

Notions of Time and Sentience: Methodological Considerations for Arctic Climate Change Research

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Abstract. For anthropologists who are involved in Arctic climate change research, cultural conceptions of time and sentience have yet to receive explicit research attention, choosing rather to focus on the societal effects of climate change and formulating more adaptive human responses. Notwithstanding the value of this research, the methodologies often used tend to reflect a culturally based assumption that there exists a single characterization of time and sentience that applies to all Arctic residents. Based on collaborative research with the Koyukon community of Huslia, Alaska, this paper challenges that assumption and identifies some of the cross-cultural challenges of conducting climate change research when differing notions of time and sentience are encountered.

Introduction

The Arctic system is undergoing profound changes. These changes include an increase in the Arctic's annual surface air temperature (Chapin et al. 2005), a decrease in the extent and mass of sea ice (Belchansky et al. 2004), alterations in ocean circulation and freshwater balance (Proshutinsky and Johnson 1997), and the thawing of permafrost resulting in coastline erosion (Couture et al. 2003). More than simply ephemeral phenomena, the changes affecting the Arctic's physical environment are also affecting the marine and terrestrial systems in many new and unforeseen

ways (Overland et al. 2004). For example, the reduction of Arctic sea ice is proving to have a considerable impact on the migration and residency patterns of ice-dependent marine mammals such as polar bears, walrus, and seals (SEARCH 2005). In fact, a 22% decline in the region's polar bear (*Ursus maritimus*) population over the past 20 years (1984-2004) has been directly attributed to the reduction of sea ice in Canada's west Hudson Bay (Sterling and Parkinson 2006). There are also indications that the decline in caribou (*Rangifer tarandus granti*) populations across the Canadian north may be related to changing weather patterns and increased snow

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accumulation on caribou wintering grounds (Griffith et al. 2002).

While it is recognized that climate change is having a significant impact on the Arctic's marine and terrestrial communities, it is less clear how these impacts will affect human activities. For instance, it remains to be seen how regional warming trends will influence the availability and harvest of traditional foods by northern residents or how some of the associated effects of climate change, such as flooding, coastline erosion, and increased forest fires might affect the sustainability of northern communities. According to Duerden (2004), it is this level of uncertainty that best characterizes our current level of knowledge about the potential effects of Arctic climate change on northern residents.

Responding to this uncertainty, researchers are turning increasingly to futures research as a means of anticipating future societal impacts of Arctic climate change. Applied in numerous community-based contexts (e.g., Cohen 1997; Furgel and Seguin 2006; Reidlinger and Berkes 2001; Yohe and Schlesinger 2002), futures research is being used to help explore the complexity of Arctic climate change in ways that can inform policy-makers and northern residents of the potential social consequences. Used to inspire more resilient human responses to changes in their local environments, futures research can help people identify some of the negative effects brought on by Arctic climate change and enable community members to formulate effective responses.

Notwithstanding the methodological value of futures research, a cautionary word is in order for those who are applying futures research in cross-cultural contexts, particularly when working with northern indigenous peoples. Stemming from collaborative research with the community of Huslia, a Koyukon community located in interior Alaska, we have found that the use of futures research can conflict with the worldview of some community members. Because much of the discourse used in futures research is grounded in a linear conception of time, the use of futures research may impose future-oriented behavior on those who do not necessarily share the same temporal orientation. Specifically, we have found that the long-term planning horizons generally used in futures research can in some ways be inconsistent with the short-term or temporal immediacy of some Huslia residents. In addition to temporal differences, we have found some hesitancy among Huslia residents to speak publicly about future conditions, particularly in relation to environmental change. Residents of Huslia, as well as many other indigenous peoples, believe that changes in the environment are not random occurrences but rather are caused by the design and consciousness of spiritual forces (Grim

2001). By asking community members to participate in a public process that explores future environmental conditions, we as researchers may inadvertently be placing research participants in situations that are potentially offensive to a sentient world — a world that can be highly sensitive, vindictive, and dangerous (Nelson 1983). These concerns, in our experience, can cause considerable anxiety among community members, resulting in their ultimate withdrawal from the research process.

In this paper we draw attention to some of the challenges of conducting research on the societal effects of Arctic climate change when differing notions of time and sentience are encountered. Recognizing the dangers of cultural generalization, our observations are based on our collaboration with Huslia researchers and community members, the previous experience of the authors who have worked with other indigenous communities in the north, conversations with colleagues, and references found in the literature. It is important to note that we are not arguing against the use of futures research *per se*, but rather our intention is to highlight some of the cultural differences that may impede community collaboration when futures research is employed. To this end, we argue that in order to avoid the imposition of culturally inappropriate research methods, a more equitable role for community members in the research process must be created from the outset, when research methodologies are formulated.

Futures Research

For anthropologists, the future has long been an area of exploration (Bloch 1977; Bourdillon 1978; Gell 1992; Gurvitch 1964; Toulmin and Goodfield 1965). Owing to the problem-solving nature of anthropology, it could be argued that the goal of our research has always been future oriented — that is, the only useful knowledge is knowledge applicable to the future (Hill and Baba 2000). This has been particularly true when the outcomes of our research are used in some form of intervention (Tax 1952). It was not until the 1980s, however, that anthropologists began to adapt traditional ethnographic interview methods to elicit images of alternative futures, an approach since referred to as Ethnographic Futures Research (EFR) (Texter 1980). Having applied conventional methods of ethnography to study the human condition, anthropologists began using EFR as a means to elicit images, preferences, cognitions, and values with respect to possible or probable outcomes (Texter 1990:141). Because EFR generates a sense of ownership among participants about the type of future they want most for their communities, EFR has also become a popular research tool for those

involved in community development (Domaingue 1989). Today, futures research is being used by a diverse group of decision-makers, consultants, and researchers to help Arctic communities envision and attain more sustainable futures. This has involved the co-discovery and evaluation of possible and preferable futures for those who are most directly affected by change (Bell 1997). For Textor (1990:139), the value of futures research rests in its methodological ability to: 1) describe alternative futures that are possible or probable for a particular population; 2) determine the state of knowledge (and uncertainty) about alternative futures; 3) identify implications and possible consequences of alternative futures; 4) serve as an early warning system for undesirable futures; and 5) identify underlying processes associated with change. Thus, the primary objective of futures research is to elicit, clarify, critique, and systematically appraise preferable outcomes (Riner 1991).

One of the principle methods used in futures research has been the scenario. Defined as plausible explorations of the future, scenarios are used to explore a range of possibilities in a world that is complex, dynamic, and unpredictable – in essence, scenarios are stories of what might be. Scenarios have proven particularly useful when the planning horizons involve decades, complexity and uncertainty are high, and people must work together to accomplish shared goals (Wollenberg, Edmunds, and Buck 2000). Scenarios are also action-oriented in that they are used to encourage individuals to be proactive in determining their own images of the future. While the methods can vary, scenarios are often introduced through semi-structured, loosely facilitated group conversations. Involving multiple stakeholders (researchers, practitioners, community members), this approach consists generally of four steps. First, a conceptual model of the social and ecological system is presented. This includes an historic profile describing how the system got to be what it is. Second, the group identifies the range of predictable and unpredictable drivers of change as well as the group's shared or contrasting vision of the future. Using the output from step two, options for the future are explored in iterative ways. This generally includes the development of simple models that explore attributes affecting the overall system (Walker et al. 2002). Last, participants evaluate the process and examine possible outcomes in terms of policy and management applications. The use of several different scenarios can help to identify the range of impacts associated with human activities. For example, Smith and Colley (2003) have used scenarios in their *Through the Eyes of Hunters* project to learn how caribou react to human presence, automobile traffic, and snow machines (skidoos) along the Dempster Highway in

the Yukon Territory of Canada. Through the use of scenarios, they were able to learn from hunters how sensitive caribou are to human activities and how much human activity would be required to produce lasting change. While no scenario can provide a definitive portrayal of exactly what will happen in the future, scenarios can serve as effective tools for examining possibilities that are at least consistent with current knowledge.

While positive or ideal images of the future are sometimes used to generate creative thought, more often negative images are used to capture individual and group imagination. The use of “wild-card images” represents unanticipated yet dramatic events that can help participants envision or prepare for worst-case situations (Heemskerk 2003). In some cases, scenarios are used to invoke anxiety or even fear thereby forcing participants to consider potential consequences of current trends. This may involve a single stunning image of the future or a series of events that are so compelling that they inspire people to take steps to prevent them from occurring (Coffee and Meerwarth 2004). Thus by helping people think the unthinkable (Heemskerk 2003), scenarios can motivate people to change their ways and to protect what is most valuable to their community's survival.

Human-Fire Interaction Research

Recognizing the potential value of future scenarios, we considered their use in a multidisciplinary research project that explored the interrelationships between climate change, human activity, and the occurrence of wildfire in the interior of Alaska. Involving university and community researchers, our project included an analysis of anthropogenic influences on the boreal fire regime, such as ignition and suppression activities, and how wildfire affects people, for example through the availability of resources (e.g., game, berries, timber). Owing to the complexity of our research focus, scenario planning was considered potentially useful given that our research addresses a web of inter-related problems, the issues of concern transcend disciplines, and the processes that underlie our investigation interact on various scales (Van Notten et al. 2003). Perhaps even more importantly, scenario planning was thought to be an effective method for engaging community members in the research process. For example, through scenario workshops we could explore with community members how they might respond hypothetically to a destructive fire season, not unlike Alaska's 2004 fire season. Specifically, we might discuss how subsistence activities might be affected by a large-scale wildfire disturbance and how community members might respond in the future to the loss of traditional harvesting areas. Scenarios might also be used to examine how com-

munity members would deal with health-related issues (such as smoke ingestion) associated with increased fire activity or the short- and long-term impacts resulting from community relocation.

This approach was discussed at some length during a research planning workshop held at the University of Alaska Fairbanks in May 2005. With university and community research members present to finalize the coming year's research schedule, two of our project researchers from the Koyukon community of Huslia (L. DeWilde and O. Huntington) pointed out that, despite the potential value of future scenarios, such methods might prove problematic when working with Huslia residents. Specifically, we were told that by asking community members to participate in a research process designed specifically to forecast future conditions, and particularly in relation to environmental change, we would likely be asking community members to participate in a process that is in many ways culturally inappropriate. Because scenarios are based on long-term planning horizons where the past, present, and future are distinct periods of time that can be treated as discrete entities, we were told that such an approach might be inconsistent with the temporal orientation of some community members.

For many Huslia residents, time is viewed in terms of how significant events are to the individual and how such events fit into the wider scheme of immediate needs. Given the long-term orientation of scenario planning our approach would fail to reflect the present time-sense of many Huslia residents and might even be perceived by some community members as yet another technique used by outsiders to impose western values. We were further told that because our scenarios would involve negative or wildcard images of wildfire (i.e., a destructive fire season), our approach would fail to respect the agency that is inherent within the physical environment – in this case the sentient qualities of wildfire. For the Koyukon, all aspects of the environment (including wildfire) are sensate and personified. Because of this, aspects of the environment can be offended if proper respect is not shown. Huslia researchers then cautioned us that if these contrasting notions of time and sentience were not recognized and reflected in our methodology, there would be little hope of gaining the trust of Huslia residents. It was at this point that we began to think more critically about our own methodological assumptions and how differing notions of time and sentience might influence Koyukon conceptions of Arctic climate change.

Koyukon Time Reckoning

Within Alaska there are 9 distinct Athabaskan groups. The Koyukon, represent the most north-

westerly group, inhabiting 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 (see Figure 1).

The Koyukon have generally been divided into three major sub-divisions: 1) those residing along the middle Yukon River, from Steven's Village down river to the community of Koyukuk; 2) those residing along lower Yukon River, from Nalato to the Blackburn Creek; and 3) the Koyukon living along the Koyukuk River and its tributaries (Clark 1981). At the time of European contact (1800–1870) the Koyukon had an approximate population of 2,000 (Langdon 1992). Huslia, the Koyukon community that partnered with us in this research, is located on the north bank of the Koyukuk River, approximately 290 air miles west of Fairbanks. The current population of Huslia is approximately 293, 274 being of Koyukon descent (U.S. Census Bureau 2000). The contemporary economy of Huslia can be best characterized as mixed between wage labor and subsistence production. The mean income of Huslia households is \$28,343 (U.S. Census Bureau 2000) with over 1,000 pounds of wildfoods harvested per individual annually (Marcotte 1986).

Ethnographic information on the Koyukon is limited relative to early accounts of other Alaska Native peoples. However, the information that does exist is exceptionally rich in detail. Some of this work includes descriptions of Koyukon cultural change (Loyens 1964), rituals (Loyens 1966), ceremonialism (Clark 1970), language (Jones 1978), and Koyukon cultural ecology (Nelson 1983). Perhaps most extensive are the contributions made by Julius Jetté, a Jesuit Priest who lived among the Koyukon for nearly 30 years at the turn of the twentieth century. Living and working along the lower and middle Yukon River, Jetté documented Koyukon healing practices (Jetté 1907), folklore (Jetté 1908–09), superstitions (Jetté 1911), riddles (Jetté 1913), geographical place-names (Jetté n.d.a), and most significant to this discussion, Koyukon time reckoning (Jetté n.d.b).

Through *Time-Reckoning of the Ten'a* we learn that, for the Koyukon, the largest unit of temporal measurement was the solar year. Referred to as either *no-rodolel* or *no-ronetuiht*, both terms are translated to mean 'to wind' or 'to move in a circle'. The prefix *no* is used to denote a cycle, and both terms indicate a recurring seasonal round (Jette n.d. b). The Koyukon also had terms for 'next year' (*orta*) and the 'year after next' (*or ronotla*). However, Jetté could identify no terms in the Koyukon lexicon for time periods beyond *or ronotla*/the year after next. Within the solar year the Koyukon identified four distinct seasons that were differentiated by physical changes occurring on the land. Unequal in dura-

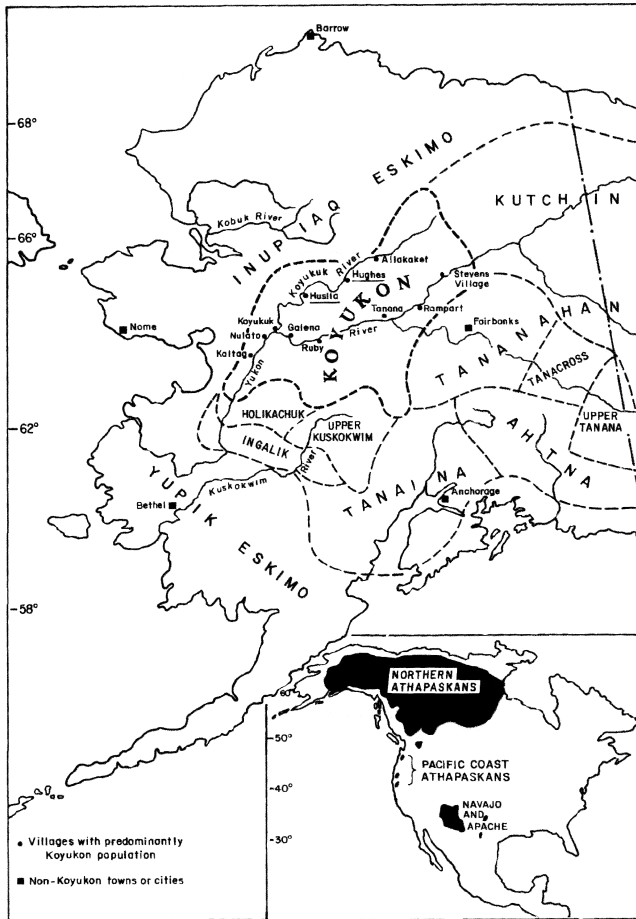


Figure 1. Koyukon and Athabaskan distribution (Nel-son 1983).

tion, winter (*roih*) was considered the main season of the year and lasted for what is now considered to be seven months. Winter would generally begin with the freezing of the main rivers and streams in mid-October and would end with the break-up of ice in mid-May (Jetté n.d.b). Winter was followed by a spring period that might only last as long as two weeks. Referred to as *rolukot*, or ‘the running of ice,’ this term denotes the period of time between break-up and the reappearance of vegetation (Jetté n.d.b). The summer (*san* or *sana*) was the time of year when the rivers were open to navigation. This period lasted approximately four months and began when ice was no longer flowing in the rivers. Autumn, or *roihtsen*, was a short period of time when ice began to form in the main rivers until complete freeze-up. Like the short spring period, autumn on average would last only two or three weeks in late October (Jetté n.d.b).

The timing for each of the four seasons of the year was not fixed but rather would be adjusted year-to-year depending on seasonal characteristics. For example, during Jette’s stay with the Koyukon

he documented the specific dates for break-up and freeze-up. Over a 22-year period, the average date of ice break-up in the middle part of the Yukon River was May 18th with the extreme dates being May 7th, in 1902, and May 27th, in 1894. The average date of freeze-up was October 23rd, with the extreme dates being October 13th, in 1877, and November 10th, in 1901.

To distinguish the seasons of the year further, the Koyukon identified 16 distinct periods of seasonal transition. For each period, time was measured in terms of duration, or how long a specific activity or event would last. These temporal periods include:

1. *Me nen tar-kenet’oihe* [the time when the sun is under the water]
2. *Me nen niltsa dzan yedelaihe* [the time of lengthening days]
3. *Telet-soo* [time of the eagles]
4. *Kolekeih-soo* [time of the hawk]
5. *Kaka-soo* [time of the geese or time of the animals]
6. *Me nen lu tedare* [time of the breaking of the rivers]
7. *Me nen to-tsih-leyaihe* [the time for launching canoes]
8. *Me nen keton nelyaihe* [time during which leaves grow]
9. *Kal-nora* [time of the king salmon]
10. *Nular-nora* [time of the dog salmon]
11. *Sanlar-nora* [time of the silver salmon]
12. *Nolltar-nora* [time of the second run of dog salmon]
13. *Roihtse-luka-nora* [time of the autumn fish]
14. *Men nen tedetihe* [time of the freezing]
15. *Men nen ketsunelainhe* [time during which we trap marten]
16. *Men nen ral a-tlo-karaleyaihe* [time when marten turns its behind to the trap]

Despite the common use of these terms among the Koyukon, individuals would construct their own points of seasonal demarcation. While members of one village or settlement would follow the temporal orientation of their elders, most often there were differences between neighboring villages whose elders might read seasonal change differently. As a result, it was nearly impossible to find two villages, let alone individuals, who would agree perfectly on the timing of seasons (Jetté n.d.b:12).

Chronological exactness was of little concern to the Koyukon. In fact “the practice of numbering years, counting them down to the actual one, from some remarkable event in history . . . is altogether unknown to them” (Jetté n.d.b:1). One’s age was also of little relevance to the Koyukon. Rather it was level of experience that an individual had

gained over the course of his or her life that was considered most significant (Jetté n.d.b: 19). This is similar to the Inuit of eastern Canada who relied on personal memories and experiences for temporal organization, and not abstract, generalized milestones such as age, month, or year (Briggs 1992). If asked directly about one's age, individual Koyukon would make comparisons between oneself and another – "I am older than he" or "we are the same age." If pressed further, Jetté found that people would relate their age to the occurrence of a specific event – "I was born the summer after the Nulato massacre" (Jetté n.d.b).

When traveling across the land, the Koyukon would reckon time in one of two ways. The first being the number of nights spent traveling – "it is two nights travel from here." The other was a more localized way. For example, Jetté found that one would often note the amount of food consumed during a journey as a signifier of time and distance – "I used one dried fish during my travel." Knowing that one dried fish would be consumed over two days of travel, others within the group would know generally how long the journey lasted (Jetté n.d.b:18). Recording the days of the week was not practiced until after the Koyukon came into contact with Russian missionaries (ca. 1838). This is believed so because "there is no vestige of either in the folklore or the old traditions of the Koyukon" and the Russians were the first to encourage the Koyukon to keep track of the days of week in order to observe Sunday prayer (Jetté n.d.b:16). To keep tally of the days of the week, the Koyukon were shown to make notches on sticks. Single notches were made for Monday through Saturday and a double notch in the form of an X was used to mark Sunday (Jetté n.d.b:16). By the early 1900s some Koyukon households had acquired clocks. However, Jetté found that rarely would the clocks of any one village agree and it was quite common to find time differences of two, four, or even seven hours, between adjacent houses. This, however, was rarely a concern for the "Koyukon who lacked any interest in the exact measure of time" (Jetté n.d.b:18).

Insights on Koyukon time reckoning can also be gleaned from their material culture, and particularly in relation to production, saving, and storage. The lack of material accumulation among the Koyukon suggests a prioritization of immediate needs over any long-term interest in storage and investment. The Koyukon would even impose sanctions on those who would accumulate in anticipation of future needs rather than share with others in the present. These sanctions could range from ridicule and gossip about selfish or stingy behavior to physical confrontation and even banishment. Sanctions could also come in the form of spiritual reprisals such as bad luck in

hunting, personal injury, or even death (Nelson 1983). Similar to the Koyukon, the Nunamiut of north Alaska were known to tease individuals who would think so much about the coming season that they would forget what needs to be done in the present (Gubser 1965:192). Among the Utkuhikhalingmiut of eastern Canada, individuals would also be ridiculed as being "childishly afraid" when they cached more food than others in preparation for the lean spring season (Briggs 1970:213). Although some planning and preparation in one's life was necessary for survival, neither the Nunamiut or the Utkuhikhalingmiut formulated projects that required planning or accumulating resources for more than a few days, weeks, or at most one season ahead of time (Briggs 1992; Gubser 1965). For the Koyukon as well, long-term planning was never done more than one season or, at most, a year in advance (VanStone 1974:75). While "this uncertainty may seem unsatisfactory to us, it is not so for the Koyukon, who live from hand to mouth, with the greatest unconcern for tomorrow" (Jetté n.d.b:12).

Nearly 40 years after Jetté published *Time-Reckoning of the Ten'a*, Robert Sullivan visited the Koyukon territory and, like Jetté documented aspects of Koyukon time-sense. Working in the Koyukon communities of Koyukuk, Nulato, and Kaltag, Sullivan found that Koyukon time reckoning had gone unchanged since Jetté's turn-of-the-century accounts and remained very much unlike the time-sense common among societies in the west. For the Koyukon, time was not conceived as a continuous duration divisible into a series of smaller units, but rather emphasized the reoccurrence of distinct and cyclical phenomena (Sullivan 1942). It is through this frame of temporal reference that Koyukon observed time. Sullivan (1942) also noted that the differences between Koyukon and western time-sense should not be attributed to mentality or racial composition, but rather was the result of different cultural experiences that produced a unique psychological outlook on life and the world around them.

Since Jetté and Sullivan made their observations, the temporal orientation of Huslia residents has no doubt been influenced in a number of significant ways — whether in relation to changes in their seasonal mobility, entrance into the wage economy, schooling, political involvement, television, or the many others activities that now influence Huslia social life. Given the extent of change that has occurred over the past century throughout the Arctic, it is quite likely that the temporal orientation of many northern indigenous peoples is considerably different now than in the past, when adjusting to change and uncertainty was a constant feature of life (Duerden 2004). The casual

visitor to Huslia might easily conclude after arriving on the local runway and seeing the comfortable housing, the school, skidoos, and other modern technologies, that much of the “traditional” Koyukon culture has been lost to change. However, beneath what is immediately observable remains considerable cultural continuity, including a continuity in the ways in which time is observed and prioritized. For many residents of Huslia, the here-and-now continues to be most relevant to daily routines, subsistence production, and their contemporary material culture. For residents of Huslia, time is not derived, either historically or in the present, solely from linear sequencing, but rather is constructed around immediate needs and by seasonal indicators. As noted by Orville Huntington:

Most of us still plan seasonally. When things change early in a season we look for indicators. For example, when hunting Black Bear we look at how much grass is blocking the entrance to the den to estimate winter severity. Or when planning our fishing effort we look at snow conditions, ice thickness, and how people are doing at the mouth of the Yukon [River] early in the season for a better indicator of [salmon] run strength. We usually adjust to things as they come up. Most Huslia residents live for today. (email communication with Natcher, 2005)

Suchet (2002) has found similar temporal attitudes among indigenous peoples of the western Cape York Peninsula in Australia where time is denoted by seasonality, events, and activities that occur on the land. For example, elders “know when it’s harvest time when grass seeds burst and seeds fall off . . . When dragon flies are around it’s good fishing, especially salmon . . . and when the crab flower blooms the mud crabs are ready to eat” (Suchet 2002:150). Thus time reckoning among the indigenous peoples of Cape York as well as the Koyukon of Huslia continues to be reflected in the temporal rhythms of the environment rather than being organized by discrete temporal units as it is so often conceptualized by non-indigenous peoples in the “west” (Evans-Pritchard 1939).

This is not to suggest that Huslia residents lack a future orientation. Rather, the contemporary life of Huslia residents has become filled with any number of regularly scheduled activities. These include the work-related demands of wage employment, attendance at community social events, meetings and medical appointments in Fairbanks and Anchorage, attendance at the annual Alaska Federation of Natives conference, youth sporting events, high school graduation, and even scheduling around the broadcast of favorite television shows. The sheer number of events that now fill

the daily lives of Huslia residents could easily suggest a change in temporal orientation to one that revolves around a calendar and clock. Notwithstanding these changes, there remains a great deal of resistance among Huslia residents to allow events that lie in the future to organize one’s life. While at times adhering to a future time-sense, many Huslia residents continue to prioritize short-term or more immediate needs that are influenced by environmental rhythms and defined by local economy and ecology (Bloch 1977). This temporal orientation is similar to what Bourdieu (1963) refers to as the prioritization of the “forthcoming future,” or the concrete horizon of the present, that can be manipulated and, to a certain extent, managed. This more immediate future differs from the distant and unknowable future that can only be influenced by spiritual forces and thus outside human manipulation (van Est and Persoon 2001).

Despite the patterns of change that now encourage discipline to the clock, the temporal present continues to dominate the time-sense of Huslia residents. Therefore, it would be a mistake to presume that changes over the past 100 years in Huslia social life have necessarily resulted in fundamental change in their temporal orientation. And it is this temporal orientation that continues to influence how some Huslia residents view the world and the changes taking place in it. As one Huslia elder shared:

There’s a lot more to life and to this world than what really meets the eye, and our Native people knew this from a long time ago. When the Elders said the weather is getting old, they knew that everything goes in cycles. (Fred Bifelt, personal communication 2005)

The Sentient World of the Koyukon

The second point that was raised during our research planning workshop dealt with local concerns over public discussions of environmental change and how best to plan for uncertainty. To speak of the future with a level of certainty is considered a basic component of futures research. By thinking the unthinkable, communities are better able to cope with future crises and surprises (Heemskerk 2003). However, to Huslia residents, and specifically the elders, the idea of planning the future is not only presumptuous but can also be spiritually dangerous, for it demonstrates a sense of arrogance towards the sentient world. For residents of Huslia, aspects of the environment represent the transformed embodiments of formerly human spirits that are imbued with consciousness. The earth itself is a source of pre-eminent spiritual power called *sinh taala’* (Nel-

son 1983). Other physical entities invested with sentient qualities include certain landforms, features of the sky, water, and river ice. Representing perhaps the most temperamental of these entities and, at times the most tyrannical in behavior is the weather. The temperature in particular is perceived to be much more than a physical condition of inert air but rather a wild and at times a moody animal (Nelson 1983). Similarly the wind (*alts'eeyh doyeega* or wind spirit), if offended, can cause strong and destructive gales. Because the environment is imbued with awareness and power, events that occur in it are seen as manifestations of an omniscient presence. To the Koyukon, there is no such thing as a random event – things happen for a reason and most often as a result of human action. “If a man brags that storms or cold cannot stop him from doing something, the weather will take care of him. It will humble him with its power, because it knows” (in Nelson 1983:26). Seen in this way, one’s actions must be carefully mediated by respect and awareness.

To help ensure appropriate behavior and the avoidance of misfortune, Koyukon behavior is guided by an elaborate code of conduct that governs interaction with the non-human world. These codes of conduct have been transmitted for countless generations and are contained in stories of the Distant Time. Representing Koyukon oral history, Distant Time stories recount events where inappropriate human behavior resulted in some type of environmental consequence (Nelson 1983). The lessons contained in Distant Time stories are used by Huslia residents as guidelines by which to avoid similar mistakes. The basic message of all Distant Time stories is to avoid disrespect in accordance with a code of etiquette and morality that governs Koyukon relationships with world around them. For example:

When the river ice breaks up each spring, people speak to it, respectfully and acknowledge its power. Elders make short prayers, both in Christian and traditional Koyukon, asking the ice to drift downstream without jamming or causing floods. By contrast, some years ago, the U.S. Air Force bombed an ice jam on the Yukon River to prevent inundation of communities. Far from approving, some villagers blamed subsequent floods on this arrogant use of physical force. In the end, nature will assert the greater power. The proper role for humans is to move gently, humbly, pleading or coercing, but always avoiding belligerence. (Nelson 1983:217)

An example from our own research provides some additional insight on the sentient world of the Koyukon. In January 2005, several members of our research team were invited to take part in a community workshop held in Huslia that explored climate-induced changes in the environment. The

workshop focused in large part on local observations and traditional knowledge relating to climate change in northern latitudes (Huntington et al. 2006). Approximately 50 people attended the two-day workshop, including academic researchers, government agency representatives, Huslia residents, and invited guests from neighboring Koyukon and Inupiaq villages. While relatively well attended, severe winds kept many invited guests from flying in from neighboring villages and kept some Huslia residents in-doors and out of the gusty and frigid conditions. More seriously, the high winds and severe weather conditions resulted in several Huslia men leaving the community to form a search and rescue party to locate a local hunter who was caught by surprise by the winter storm and was delayed returning home. After several days of searching, both the hunter and the members of the search and rescue team returned to Huslia unharmed, despite the continuance of the windstorm. During this time, and at the advice of Huslia leadership, the workshop on climate change continued.

While nothing was said to any of the visitors directly, upon reflection some of us could not help but suspect that at least some Huslia residents may have attributed the extreme weather conditions, and the near misfortune of the local hunter, directly to the public discussions taking place in Huslia about changing weather and climate patterns. Given the cause-and-effect relationship between human action and climatic events it is quite likely that, to at least some Huslia residents, our actions may have been directly responsible for the storm. Through subsequent discussions with local residents and our co-researchers from Huslia, we have learned that there are some things that simply should not be discussed publicly – “one should not talk about such big things” – and this includes the weather. For many residents of Huslia, it is considered inappropriate to speak publicly of sentient forces at all lest they hear and take offense (Huntington et al. 2006). Failure to observe such moral behaviors can place at risk one’s survival, as well as the safety of family and friends. Feit (2004) found similar concerns among Cree hunters in northern Quebec when asked about changes in the weather. When asking about *Chutenshu*, or the powerful “North Wind” person, Feit (2004) has found that the Cree are reluctant to “talk behind the back” of the powerful and potentially dangerous wind-person. These concerns do not necessarily preclude the Cree from joking or making occasional complaints about the weather, but only in appropriate contexts, as in all social relationships (Feit 2004). Prohibitions also exist among the Koyukon for discussing wildfire. One Huslia elder told us how she was taught never to speak of wildfire because doing so would be dis-

respectful and could result in retribution. Similar beliefs are held among some indigenous peoples of California who believe that catastrophic wildfires are not a regular or natural occurrence but rather are punishments for violating religious or social rules (Anderson 2005: 57). Because wildfire, like all elements of the environment, is considered to be fully alive and sentient, residents of Huslia continue to observe a number of culturally specific rules to keep from causing offense and triggering an emotional response. Knowing that human actions can result in dramatic and often unwanted environmental consequences, Huslia residents are ever mindful of the world around them and their place in it.

Discussion

For anthropologists who are involved in Arctic climate change research, cultural conceptions of time, and in particular attitudes towards the future, have yet to receive explicit research attention. In fact, the majority of anthropologists have tended to examine issues of the past that have led to the present social and ecological conditions now affecting northern communities. The lack of attention to the varying cultural conceptions of time and future can be attributed to: 1) the difficulty of finding a meta-language to conceptualize something so ordinary and apparently transparent as the future in everyday life (Munn 1992); 2) The belief that temporal concepts were absent among non-industrial cultures (Wallman 1992); 3) the future has generally been subject to oversimplification and single stranded descriptions, rather than theoretical examinations of basic socio-cultural processes through which temporality is constructed (Munn 1992:93); and 4) anthropological methods continue to be best suited to understanding present-day behavior as caused by historical processes (Persoon and van Est 2000). Riner (1991) has argued that, for whatever reason, the lack of critical attention to the future has constrained our range of temporal perceptions. This, in effect, has removed the possibility of alternative temporal orientations, thereby rejecting other equally valid conceptions of time (Briggs 1992:86).

By failing to account for alternative temporal orientations, a linear and progressive view of time has come to frame much of the research being conducted on the social effects of Arctic change. This research has been predicated ontologically on the belief that the future is open to deliberate intervention and such intervention can be best facilitated through effective planning. This orientation is central to evaluating the effects of change and deciding how best to reach a more desirable social-ecological state. For many northern indigenous peoples, however, attitudes toward time do

not necessarily involve linear connections. Rather than conceptualizing time as a linear progression that extends into infinity, with temporal fragments that appear, pass, and then disappear, never to be seen again, time for many indigenous peoples is conceived as cyclical and patterned, appearing and disappearing into a constantly shifting and changing flux (von Thater-Braan 2001). Despite the changes that many indigenous peoples throughout the Arctic have endured, the temporal orientations of many have gone unaltered. Stern (2003:149) has found this to be true among the Inuit of Holman where, unlike their adoption of snowmobiles, television, and wage labor, the Inuit continue to contest western conceptions of time despite more than a century of colonial policy that has been designed, in large part, to dismantle Inuit economy and social organization. Although the state's power to impose regimes of time has, in many contexts, become so great that those conceptions become internalized and often self-imposed (Foucault 1977), for the Inuit, as well many other indigenous peoples, their temporal orientation has maintained considerable continuity (Hughes and Trautmann 1995).

Given how central one's temporal orientation is to cultural expression, it would be an oversimplification to assume the existence of a single and universal time-sense (Pickering 2004). Yet the need for predictability and the preoccupation with the long-term has made it very difficult for some non-indigenous peoples to accept the world as an uncertain place (Duerden 2004). After all, a community "that has no sense of direction in time, no sense of a clear future ahead is likely to be vacillating, uncertain in behavior, and have a poor chance of surviving" (Boulding 1956:125). Effective long-term planning is therefore considered necessary if we are to take measure of our current situation and to be better prepared when crises and changes occur. The supposed neutrality and virtue of future planning has, however, been called into question. Escobar (1992:132), for example, has argued that perhaps no other concept has been so insidious nor gone so unchallenged as future planning. In indigenous communities throughout the world future planning is being used as a strategic tool for achieving social, political, and economic goals as defined by the West (Howitt 2002). Despite these critiques (see also Cooke and Kothari 2001), the only critical commentary pertaining to future planning for Arctic climate change has tended to address issues of representation and how best to include those who have traditionally been excluded from the planning process. Rarely has the epistemological foundations of planning been challenged on its rationalist and progressive view of time (Howitt 2002:156).

For many northern indigenous peoples, the

very idea of long-term planning is considered an absurdity. The Innu of Labrador, for example, give little thought to the future since events are unpredictable, plans are temporary, always changeable, and, if possible, avoided altogether (Sampson 2003:154). Jean Briggs (1992) has found similar attitudes among the Utkuhikhalingmiut who would rarely speak of the future outside of a narrowly defined context. For Utkuhikhalingmiut, the future is largely inconsequential because events that lie in it have yet to occur (Briggs 1992). Fox (2002:45) has noted similar experiences working with the Baffin Island Inuit, who often redirect discussions concerning the long-term consequences of climate change to more immediate and pressing concerns faced by individuals and communities. The Koyukon also are far more inclined to discuss the temporal present rather than speculate about an unknown and unpredictable future.

Adding to this complexity is the fact that, for some northern indigenous peoples, the very act of thinking and talking about something too much ultimately causes even more problems. This was made evident to Huslia elders who explained the inappropriateness of discussing some things publicly, and particularly when discussing “such big things” as environmental change. O’Neil and his colleagues (1997) found similar hesitations among the Inuit who prefer to avoid conversations about environmental contaminants. Believing that talking, thinking, and worrying too much is the ultimate cause of illness, some Inuit feel that avoiding the contaminants issue is necessary in order to maintain one’s health (O’Neil et al. 1997:36). The same concerns exist over wildlife research where some Inuit believe that talking too much about animals will ultimately result in their disappearance. Feit (2004) found this also to be true among the Cree who believe that animals are active agents, with subjectivity and awareness of social relationships, and can therefore be offended if appropriate behavior is not followed. For these reasons, many indigenous people feel that research and western resource management strategies are founded on arrogance and should thus be avoided (Suchet 2002). Our own conversations with Huslia elders uncovered similar attitudes and revealed some of the personal struggles that Huslia elders experience when they know it is inappropriate and potentially hazardous to speak of certain environmental phenomenon, yet they are compelled to do so in order to represent and defend Koyukon perspectives in research and resource management – processes both of which are guided by western norms and values (Huntington et al. 2006). This creates a significant dilemma in that community members have noted a strong interest to be involved in research but the inappropriateness of discussing some things publicly limits

community engagement. As such, some Huslia residents may feel that their participation in climate change research is potentially far more damaging because such involvement may actually exacerbate the environmental changes being investigated. Therefore, given that the environmental effects of Arctic climate change have yet to be determined, we must ask ourselves whether or not our attempts to better understand the resulting social effects are actually giving rise to anxiety among the very people these efforts are meant to empower or perhaps may even be contributing to some of the environmental changes now being witnessed throughout the Arctic.

Conclusion

As change and uncertainty continue to accelerate in the Arctic, researchers are becoming increasingly engaged with communities in exploring how the effects of climate change can be anticipated and best prepared for. These anticipatory efforts are often supported by policymakers who are being called upon to allocate limited resources to help mitigate the impacts of Arctic climate change (Duerden 2004). Some have argued that if we are to implement appropriate strategies to ameliorate the effects of climate change, developing more effective socio-economic scenarios will prove vital (Nuttall 2001). Through scenario planning we can begin to foresee the effects of Arctic climate change and identify what impacts may be amenable to individual or collective intervention.

If future scenarios offer the best chance for northern communities to prepare for change, we as researchers must think carefully about whether or not our efforts to better understand the effects of climate change, and thus contribute to the formulation of more effective public policy, are being derived from a tempocentric view of time and an ethnocentric view of the world around us (Crabbe 2006). If we fail to consider this possibility, we not only advance the assumption that there is a single, correct, or best characterization of time and sentience that applies to all Arctic residents, but we also enable the epistemological dominance of research to go unchallenged (Janca and Bullen 2003). The consequences of such are then manifested in ineffective policy decisions and the further marginalization of the very people most affected by Arctic climate change.

Anthropologists have a great deal to contribute to climate change research but perhaps our most important contribution is in our ability to identify the range of cultural values that inform one’s understanding of the world and changes taking place in it. Given the existence of alternative understandings of Arctic climate change, we must

begin to interrogate the terms of engagement that are being used in climate change research and examine what concepts indigenous peoples themselves use for understanding change. This will demand that indigenous peoples have the opportunity to generate their own categories, concepts, and temporal dimensions for understanding change (Goebel 1998). This will also require greater recognition among researchers for the contributions that local people can make to the research process. The moral challenge for researchers will therefore be to reassess some of our own most basic assumptions about the world and to acknowledge the existence of important cross-cultural differences.

Proceeding in this way, we might also find that some forms of research cannot be translated into different cultural environments and should therefore be abandoned. This proved true in our experience in Huslia, where community researchers identified major methodological flaws at a point where adjustments could easily be made. Had this project not benefited from local involvement, it is likely that our efforts would have been stalled in mutual frustration — frustration felt by university researchers that Huslia residents lacked any real interest in the research process and frustration felt by community members over the continued denial of local beliefs and culture. Because research can produce, reflect, and reinforce values, it can also challenge the ideological and epistemological foundations of indigenous cultures. Therefore, had future scenarios been used to advance our research interests we would, in effect, have imposed a research method that is fundamentally at odds with the way in which community members view and behave in the world. This would have likely resulted in community members withdrawing from the research, thereby leaving our understanding of Koyukon temporality incomplete and the sentient world of the Koyukon unacknowledged. However, by having Huslia researchers on the project team, and engaging community members on their terms, we were able to avoid the imposition of an inappropriate methodology, thereby respecting Koyukon values and culture.

If our attempts to forestall the effects of Arctic climate change are inconsistent with the way in which indigenous peoples see the world, we will ensure the perpetuation of inequalities that have long challenged cross-cultural research in the north. However, by creating true partnerships with indigenous communities — from project design to dissemination — indigenous communities can move from being the recipients of the research process to the role of facilitators in a more effective and cross-culturally acceptable approach to climate change research in the future. If this can be accomplished, a more culturally appropriate re-

search agenda that examines the effects of Arctic climate change can be developed with indigenous conceptions and values in mind.

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References Cited

- Anderson, M. Kat
2005 *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources*. Berkeley: University of California Press.
- Belchansky, G. I., D. C. Douglas, and N. G. Platonov
2004 Duration of the Arctic Sea Ice Melt Season: Regional and Interannual Variability. *Journal of Climate* 17(1):67–80.
- Bell, W.
1997 *Foundations of Future Studies: Human Sciences for a New Era, History and Knowledge*. New Brunswick: Transaction Publishers.
- Bloch, Maurice
1977 *The Past and the Present in the Present*. *Man* 12:278–292.
- Boulding, Kenneth
1956 *The Image: Knowledge in Life and Society*. Ann Arbor: University of Michigan Press.
- Bourdieu, P.
1963 *The Attitude of the Algerian Peasant toward Time*. In *Mediterranean Countrymen: Essays in the Social Anthropology of the Mediterranean*. J. Pitt-Rivers, ed. Pp. 83–108. Paris: Mouton and Company.
- Bourdillon, M. F. C.
1978 *Knowing the World or Hiding it: A Response to Maurice Bloch*. *Man* 13:591–599.
- Briggs, Jean L.
1992 *Lines, Cycles, and Transformations: Temporal Perspectives on Inuit Action*. In *Contemporary Futures: Perspective from Social Anthropology*. Sandra Wallman, ed. Pp. 83–108. London: Routledge.
- Briggs, Jean L.
1970 *Never in Anger*. Cambridge: Harvard University Press.

- Chapin III, F. S., M. Sturm, M. C. Serreze, J. P. McFadden, J. R. Key, A. H. Lloyd, A. D. McGuire, T. S. Rupp, A. H. Lynch, J. P. Schimel, J. Beringer, W. L. Chapman, H. E. Epstein, E. S. Euskirchen, L. D. Hinzman, G. Jia, C. L. Ping, K. D. Tape, C. D. C. Thompson, D. A. Walker, and J. M. Welker
2005 Role of Land-surface Changes in Arctic Summer Warming. *Science* 310:657–660.
- Clark, M.A.
1981 Koyukon. In *Handbook of North American Indians, Subarctic 6*. June Helm, ed. Pp. 582–601. Washington, D.C.: Smithsonian Institution Press.
- Clark, Annette McFadden
1970 Koyukon Athapaskan Ceremonialism. *Western Canadian Journal of Anthropology* 2(1):80–88.
- Coffee, Nicole and Tracy L. Meerwarth
2004 Why Scenarios: The Role of Scenarios in Futures Research. In *The Anthropological Difference*. M. Gay Chandler, ed. URL:<http://futures.anthro.nau.edu/Symp00/meerwarth.htm>
- Cohen, Stewart J.
1997 Scientist-Stakeholder Collaboration in Integrated Assessment of Climate Change: Lessons from a Case Study of Northwest Canada. *Environmental Modeling and Assessment* 2(4):281–293.
- Cooke, B. and U. Kothari
2001 *Participation: The New Tyranny?* London: Zed Books.
- Crabbe, James M.
2006 Challenges for Sustainability in Cultures Where Regard for the Future May Not Be Present. *Sustainability: Science, Practice, and Policy* 2(2). URL: <http://ejournal.nbil.org>
- Couture, R., S. Smith, S. D. Robinson, M. M. Burgess, and S. Solomon
2003 On the Hazards to Infrastructure in the Canadian North Associated with Thawing of Permafrost. *Proceedings of Geohazards 3rd Canadian Conference on Geotechnique and Natural Hazards*. Pp. 97–104. Edmonton: The Canadian Geotechnical Society.
- Domaigne, Robert
1989 Community Development through Ethnographic Futures Research. *Journal of Extension*, Volume 27 (2):1–3. URL:<http://www.joe.org/joe/1989summer/fut1.html>
- Duerden, Frank
2004 Translating Climate Change Impacts at the Community Level. *Arctic* 57(2):204–212.
- Escobar, Arturo
1992 Planning. In *The Development Dictionary*. Wolfgang Sachs, ed. Pp. 132–145. London: Zed Press.
- Evans-Pritchard, E.
1939 Nuer Time-Reckoning. *Africa* 12:189–216.
- Feit, Harvey
2004 James Bay Cree: Life Projects and Politics: Histories of Place, Animal Partners and Enduring Relationships. In *The Way of Development: Indigenous Peoples, Life Projects and Globalization*. Mario Blaser, Harvey A. Feit, and Glenn McRae, eds. London and Ottawa: Zed Books, and the Canadian International Development Research Center.
- Fox, S.
2002 These Are Things That Are Really Happening: Inuit Perspectives on the Evidence and Impacts of Climate Change in Nunavut. In *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change*. Igor Krupnik and Dyanna Jolly, eds. Pp. 12–53. Fairbanks: Arctic Research Consortium of the United States.
- Foucault, Michel
1977 *Discipline and Punish: The Birth of the Prison*. New York: Penguin Books.
- Furgal, Christopher and Jacinthe Seguin
2006 Climate Change, Health, and Vulnerability in Canadian Northern Aboriginal Communities. *Environmental Health Perspective* 114(12):1964–1970.
- Gell, Alfred
1992 *The Anthropology of Time: Cultural Construction of Temporal Maps and Images*. Providence: Berg.
- Goebel, A.
1998 Process, Perceptions and Power: Notes from Participatory Research in a Zimbabwean Area. *Development and Change* 29:277–305.
- Griffith, B., D. C. Douglas, N. E. Walsh, D. D. Young, T. R. McCabe, D. E. Russell, R. G. White, R. D. Cameron, and K. R. Whitten
2002 The Porcupine Caribou Herd. In *Arctic Refuge Coastal Plain Terrestrial Wildlife Research Summaries*. D. C. Douglas, P. E. Reynolds, and E. B. Rhode, eds. Pp. 8–37. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR2002-0001.
- Grim, John A.
2001 *Indigenous Traditions and Ecology: The Interbeing of Cosmology and Community*. Cambridge: Harvard University Press.
- Gubser, N.
1965 *The Nunamiut Eskimos: Hunters of Caribou*. New Haven: Yale University Press.
- Gurvitch, Georges
1964 *The Spectrum of Social Time*. Dordrecht: Reidel.
- Heemskerk, Marieke
2003 Scenarios in Anthropology: Reflections on Possible Futures of the Suriname Maroons. *Futures* 35:931–949.
- Hill, Carole E. and Marietta L. Baba (eds.)
2000 *The Unity of Theory and Praxis: Rebuilding a Fractured Synthesis*. *American Anthropologist*

- logical Association, National Association for the Practice of Anthropology (NAPA) Bulletin, 18.
- Howitt, Richard
2001 *Rethinking Resource Management: Justice, Sustainability, and Indigenous Peoples*. New York: Routledge Press.
- Hughes, Diane O. and Thomas R. Trautmann (eds.)
1995 *Time: Histories and Ethnologies*. Ann Arbor: University of Michigan Press.
- Huntington, H. P., S. F. Trainor, D. C. Natcher, O. Huntington, L. O. DeWilde, and F. S. Chapin
2006 The Significance of Context in Community-Based Research: Understanding Discussions about Wildfire in Huslia, Alaska. *Ecology and Society* 11:40. URL:<http://www.ecologyandsociety.org/vol11/iss1/art40/>
- Janca, Aleksandar and Clothilde Bullen
2003 The Aboriginal Concept of Time and Its Mental Health Implications. *Australasian Psychiatry* 11(1):340–344.
- Jetté, Julius
1907 On the Medicine Men of the Ten'a. *Journal of the Royal Anthropological Institute* 37: 157–188.
- 1908 On Ten'a Folklore. *Journal of the Royal Anthropological Institute* 38:298–367.
- 1909 On Ten'a Folklore. *Journal of the Royal Anthropological Institute* 39:460–505.
- 1911 On the Superstitions of the Ten'a Indians. *Anthropos* 6:95–108, 241–259, 602–615, 699–723.
- 1913 Riddles of the Ten'a Indians. *Anthropos* 8:181–201, 630–651.
- n.d.a On the Geographical Names of the Ten'a. Unpublished Manuscript Provided by Gonzaga University.
- n.d.b On the Time Reckoning of the Ten'a. Unpublished Manuscript Provided by the Oregon Provincial Archives of the Society of Jesus, Crosby Library, Gonzaga University.
- Jones, Eliza
1978 *Junior Dictionary for Central Koyukon Athapaskan*. Anchorage: National Bilingual Materials Development Center.
- Krauss, Michael E.
1982 *Native Peoples and Languages of Alaska*. Alaska Native Language Center, University of Alaska Fairbanks.
- Langdon, Steven J.
1992 *The Native People of Alaska: Traditional Living in a Northern Land*. Anchorage: Greatland Graphics.
- Loyens, William J.
1964 The Koyukon Feast for the Dead. *Arctic Anthropology* 2(2):133–148.
- Loyens, William J.
1966 The Changing Culture of the Nulato Koyukon Indians. Ph.D. dissertation, Department of Anthropology, University of Wisconsin. Madison: University Microfilms.
- Marcotte, James R.
1986 *Contemporary Resource Use Patterns in Huslia, Alaska, 1983*. Department of Fish and Game, Division of Subsistence Technical Paper, 133, Fairbanks, Alaska.
- Munn, Nancy D.
1992 The Cultural Anthropology of Time: A Critical Essay. *Annual Review of Anthropology* 21:931–23.
- Nelson, Richard
1983 *Make Prayers to the Raven: A Koyukon View of the Northern Forest*. Chicago: University of Chicago Press.
- Nuttall, Mark
2001 Indigenous Peoples and Climate Change Research in the Arctic. *Indigenous Affairs* 4:26–34.
- O'Neil, John D., Brenda Elias, and Annalee Yassi
1997 Poisoned Food: Cultural Resistance to the Contaminants Discourse in Nunavik. *Arctic Anthropology* 34(1):29–40.
- Overland, J. E., M. Spillane, and N. N. Soreide
2004 Integrated Analysis of Physical and Biological Pan-Arctic Change. *Climate Change* 63(3): 291–322.
- Persoon, Gerard and Diny M. E. van Est
2000 The Study of the Future in Anthropology in Relation to the Sustainability Debate. *European Journal of Anthropology* 35:7–28.
- Pickering, Kathleen
2004 Decolonizing Time Regimes: Lakota Conceptions of Work, Economy, and Society. *American Anthropologist* 106(1):85–98.
- Proshutinsky, A.Y. and M. A. Johnson
1997 Two Circulation Regimes of the Wind Driven Arctic Ocean. *Journal of Geophysical Research* 102:493–514.
- Reidlinger D. and Fikret Berkes
2001 Contributions of Traditional Knowledge to Understanding Climate Change in the Canadian Arctic. *Polar Record* 37(20):315–329.
- Riner, Reed D.
1991 Anthropology about the Future: Limits and Potential. *Human Organization* 50(3):297–311.
- Sampson, Colin
2003 *A Way of Life that Does Not Exist: Canada and the Extinction of the Innu*. London: Verso Press.
- Study of Environmental Change (SEARCH)
2005 *Plans for Implementing the International Polar Year and Beyond*. Fairbanks: Arctic Research Consortium of the United States (ARCUS).

- Smith, Barney and Dorothy Colley
2003 Through the Eyes of Hunters: How Hunters See Caribou Reacting to Hunters, Traffic, and Snow Machines near the Dempster Highway, Yukon. Yukon Fish and Wildlife Branch MR-03-01. Whitehorse:Yukon Territory.
- Stern, Pamela
2003 Upside-Down and Backwards: Time Discipline in a Canadian Inuit Town. *Anthropologica* 45:147–161.
- Stirling, Ian and C. L. Parkinson
2006 Possible Effects of Climate Warming on Selected Populations of Polar Bear (*Ursus maritimus*) in the Canadian Arctic. *Arctic* 59(3):261–275.
- Suchet, Sandie
2002 “Totally Wild”? Colonizing Discourses, Indigenous Knowledge, and Managing Wildlife. *Australian Geographer* 33(2):141–157.
- Sullivan, Robert J.
1942 Temporal Concepts of the Ten’a. *Primitive Man* 15(3–4):57–65.
- Tax, Sol
1952 Action Anthropology. *America Indigenia* 12:103–109.
- Texter, R. B.
1990 Methodological Appendix. In *The Middle Path for the Future of Thailand: Technology in Harmony with Culture and Environment*. S. Ketudat, ed. Pp. 135–152. Honolulu: Institute for Culture and Communication.
- Textor, R. B.
1980 *A Handbook on Ethnographic Futures Research*. Stanford: Stanford University Press.
- Toulmin, Stephen and June Goodfield
1965 *The Discovery of Time*. London: Hutchinson.
- United States Census
2000 American Indian and Alaska Native Areas. General Population Characteristics. Washington: United States Department of Commerce Economics and Statistical Administration.
- Van Est, Diny and Gerard Persoon
2001 Constructing the Future: Dynamics of Local and External Views Regarding Community-Based Resource Management. In *Analytical Issues in Participatory Natural Resource Management*. Bhaskar Vira and Roger Jeffery, eds. Pp. 37–50. London: Palgrave.
- Van Notten, Phillip W. F., Jan Rotmans, Marjolein B. A. van Asselt, and Dale S. Rothman
2003 An Updated Scenario Typology. *Futures* 35:423–443.
- Vanstone, James W.
1974 *Athapaskan Adaptations: Hunters and Fishermen of the Subarctic Forest*. Chicago: Aldine Publishing Company.
- von Thater-Braan, Rose
2001 The Six Directions: A Pattern for Understanding Native American Educational Values, Diversity, and the Need for Cognitive Pluralism. Paper presented at the SECME Summer Institute Plenary Session, University of Arizona, Tucson, Arizona, July 10, 2001. URL: <http://oneearthoneuniverse.org/doc/CognitivePluralism.pdf>
- Walker, B., S. Carpenter, J. Anderies, N. Abel, G. S. Cumming, M. Janssen, L. Lebel, J. Norberg, G. D. Peterson, and R. Pritchard
2002 Resilience Management in Social-Ecological Systems: A Working Hypothesis for a Participatory Approach. *Conservation Ecology* 6(1):14. URL:<http://www.consecol.org/vol6/iss1/art14>
- Wallman, Sandra
1992 *Contemporary Futures: Perspectives from Social Anthropology*. London: Routledge Press.
- Wollenberg, Eva, David Edmunds, and Louise Buck
2000 Anticipating Change: Scenarios as a Tool for Adaptive Forest Management. Center for International Forestry Research. SMT Grafika Desa Putera, Indonesia.
- Yohe, Gary and Michael Schlesinger
2002 The Economic Geography of the Impacts of Climate Change. *Journal of Economic Geography* 2:311–341.