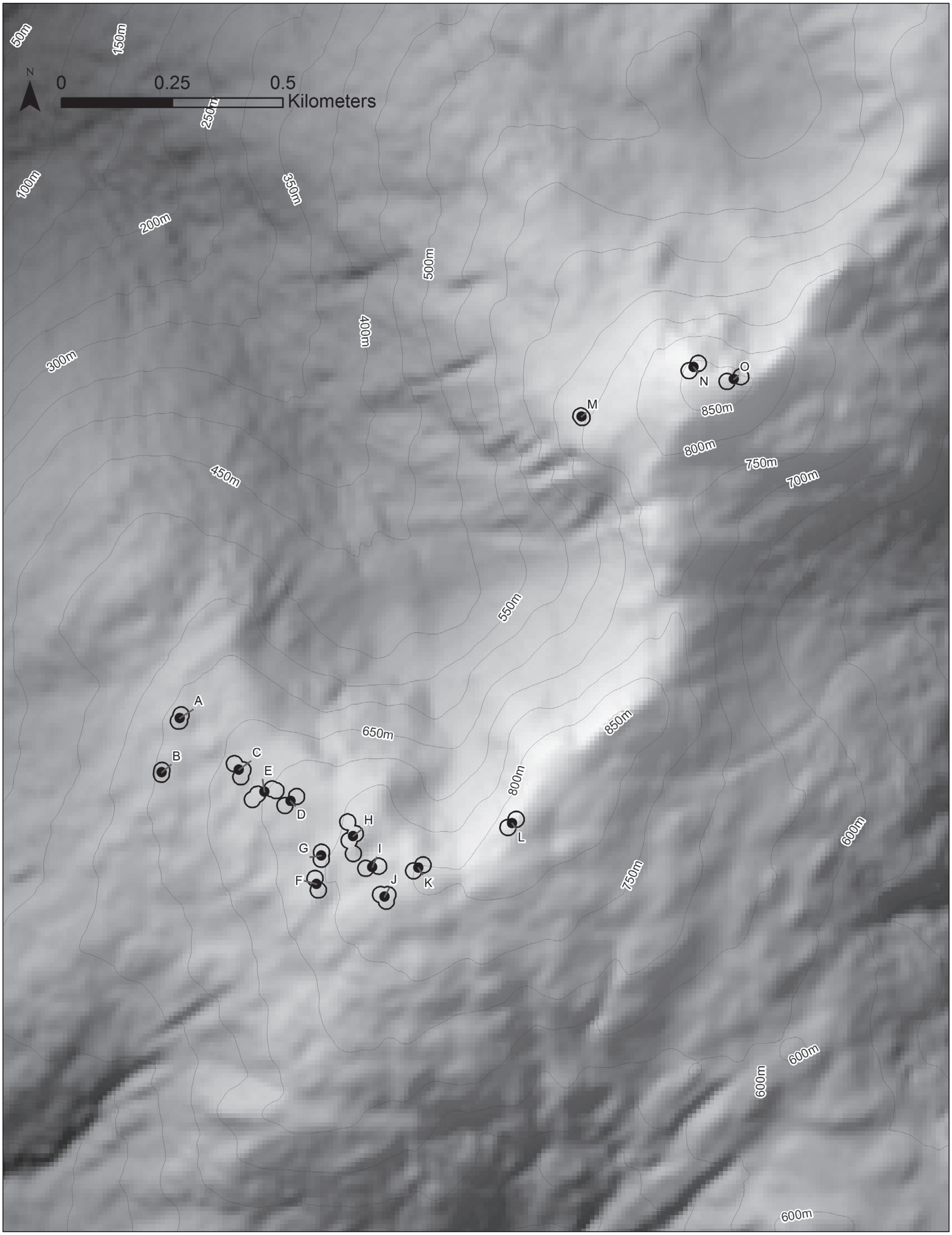

Figure 6. Cairn shooting coverts shown with overlapping 18 m buffers.

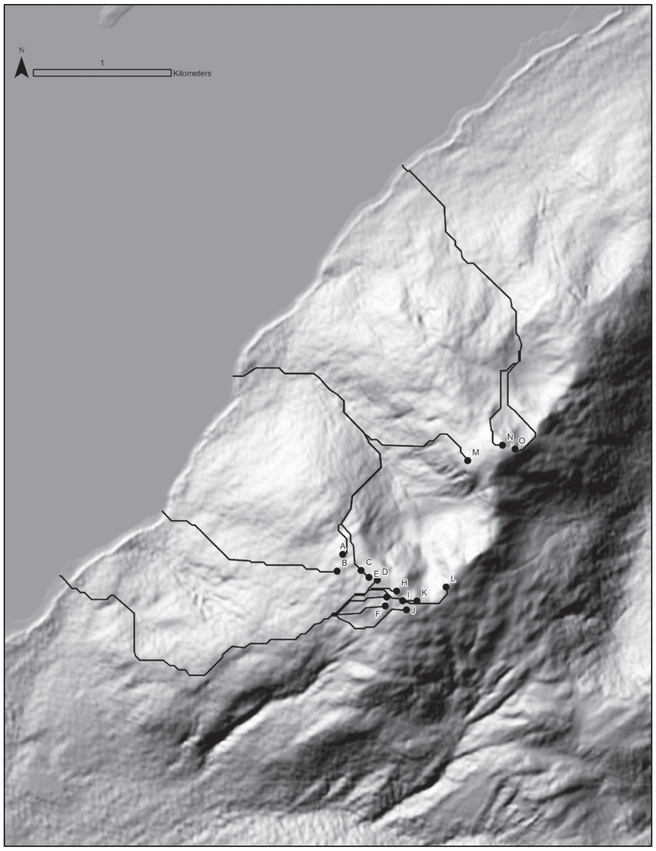

Figure 7. Cairn shooting coverts and terrain-based least-cost-paths.

the mountain within a set of predetermined travel costs.[15] These routes, as a proxy for accessibility, are here acknowledged to be that of idealized models of pedestrian travel, and therefore are not made to reflect an almost infinite array of cost-benefit decisions encountered by individuals in prehistory (cf. Branting 2012). This attempt at creating a means of visualizing potential routes of access to and from the alpine cairns is one where the minimal expenditure of caloric effort, as a means of human energy cost, is assumed.[16] With this scenario we are presuming (1) the act of field dressing on the mountain only, and (2), given the coastal archaeological record reported by Reimer (2003) and Crockford (2016), that all or much of the animal was consumed and/or found useful.

DISCUSSION

It has been well argued that archaeologists oftentimes are influenced by a phenomenological perspective whereby issues of "meaning" and "subjectivity" are embraced in the pursuit of an understanding of the role of modified landscapes within identity "formation and negotiation" (Johnson 2012). With interest in how humans experienced, assigned meaning to, and communicated the history of a changing landscape, it is often worth acknowledging that "myth does not mean something untrue, but a concentration of truth" (Lessing 1992:35).

Exploring the construction, placement, and potentially varied use of cairns on the islands of Baranof, Chichagof, and the immediate vicinity is not to be confused with creating another overinterpretation of the archaeological record. In social science, replacing speculation with observation, both experiential and analytically quantitative, should be a goal with which to continually confront Gibbon's (2014:27) truism in archaeological research that "much of what we think we know remains uncertain." It is clear that with regard to these cairns, we do not "know." Nevertheless, given our brief discussion of activities in alpine environments, ethnohistoric and ethnographic tradition, and experiential accounts, we pose, as an axiom from which isolated hypotheses may be deduced, that pre-and protohistoric activities in the alpine settings of Baranof and Chichagof islands and mountains adjacent to portions of Peril Strait were focused on procurement of highly valued resources. The construction and placement of rock cairns used during at least some of these activities proliferated and, to an extent, were created and re-created through generations to be signified as markers of land use, sociocultural identity, and perseverance in the face of relatively rapid biophysical and social change.

Anthropological archaeologists are becoming increasingly aware that the "incompleteness and complexity of information derived in archaeological contexts is not in itself sufficient to . . . [solve] . . . significant problems about the human past"; the problem being the ongoing struggle to understand what conditioned past sociological dynamics (Van der Leeuw and Redman 2002:603–604). The extent to which the cairns may have played a role in a portion of past social dynamics in this area is acknowledged to be heavily influenced by perception, such that others seeing the same modified landscape may not share the same observations (Golledge and Stimson 1997:400–405; Kosso 1991:625; McGlade 1995:113). We contend that perspectives on the potential past utility of the cairns and their contemporary sociocultural significance do not negate each other. Both are grounded in social behavior drawing on identity maintenance, the

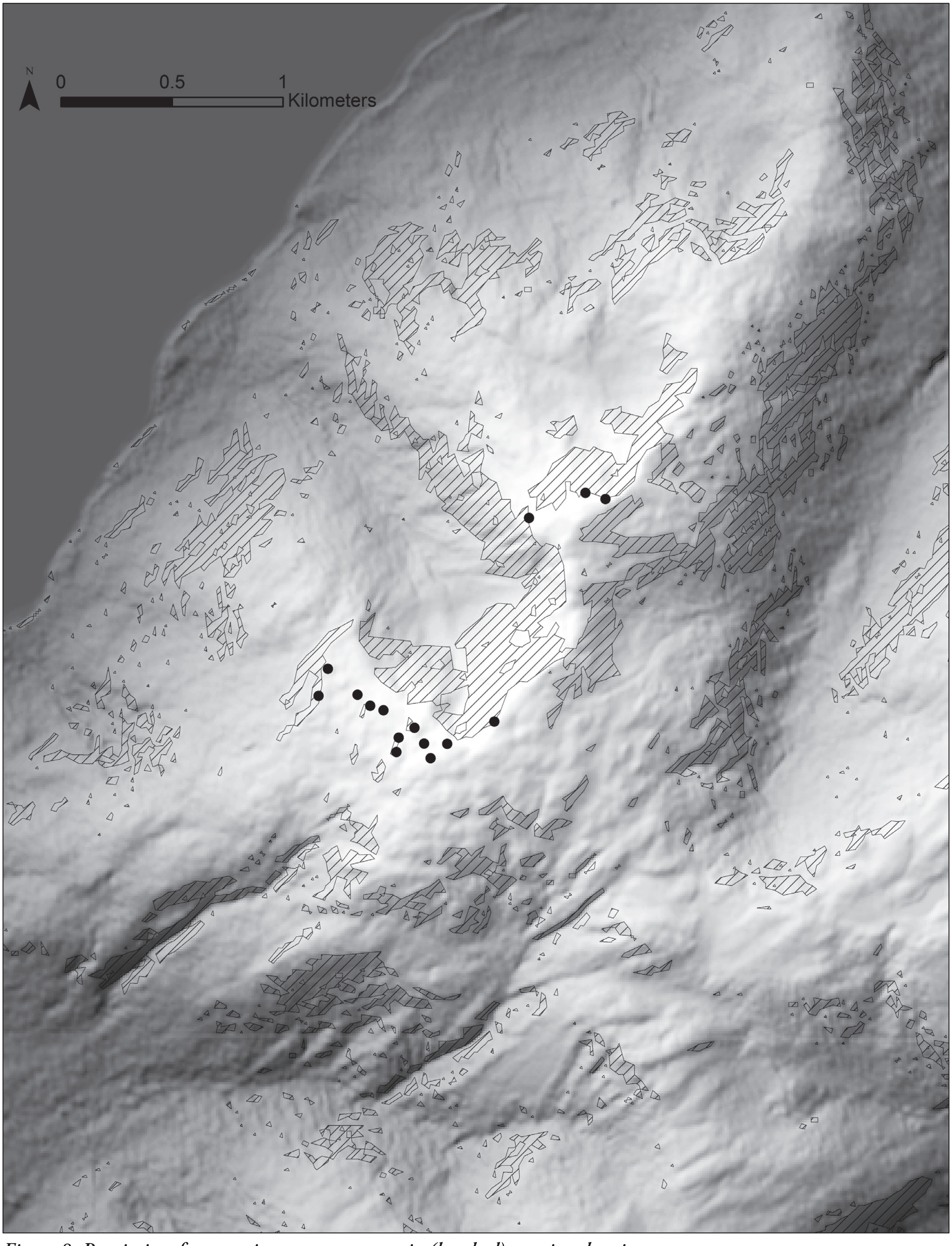

Figure 8. Proximity of mountain goat escape terrain (hatched) to cairn shooting coverts.

pursuit of status, the value of cohesiveness in the face of competition, and perseverance within a dominant society—all of which permeate, in various degrees of intensity, the far distant and historic reality of most North American indigenous groups.

ACKNOWLEDGEMENTS

Fieldwork associated with this research was supported by the National Science Foundation, Arctic Social Sciences Program, Division of Polar Programs, #1230132. We are also grateful to Tongass National Forest, Sitka Tribe of Alaska, and the Angoon Community Association—Kootznoowoo Tlingit for their permission and cooperation in pursuit of this research. Versions of this paper were presented at the Ninth International Congress of Arctic Social Sciences, June 2017, Umeå, Sweden, and the 83rd Annual Meeting of the Society for American Archaeology, April 2018, Washington, DC.

NOTES

1. Thornton (2008:44–56) describes a *kwáan*, derived from the Tlingit term "to dwell," as those members inhabiting a particular place, especially a winter village, with the absence of any organized sociopolitical structure.
2. The term *home range* is used here to refer to the area habitually exploited by a group of individuals, whereas the term *territoriality* is used in contemporary social and biological science with reference to an area exclusively used and defended by an individual or small group (Mitani and Rodman 1979). In the Barkley Sound area of western Vancouver Island, for example, ethnohistorical and archaeological information suggests a socioeconomically complex collector strategy where local groups had control over small "social defined territories," yet had limited access to resources outside that loosely defended area, constrained only by the activities of other communities (McMillan et al. 2008:221).
3. Hunting in unglaciated refugia during the late Pleistocene has been suggested (e.g., Schalk et al. 2007; see also McMillan and McKechnie 2015:12), while material evidence of more recent precontact use of alpine and subalpine environments has fostered consideration of hunting and other procurement activities that transcend short-term subsistence needs. Prehistoric use of alpine and subalpine zones in the northern Cascade mountain range of British Columbia and Washington, for example, is believed to reflect increasing population and overlapping home ranges of separate groups (Mierendorf 1999, 2003).
4. Constructing or altering these loose rock features was unlikely to be energetically costly, assuming temperate weather conditions and individuals of uncompromised strength and endurance. For example, approximately 900 calories per person was required to construct loose rock, low (<1 m) fences in the Great Basin where the largest rock could exceed 30 cm in diameter (Hocket et al. 2013:70). Building on and around the loose fractured bedrock and possibly moving large rocks slightly permitted enhancing the concealment opportunities of the natural topography familiar to the mountain goat.
5. White (2006:190), however, emphasizes that mountain goat overwintering strategies likely vary with altitude over small spatial scales in Southeast and central Alaska.
6. The mortality of mountain goat due to malnutrition, nonhuman predators, avalanche, and cliff falls suggests that scavenging by humans encountering a mountain goat was possible (White et al. 2011). Competition from a broad array of other animals, as well as ravens and bald eagles, however, suggests that productive scavenging by humans, even for random faunal material, was likely rare.
7. The presence of males only as constituting these hunting parties is an assumption that rests primarily on ethnohistorically grounded scenarios. The role of women in the active procurement of game animals, especially in the subarctic prehistoric past, let alone butchering, processing, distribution, and storage, is only beginning to be assessed in the northern latitudes (Brumbach and Jarvenpa 2006; Jarvenpa and Brumbach 1995, 2015).
8. The collection of highly valued wool from shedding mountain goats in the brush "above timber line" during the spring and summer is also well documented (e.g., Willoughby 1910:6; see also Johnson 2013:137).
9. Other fauna that may have been encountered during the warm season in the alpine zones are Sitka black-tailed deer (*Odocoileus hemionus sitkensis*), ptarmigan (*Lagopus lecurus*), ground squirrel, and marmot

(cf. Greer and Strand 2012:144; VanderHoek et al. 2007).

10. Based on field data for the Rocky Mountain range of central Colorado, we use a mountain goat group size ranging from approximately five in the warm season to eight in the winter, preferring windswept slopes with minimal snow accumulation (Gross et al. 2002).
11. Mountain goat habitat is generally described as southerly facing moderate slopes at midelevations with nearby terrain that allows for effective escape from predators. Escape terrain is generally defined as greater than 33-degree slope.
12. This fine-grained grouping of individual cairns is obviously that which can be intuited currently. Given the disturbance and construction of at least one of the observed rock features to create what appears to be a U-shaped hunting blind, we can assume that during the course of generations of activity in this setting cairns were vulnerable to having been deconstructed, rebuilt, and/or relocated, not unlike that of circles of stone commonly referred to as "tipi rings" in the high altitudes of the Rocky Mountains and northern plains (Hartley and Vawser 2007), "shooting coverts" in west Greenland (Grønnow et al. 1983:45), and *inuksuit* drive lines in the central Canadian Arctic (Friesen 2013).
13. Basic environmental information was obtained from a 10 m resolution digital elevation model (DEM), downloaded from the United States Department of Agriculture, Natural Resources Conservation Service Geospatial Data Gateway (USDA, November 2016). Aspect and slope raster layers were derived from the DEM using the aspect and slope spatial analyst tools in ArcGIS 10.4. We used the extract-to-points spatial analyst tool to obtain these values for each group. For cairns that fell outside our SC groupings, we used the Euclidian distance spatial analyst tool to determine the distance of each outlier from the nearest SC group.
14. Contemporary estimates by the Alaska Department of Fish and Game indicate that an average field-dressed weight of 113 kg mountain goat is 68 kg, 39 kg of which is usable meat. Adult males can be 40–60% larger than females, especially after five years of age (White 2006). Contemporary regulated hunting of mountain goat on Baranof Island has been ongoing since 1949 (Shafer et al. 2011:1266).
15. Least-cost-path analysis using the ArcGIS 10.4 spatial analyst tool set was conducted to determine the location of potential routes from the coast to each SC group. Results of this analysis create a representation of the routes of possible access to a given location on the mountain within a set of predetermined travel costs. With this procedure a cost surface layer was established, each cell within the layer representing the cost of movement over that cell. Degree of slope is most commonly used as a cost surface. However, effective slope, as recommended by Bell and Lock (2000:88), is used here to reflect the cost of movement. For example, a virtually impossible-to-traverse 80-degree slope would have an effective slope of 333 versus a challenging 55-degree slope yielding an effective slope value of 84. The effective slope for each raster cell is calculated as the ratio of the tangent of the slope angle to the tangent of the flat surface (or 1-degree slope): {tan(slope)/tan(1)}. This equation is designed to represent "the change in potential energy after ascending a slope" with potential energy defined as mass × gravity × height, where "mass" is equal to the traveler weight and "height" is the angle of slope (Bell and Lock 2000:88). The equation is then reduced to height ratios, as the weight of the traveler and gravity are both constants. Using the Path Distance tool, a cost distance raster was then calculated based on the cost surface layer and the DEM. The DEM was used to determine the actual surface distance traveled from one cell to the next. Finally, the least-cost paths were created using the Cost Path tool.
16. Estimates of energetic costs of pedestrian travel are notoriously complex given the number of interacting variables operating in human locomotion, namely body mass, gender, velocity, burden weight, gradient, and terrain. Furthermore, these measurable variables do not include factors of individual behavior and communication within small group movement, versus that of hiking an ascent or descent alone, both of which have significant effects on energy expenditure (Branting 2012:219). It is important to acknowledge also the negative gradient and terrain conditions in formulating models of pedestrian movement in the coastal mountains. While gravity contributes to movement down the mountain, grades >8% increase energy costs regardless of a burden. Wood and Wood (2006), for exam-

ple, point out that least-cost-paths, in general and while up to 3% longer, offer an 11–24% energetic cost (kcal) savings compared to that of a shortest path in the Sierra Nevada Mountains of northern California. With transport of all or a portion of a 68 kg carcass, those costs increase dramatically, especially with the steepness of the slope, independent of terrain conditions. While human physiologists have yet to establish an empirical equation appropriate for a mountain setting that estimates energy expenditure in steep downhill transport with a defined burden, it is known that the weight of the load, in proportion to the human body mass, is one of many key variables in the energy cost of a downhill trip (Bastien et al. 2005; Kramer 2010). This issue is further complicated by how a load is carried, where dependence on the arm as opposed to being carried on the trunk of a body (e.g., backpack) increases the metabolic cost.

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