

Research, part of a Special Feature on [Crossing Scales and Disciplines to Achieve Forest Sustainability](#)
**Factors Contributing to the Cultural and Spatial Variability of Landscape
Burning by Native Peoples of Interior Alaska**

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ABSTRACT. Although wildfire has been central to the ecological dynamics of Interior Alaska for 5000 yr, the role of humans in this dynamic is not well known. As a multidisciplinary research team, together with native community partners, we analyzed patterns of human-fire interaction in two contiguous areas of Interior Alaska occupied by different Athabaskan groups. The Koyukon in the western Interior considered fire a destructive force and had no recollection or oral history of using fire for landscape management. Low lightning-strike density and moist climate constrained the effects of lightning fires, and a subsistence dependence on salmon, a relatively predictable resource, resulted in a trilocality residency pattern. In this environment the occurrence of wildfire would have negatively impacted territorial use and the exploitation of wildlife resources. In contrast, the Gwich'in of the eastern Interior actively used fires to manage the landscape. The Gwich'in territory experienced a higher lightning-strike density and a corresponding increase in wildfire activity. The Gwich'in showed greater mobility in hunting moose and caribou, their less spatially predictable subsistence resources, which enabled them to avoid and/or target a range of habitats affected by wildfires. The contrasts between these two neighboring Athabaskan groups indicate different uses and views of wildfire that are derived from their cultural adaptation to local biophysical and ecological settings. These findings call into question the commonly held view that native peoples of North America pervasively and near universally modified landscapes through the use of fire.

Key Words: *Alaska; Gwich'in; human-fire interaction; indigenous Koyukon; land management; landscape burning.*

INTRODUCTION

Debates continue over the extent to which native peoples of North America used fire to modify the landscape prior to European contact. Some argue that nearly all of North America was significantly altered by native people's use of landscape burning, resulting in virtually no area untouched by human influence (e.g., Stewart 1954, Pyne 1982, Denevan 1992). Lewis (1980, 1988) noted the near universality of landscape burning by all known populations of North American Indians. This, in effect, influenced the historical ecology of almost every habitat in North America (Lewis and Anderson 2002). Taking a more tempered stance, Snyder (1998) acknowledged the widespread practice of landscape burning by native peoples but

suggests that there were likely some areas of North America free of native influence, even if some native peoples managed other parts of the environment quite intensively. Baisan and Swetnam (1997) similarly suggest that across North America there existed both 'natural' and "humanized" landscapes; a view consistent with Baker's (2002) "varying significance model" that describes the North American landscape as a mosaic with some areas modified by native burning and others not affected at all. Despite the evidence that native peoples in both the continental United States and Canada routinely used fire to modify the land, others argue that the pre-Columbian landscape of North America was shaped predominantly by climate and vegetation with no measurable human influence (e.g., Viereck 1973, Kasischke and Stocks 2000).

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Given the fragmentary nature of evidence, derived in large part from a brief historical period, it remains unclear as to the actual impact that native burning may have had in shaping the natural environment of North America. However, Anderson (2005) suggests that if the debate over native burning is ever to be resolved, more intensive multidisciplinary studies that examine the burning patterns of North America's native peoples are required. These studies should necessarily involve social and natural scientists who together undertake regional studies to define the geographical boundaries of the native populations that practiced landscape burning at the time of European contact. These regional studies could then serve as the starting point for a more critical evaluation of the actual role that native peoples may have had in shaping North America's biotic and physical environments.

It is in this context that a regional analysis for Interior Alaska was conducted. Involving a multidisciplinary research team, together with native community partners, our approach involved analyzing patterns of human-fire interaction over time and then stratifying the predominant anthropogenic influences during those periods. As part of this process we examined the extent to which native peoples of Interior Alaska used fire to modify the boreal landscape. Involving the Gwich'in and Koyukon of Alaska, two neighboring Athabaskan groups sharing a contiguous boundary, we examined whether or not landscape burning was used historically as a cultural practice. We then identified the factors, both social and ecological, that may have contributed to the adoption of fire as a landscape management tool. The results of this research provide important new insight on the cultural and spatial variability of landscape burning by native peoples of Interior Alaska. Our results are also theoretically useful for furthering our understanding of how native peoples of Alaska adapted to the northern boreal environment. From a more pragmatic perspective it is hoped that the results of this analysis will be useful to state, federal and native land managers who are being increasingly called upon to return areas of the boreal forest to a pre-European condition.

METHODS

Essential components of our research, particularly given the sensitivities associated landscape burning, were trust, flexibility, personal relationships, and committing the necessary time to achieve all of the above. Our research questions were explored through a multimethod, multiphase approach. The research was initiated with a literature and archival review of historical materials relating to native burning at the time of European contact. This involved a review of government documents, letters, diaries, photographs, autobiographies, maps, technical reports, transcribed interviews, and published and unpublished manuscripts. Early editions of local Alaska newspapers (e.g., Ruby Record-Citizen) were also reviewed for potential references to native burning. Together these sources offered firsthand accounts from explorers, government agents, missionaries, and miners who had observed native burning in Alaska's interior.

Interviews were conducted in the Gwich'in community of Birch Cree Village and the Koyukon community of Huslia. Interviews in Birch Cree Village were conducted in 1996 as part of a preceding study that addressed changes in Alaska fire policy and associated impacts on native land use and subsistence harvesting (Natcher 2004). In total, 15 community members were interviewed. This sample represents approximately half of the total population of Birch Cree Village; the total population is made up of 34 residents. Huslia interviews were conducted by several members of our research team and occurred at scheduled and agreed upon times as well as opportunistically over the course of the 3-yr study (2003-2006). Using semidirected and open-ended questioning techniques, interviews in both Birch Cree Village and Huslia took the form of free-flow, but directed conversations. In general, our questions addressed whether landscape burning was a practice used by the Gwich'in or Koyukon, information relating to the frequency and seasonality of burning, location at which burning may have occurred, and reasons for using fire as a management tool, i.e., habitat enhancement, travel, and fuel reduction. If community members had no knowledge of fire being used to modify the land, our interviews then explored possible scenarios of why landscape burning was not practiced. Although speculative, these insights nonetheless allowed local interpretations

Table 1. Athabaskan groups and estimated population at contact (Langdon 1992).

Group	Location	Population
<i>Riverine</i>		
Koyukon	Middle Yukon and Koyukuk Rivers	2000
Deghitan	Lower Yukon and Kuskokwim Rivers	1500
Holikachuk	Lower Middle Yukon and Innoko Rivers	500
Tanana	Lower Tanana River	500
Tanacross	Middle Tanana River	300
<i>Upland</i>		
Gwich'in	Upper Yukon and Porcupine Rivers	1500
Han	Upper Yukon River	300
Upper Tanana	Upper Tanana River	200
Upper Kuskokwim	Upper Kuskokwim River	200
<i>Pacific</i>		
Atna'	Copper River	1000
Dena'ina	Cook Inlet, Susitna, and Upper Kuskokwim Rivers	3000
<i>Total</i>		11,000

to be introduced by those who are most familiar with their own cultural history and who are intimately aware of landscape characteristics.

Three community workshops were also held in Huslia (see <http://www.ecologyandsociety.org/vol11/iss1/art40/>). The primary objectives of the workshops were to engage community elders and other knowledgeable residents about wildfire, document traditional ecological knowledge about the effects of wildfire on ecosystem services, and to gain insight on contemporary attitudes about wildfire policy in Alaska. During these discussions, the issue of landscape burning was also introduced. Community members then had the opportunity to share what they new about fire's intentional use and whether it was a part of the cultural repertoire of the Koyukon people. It should also be noted that because two Huslia residents, O. Huntington and

DeWilde, were also members of the research team, our research design benefited tremendously from their emic perspective. Their involvement also allowed numerous informal discussions to occur about what they had learned from their elders about wildfire and its historical use.

In addition to the above we also compared topographic information, average monthly air temperature, and precipitation records from 1901 to 1930 for the Koyukon and Gwich'in territories. Territory outlines (Fig. 1) were derived from *native Peoples and Languages of Alaska* base map developed by Krauss (1982). The average monthly climate values for half-degree grid cells from the Climatic Research Unit dataset were calculated (New et al. 2000) and resampled to 1-km resolution using a cubic resampling algorithm.

Fig. 1. Native peoples and languages of Alaska (Krauss 1982).



RESULTS

Within Alaska there are nine distinct Athabaskan groups (see Table 1). Occupying Alaska's eastern interior region are the Gwich'in who comprise nine subregional bands, they include: the Arctic Red River, Peel River, Upper Porcupine River, Crow River, Black River, Chandalar River, Yukon Flats, Dihai, and the Birch Creek Gwich'in (Slobodin 1981). The Gwich'in territory extends eastward from the community of Beaver to Canada's Mackenzie River valley and north to the community of Inuvik. Prior to the 19th century, the Gwich'in occupied most if not all of the southern slopes of the Brooks Range. However, as a result of early 19th century conflict with the Inupiaq, the Gwich'in territory shifted eastward to its present location (Gubser 1965). At the time of European contact (1800–1870) the Gwich'in population was

estimated to be approximately 1500 (Langdon 1992).

Based on our review of archival and historical accounts, together with the results of Birch Creek Village interviews, several historical uses for landscape burning among the Gwich'in were revealed. In reference to hunting, Masson (1889:77-78) noted that fires would be used by the Gwich'in to clear the underbrush of the forest and to aid in locating and pursuing game:

The banks on both sides are high and barren, which is supposed to be occasioned by the great fires made in the spring season by the inhabitants to clear the country of underwood, in order to enjoy more ease in hunting.

Fire was also used to influence the movement of moose during fall hunts:

There were many fir trees standing by themselves whose lower branches were dead, and these when touched with a match would burn and quickly snap almost like firecrackers. The flames would then rapidly shoot to the tops of the trees, making a brilliant fire accompanied by a dense smoke. There was no danger of a forest fire, as the trees that were fired were always old trees and were for the most part dead at the bottom, and then nearly always stood alone. The crackling of the lower branches could be heard from afar, and the scent of the burning wood would soon be caught by the sensitive nostrils of any moose that might be in the vicinity (Martindale 1913:62).

Bales (1904:264-265) also reported that the Gwich'in would use fire to kill standing timber in order to create caribou fencing:

Every few years the natives fire this timber, which usually stands on damp, moss-covered ground and is only deadened by the fires. It does not rot quickly and is very strong and runs from twenty to thirty feet long. These dead trees are easily pulled up or pushed over after being killed as they are not deep rooted.

During his time in the Upper Yukon River area, Harry deWidt (1904:230) noted that the Indians of this region would use fire to keep travel lanes open as they moved about the country. A related practice was the setting of trees ablaze for the purpose of signaling one's presence to others, as noted by Osgood (1936:103):

The use of smoke signals adds to our knowledge of the Kutchin [Gwich'in]. When a party splits on a hunting trip, a successful member may make a smoke signal. To do this he chooses a hill with a brushy green spruce tree on it, which he burns without cutting it down. Also a person looking for someone may do the same thing to indicate his presence.

Using fire to create dry fuel wood and combating insects were other uses reportedly used by the Gwich'in. For example Petitot (1876:43) reported

that the Indians do not hesitate in firing the forest to provide a source of dry wood. The fact that the fire might ravage the forest over a distance of several miles was not, according to Petitot, a matter to any concern.

In reference to insect defense, Schwatka (1885:114-115) found:

Evidences of conflagration in the dense coniferous forests were everywhere frequent and the Indians were credited with deliberately starting fires...with the idea of clearing the district of mosquitoes.

Brooks (1911:206) also noted that:

Large quantities [of forest] are annually destroyed by fire, for which the natives must largely be held responsible. It seems probable that they deliberately burn over large tracts in order to somewhat reduce the insect pest. That this indifference to forest fires was not learned of the white man is shown by the fact that many tracts are found which must have burned over long before the appearance of any foreigner.

Reports on the use of fire to combat insects, as well as attributing the escapement of large fires to the carelessness of the Gwich'in, should be read with considerable caution. Although Birch Creek residents acknowledge that the use of fire by their ancestors may have at times resulted in unanticipated effects, they object to reports that characterize their ancestors as being indifferent to the effects of fire. They also object to suggestions that the Gwich'in would set fire to the forest simply to escape insect pests. Birch Creek residents were quick to note that it was more likely the 'white' explorers and government agents who were frustrated by mosquitoes and other biting insects and not the Gwich'in who were quite comfortable in the bush and well accustomed to the boreal environment. Aware of the challenges and uncertainties associated with securing subsistence resources, residents of Birch Creek staunchly reject any notion that their ancestors would use fire negligently if it were to mean the potential loss and destruction of valued resources. Living in an environment characterized largely by resource scarcity and variability, the Gwich'in have adapted successfully to the boreal environment for

thousands of years (Vanstone 1974). Given the constant uncertainties associated with living in the northern boreal forest, it is unlikely that the Gwich'in would use fire in a way that would further challenge their own survival.

Offering an explanation for the interpretations of early explorers, residents of Birch Creek recalled that there were times when their ancestors would allow campfires to burn after camps were broken; specifically following fall moose hunts. When conditions fostered the spread of fire, Gwich'in hunters would generally welcome the ecological changes brought about by disturbance (Natcher 2004). Some of the benefits associated with these post-burn landscapes would have included the growth of new grass, herbs, and shrubs that would attract small mammals and furbearing species, increase browse production for moose, and the growth of plant and berry species that would be used by the Gwich'in for nutritional and medicinal purposes. These post-burn landscapes would then serve as important resource sites until landscape productivity began to decline with forest succession. Birch Creek residents also made it clear that such uses of fire would not have occurred in dry years or in locations at which the spread of wildfire could threaten other important resource areas or the safety of others. Rather, fires would only have been allowed to burn in seasons of high precipitation or when frost conditions would deter an extensive spread of wildfire. Used in this way, these relatively small fires would actually reduce the threat of larger and more destructive wildfires by diversifying the landscape and by reducing the regional fuel load of the forest. These factors, unrecognized by Europeans newcomers, all figured into the historical use of landscape burning by the Gwich'in. Thus, what may appear to have been the carelessness and negligence on the part of the Gwich'in was in reality an indication of a highly sophisticated understanding of fire when used strategically on the land (Natcher 2004). Based on historic and contemporary accounts it now seems clear that the effects of fire were well understood by the Gwich'in and the prescribed use of fire represented an important strategy used by the Gwich'in to enhance the productivity of their territorial lands.

Directly west of the Gwich'in are the Koyukon Athabaskans. Representing the most northwesterly group of Athabaskans in Alaska, the Koyukon inhabit a region adjacent to the Lower and Middle

Yukon River, extending along the Koyukuk River as far north as the south slope of the Brooks Range. The Koyukon have generally been divided into three major divisions: (1) the Middle Yukon, which includes the Koyukon living along the Yukon River from Steven's Village down river to Koyukuk located just below the mouth of the Koyukuk River; (2) the Lower Yukon, which includes the Koyukon along the Yukon River from Nalato to the Blackburn Creek, including the Koyukon in the Kaiyuh Slough-Khotol River region; and (3) the Koyukon living along the Koyukuk River and its tributaries (Clark 1981). At the time of European contact (1800–1870) it is estimated that the Koyukon had an approximate population of 2000 (Langdon 1992).

From the accounts of Huslia residents, ethnographic sources, and archival records it appears that the Koyukon did not use fire historically to modify the landscape. In fact, fire was considered a force to be avoided. Rather than being valued for its creative attributes, the Koyukon chose to do without what they regarded as being fundamentally destructive. In fact, what the Koyukon feared most was the barren land that would be left for years following a wildfire, particularly when wildfires occurred near settlements or important resource sites (Nelson 1983). These same concerns continue to be held by many Huslia residents today.

That is not to say that the Koyukon did not use fire in other ways. For example, aside from obvious uses such as for heating and in food preparation, the ashes of fire would be used to conceal the scent of underground food caches. By sprinkling a layer of ash over top of the cache, small mammals and insects would leave underground food stores undisturbed. Ash from fire also had spiritual connotations. By spreading ash around places of residence, misfortune could sometimes be avoided. Koyukon hunters also valued the smoke of fire. By basking oneself in the smoke of campfires, hunters could mask their scent from unsuspecting prey. However, in terms of landscape management, no reports could be found regarding fire's intentional use.

DISCUSSION

Despite occupying neighboring territories, and sharing a contiguous boundary, our research has found that only the Gwich'in and not the Koyukon

used fire to modify the landscape. The Koyukon, occupying a similar and adjacent territory chose not to adopt fire as a management tool, and by all accounts viewed wildfire as a destructive force and something to be avoided. This interregional and cross-cultural difference led us to ask what factors might have contributed to the cultural and spatial variability of landscape burning in Alaska's interior region?

Biophysical factors

Exploring this question we first examined possible differences in the biophysical characteristics of the two regions. The Koyukon territory is slightly warmer (Table 2) and moister (Table 3) than the Gwich'in territory. The Koyukon area also shows a larger range in monthly precipitation over its geographic extent, especially in September, that could be the result of the larger variability in elevation compared to the Gwich'in territory. In terms of territorial range, the Koyukon territory is slightly larger than the Gwich'in territory in Alaska with 156,507 km² vs. 108,340 km², respectively. The two territories have similar mean elevations (Table 2). However, the Koyukon territory includes higher mountains whereas maximum elevations in the Gwich'in territory do not exceed 2208 m. Accordingly, the Koyukon territory includes a larger range of very steep slopes that are not found in the Gwich'in territory (Table 4). According to Nelson (1983) it is because of this landscape diversity that the Koyukon never adopted landscape burning as a cultural practice. Because rivers are constantly reshaping the terrain of the Koyukon territory, the natural vegetation along waterways is highly and naturally diversified. For this reason there was little need for the Koyukon to use fire as a means to enrich the environment (Nelson 1983).

Natural disturbance

The Gwich'in territory is in large part covered by boreal forest. Tree cover is absent only periodically and primarily on flooded islands, some lowland areas of the Yukon Flats, and above the tree line (Slobodin 1981). The Koyukon territory is composed of lowland flats with their myriad of bogs, sloughs, and small lakes, as well as adjacent boreal forest and mountainous upland areas. As one goes further north it becomes more arid with a

proportionately greater extent of open taiga (Clark 1981). Dissing and Verbyla (2003) found that during a 14-yr period (1986-1999) lightning-strike density in Alaska's interior is consistently higher in forested areas than in tundra or shrub vegetation zones. Attributed to high sensible heat fluxes that enhance convective activity of air-mass thunderstorms and to the boreal forest biome that exists in a climatic region that sustains the convective activity, the boreal forest experiences the highest density of lightning strikes. In terms of lightning-strike density (LSD), Dissing and Verbyla (2003) determined that the Yukon uplands experienced 5.4 strikes/km² and forested areas of the Yukon Flats received 8.0 strikes/km². This compares to 3.7 strikes/km² in the Koyukuk Flats. Although we cannot say with certainty that the higher ratio of lightning strikes in the Gwich'in territory contributed to the Gwich'in's adoption of landscape burning, Lewis (2002) found that the most intense and elaborate uses of prescribed burning by indigenous peoples occurred in environments most heavily affected by lightning fires. This was done in part to ameliorate the undesirable impacts of natural fires that would result from lightning activity. This argument is similar to that of Folke and his colleagues (1998) who have noted that one way traditional societies have dealt with ecological surprises is to create small disturbances that would forestall much larger perturbations. In this case the Gwich'in may have used fire to nurture forest disturbance, thereby creating conditions that might limit the occurrence and spread of large unpredictable fires. This practice was indirectly referenced to by Birch Creek residents who noted that one of the benefits associated with delayed burns was the resulting diversification of the forested landscape, which offset the detrimental effects of large, naturally occurring wildfires.

Subsistence and settlement patterns

Although occupying adjacent territories, the primary subsistence and settlement patterns of the Gwich'in and Koyukon differed in several significant ways. Among the Koyukon, salmon fishing represented the single most important subsistence activity. Primary species include king (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus kisutch*), and chum (*Oncorhynchus keta*) salmon, as well as other fish species such as whitefish, blackfish, inconnu, grayling, lingcod, and pike. It was not until the 1970s that moose (*Alces alces*)

Table 2. Mean monthly temperature (1901–1930) comparison of Koyukon and Gwich'in territories in Alaska.

Koyukon-Temperature (°C)						Gwich'in-Temperature (°C)					
month	May	Jun	Jul	Aug	Sep	month	May	Jun	Jul	Aug	Sep
mean	3	8	10	8	3	mean	1	7	10	7	2
min	-2	2	4	2	-1	min	-6	0	4	2	-2
max	8	14	16	13	6	max	7	14	15	12	5
stdev	2	4	3	3	2	stdev	3	3	3	3	2

became plentiful throughout the Koyukon region. Until that time, the availability of moose was limited and they were particularly scarce prior to 1900 (Clark 1981). Caribou (*Rangifer tarandus granti*) populations were also subject to extended periods of decline, and were particularly rare in the Koyukon territory at the turn of the 20th century (Clark 1981).

The subsistence patterns of the Koyukon were reflected in their season settlement patterns. Characterized as a tri-local residency pattern, i.e., winter villages, spring camps, and summer fish camps, the Koyukon would make seasonal moves that involved entire families relocating for extended periods (Langdon 1992). Within the Koyukon region were areas that were exploited communally, but other areas were considered private, family-help property. Among the Koyukon, fish camps as well as beaver houses and ponds, muskrat swamps, bear hibernation holes, berry grounds adjacent to fish camps, and some bird hunting areas were considered to be privately held (Clark 1981).

Lacking access to consistent salmon runs, the Gwich'in were most dependent on caribou (*Rangifer*). As well as using other aquatic and terrestrial species, the Gwich'in harvested both barren ground (*Rangifer tarandus granti*) and woodland caribou (*Rangifer tarandus*) species. Pursued in a number of ways, the Gwich'in's main method for hunting caribou was the surround or corral. The use of a surround would produce the largest food supply and easily surpassed the total harvest of salmon (Slobodin 1981). In addition to

caribou, the Gwich'in also harvested moose. Individuals or pairs of related men would generally hunt moose during the early spring. Like the Koyukon, the Gwich'in subsistence patterns were reflected in their social and residential organization. Living in small, two- or three-family camps virtually year-round, the Gwich'in moved regularly to known resource sites on hunting trips (Langdon 1992). This flexible social structure and relative ease of mobility enabled the Gwich'in to adjust their territorial use as necessary in order to take advantage of the most productive resource areas that could be found within their territorial range. In fact, given their dependence on caribou and moose, the mobility of the Gwich'in represents their primary adaptive feature.

The differences between Koyukon and Gwich'in subsistence and settlement patterns likely influenced how each group perceived wildfire. The Koyukon, who depended largely on the annual return of salmon, enjoyed a relatively consistent and somewhat predictable resource base. The restricted mobility pattern that emerged no doubt influenced how the Koyukon perceived wildfire, particularly in cases where important resource sites might be affected (i.e., fish camps). Although quite mobile as compared to other Athabaskan groups, e.g., Dena'ina, Atna', the Koyukon did not exhibit the high degree of social and territorial flexibility as their Gwich'in neighbors. The Gwich'in, who depended on caribou and to a lesser extent moose, if not benefiting directly through the effects of wildfire, i.e., increased browse production for

Table 3. Mean monthly precipitation (1901-1930) comparison of Koyukon and Gwich'in territories in Alaska.

Koyukon precipitation (mm)						Gwich'in precipitation (mm)						
month	May	Jun	Jul	Aug	Sep	month	May	Jun	Jul	Aug	Sep	
mean	16	42	67	56	38	mean	7	34	47	31	10	brdrw15
min	5	25	43	35	2	min	1	25	38	19	0	brdrw15
max	26	58	91	76	74	max	12	42	56	43	20	brdrw15
stdev	5	9	10	7	14	stdev	3	4	5	5	7	brdrw15

moose, could adjust their territorial use in order to avoid or target disturbed areas. As noted above, this mobility was critical to their success in exploiting their primary subsistence resources. Considered together, one can begin to discern some of the interrelated factors, e.g., subsistence, mobility, and social organization, which may have contributed to adoption of the fire as a landscape management tool by the Gwich'in, and to the views of the Koyukon that wildfire is a potentially destructive force.

CONCLUSION

Wildfire has been a part of the ecological dynamics of Interior Alaska since the arrival of black spruce (*Picea mariana*) 5000 yr ago (Lynch et al. 2003, Lynch et al. 2004). With return intervals ranging from 50–150 yr, wildfire is an important part of the disturbance and succession process. What is not yet known is the role that humans may have had in influencing this process over time. In an effort to address this question, we conducted a regional analysis that examined the geographical extent to which native peoples of Interior Alaska used fire to modify the landscape at the time of European contact. Although the actual impact that native peoples may have had on Alaska's interior remains unclear, we have nonetheless determined that during the historic period of human occupation in Interior Alaska, landscape burning by native peoples varied both spatially and culturally. Through multidisciplinary research, which involved an archival review, collaborative research with

Gwich'in and Koyukon communities, and biophysical analyses, we have learned that prior to European contact, the Gwich'in Athabaskans developed a sophisticated understanding of the effects of fire when used in the boreal environment. Used in hunting, travel, communication, and fuel reduction, the Gwich'in used fire as an effective land management tool. In contrast, and based on their own understanding of a different landscape, the neighboring Koyukon Athabaskans chose not to adopt the practice of landscape burning. Seen as disadvantageous to territorial use, the Koyukon considered the occurrence of wildfire to be fundamentally destructive and something to be avoided. Some of the factors that have contributed to this regional and cultural variability may include differences in the terrain between the Gwich'in and Koyukon territories, lightning-strike density and the occurrence of natural disturbance, and differences in subsistence and settlement patterns. Together, these factors offer some explanation for why the Gwich'in and not the Koyukon used fire to modify the landscape. In the end these results have taken us one step closer to estimating the actual impact that native peoples may have had in shaping Alaska's boreal forest.

Responses to this article can be read online at:
<http://www.ecologyandsociety.org/vol12/iss1/art7/responses/>

Table 4. Elevation (m) and slope (degree) comparison of Koyukon and Gwich'in territories in Alaska.

Elevation	Koyukon	Gwich'in	Slope	Koyukon	Gwich'in
mean	1128	1030	mean	19	13
min	6	104	min	0	0
max	5385	2208	max	40	26
stdev	850	428	stdev	12	8

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