

# Gone the Bull of Winter?

## Grappling with the Cultural Implications of and Anthropology's Role(s) in Global Climate Change

by Susan A. Crate

Because global climate change is intimately linked to culture, anthropologists are strategically well-placed to interpret it, communicate information about it, and act in response to it both in the field and at home. Fieldworkers are increasingly encountering reports of the local effects of climate change from their research partners, and it is becoming apparent that indigenous peoples' recognized capacity for adaptation to change may not be sufficient to cope with these effects. Fieldwork among Viliui Sakha of northeastern Siberia suggests an action-oriented approach to anthropological climate change research that begins by developing cultural models of the local effects of global climate change, goes on to fill in the gaps with Western scientific knowledge, and ends with the dissemination of that information and its use for the development of adaptive strategies, policy recommendations, and advocacy.

In the summer of 2003, well into my second decade of study and research with rural Viliui Sakha, native horse and cattle breeders inhabiting the Viliui regions of northeastern Siberia, I heard my research partners' first testimonies to the local effects of global climate change.<sup>1</sup> Since that time, Sakha have continued to speak about the "softening"<sup>2</sup> of the climate and the increasing summer precipitation, factors that are affecting their ability to maneuver the brief window of summer to harvest enough hay to sustain their herds through the winter. Concomitantly, I realized that other field researchers, most notably anthropologists, are also encountering the issues of global climate change with their research partners. Although many of us are versed in the frames of adaptive capacity and resilience, we have begun to doubt that such coping mechanisms are sufficient to deal with the effects of global climate change. We realize that environmental and cultural change far beyond the reach of restoration is occurring.

We find ourselves in a state of emergency as field researchers and are confronted with an ethical and a moral issue, and a number of questions related to our age-old struggle as academics to reconcile anthropology's applied, public, and activist roots (Lassiter 2005, 84). We ask what our proper responses and responsibilities to our research partners are in these revelations. How do we translate, advocate, educate, and

mediate between our research communities and the larger global community? What theoretical frames inform these queries, and how can we design effective research approaches?

Those of us who work with indigenous<sup>3</sup> communities<sup>4</sup> de-

1. I use "research partners" here to refer to the people and communities with whom I conduct research. I am talking about climate change attributed directly or indirectly to human activity in accordance with the United Nations Framework Convention on Climate Change's use of the term (IPCC 2007, 20). Global climate change is a complex, changing phenomenon. It is beyond this article's scope to detail the science and recent findings. I will, however, provide a brief overview based on the Arctic Climate Impact Assessment (ACIA 2005). Scientists studying ice cores and other evidence have ascertained the correlation between concentrations of CO<sub>2</sub> in the atmosphere and temperature. Since the industrial revolution, global CO<sub>2</sub> concentrations have risen 35%. Average global temperatures have increased 0.6°C, and added CO<sub>2</sub> at the present rates will result in a rise in average temperature of 1.4°–5.8°C in the next century. Climatic changes are expected to result in a dramatic change in air and ocean currents, sea-level rise, and unpredictable precipitation events. These changes will significantly impact human, animal, and plant communities. Some readers may consider the term "global climate change" misleading because it suggests a single phenomenon when global climate change is a complex of multiple processes, dimensions, influences, feedbacks, and impacts. However, it is beyond the scope of this article to identify the exact combination of processes involved each time I use the term.

2. "Softening" refers to a lessening of the extremes of the climate, most often referring to temperature highs and lows.

3. I use the term "indigenous" as defined in Article 1 of the International Labor Organization's "Convention Concerning Indigenous and Tribal Peoples in Independent Countries" (ILO No. 169): "People who are regarded as indigenous on account of their descent from the populations which inhabited the country, or a geographical region to which the country belongs, at the time of conquest or colonization or the establishment of present State boundaries and who, irrespective of their legal status, retain some or all of their own social, economic, cultural and political institutions." Also,

**Susan A. Crate** is an anthropologist specializing in Human Ecology and Assistant Professor in the Department of Environmental Science and Policy at George Mason University (David King Hall, MS 5F2 4400, University Drive, Fairfax, VA 22030-4400, U.S.A. [scrate1@gmu.edu]). This paper was submitted 10 VII 06 and accepted 25 X 07.

pendent on the natural environment for their livelihoods deliberate on our role in facilitating our research partners' adaptive responses.<sup>5</sup> We ponder what our response should be when our research partners' testimonies enter our stories, since global climate change is mainly fueled by lifestyles based on consumption. Western anthropologists may contemplate how to translate their field experience of global climate change into compelling messages and projects to persuade home audiences to move toward a carbon-free, sustainable society.<sup>6</sup> Similarly, non-Western and indigenous anthropologists may craft appeals on a more global scale to strengthen and empower their research partners' voices in the arenas of climate justice and human rights.

My own "ethnographic moment"<sup>7</sup> occurred when I heard a Sakha elder<sup>8</sup> recount the age-old story of Jyl Oghuha (the bull of winter). Jyl Oghuha's legacy explains the 100°C annual temperature range of Sakha's subarctic habitat.<sup>9</sup> Sakha per-

sonify winter, the most challenging season for them, in the form of a white bull with blue spots, huge horns, and frosty breath. In early December this bull of winter arrives from the Arctic Ocean to hold temperatures at their coldest (−60° to −65° C; −76° to −85°F) for December and January. Although I had heard the story many times before, this time it had an unexpected ending (male, b. 1935):<sup>10</sup>

The bull of winter is a legendary Sakha creature whose presence explains the turning from the frigid winter to the warming spring. The legend tells that the bull of winter, who keeps the cold in winter, loses his first horn at the end of January as the cold begins to let go to warmth; then his second horn melts off at the end of February, and finally, by the end of March, he loses his head, as spring is sure to have arrived. It seems that now with the warming, perhaps the bull of winter will no longer be.

Both the transformation of their symbolic culture<sup>11</sup>—represented here by the bull of winter—and of their subsistence culture—the increasing challenge to maintain their herds as warming continues—reframe the implications of unprecedented global climate change. I argue that global climate change—its causes, effects, and amelioration—is intimately and ultimately about culture. It is caused by the multiple drivers of Western consumer culture, it transforms symbolic and subsistence cultures (represented by the Viliui Sakha case here), and it will only be forestalled via a cultural transformation from degenerative to regenerative consumer behavior. Accordingly, anthropologists are strategically well-placed to interpret, facilitate, translate, communicate, advocate, and act

---

I use the terms "indigenous," "aboriginal," and "native" interchangeably (Brown 2003, xiii).

4. I use "community/communities" in a general way to refer to a population that is associated with a specific ethnicity or geographic location, e.g., "indigenous community" or "village community." These are not necessarily communities that are unanimously united in their interests and speak with one voice. Different inhabitants have different opinions, conflicting agendas, and different connections to the centers of power.

5. My intent here is not to create a polar contrast between indigenous peoples and Western peoples. On the contrary, my aim is to show the complex ways in which indigenous peoples shape and are shaped by the world system in order to highlight both the tenacity and the vulnerability of their cultural survival—which depends on an intimate knowledge of and connection to the natural world.

6. I use "consumer culture" generically to refer to any culture that is founded on attachment to materialistic values and/or possessions.

7. A term I use based on Stuart Kirsch's (2002, 175) use and for which he gives credit to Marilyn Strathern (1999).

8. I use "elders" differently from the popular use in the anthropological literature on North American First Nations and indigenous peoples. In the post-Soviet context, elders do not enjoy a degree of authority within their community that corresponds to that, for example, of Inuit elders. Sakha elders belong to a specific age cohort (55+). Only in recent years, with conscious efforts to recall and revive their knowledge, are elders gaining some degree of authority in their settlements (Crate 2006b).

9. There are several portrayals of the bull of winter in classic Sakha ethnographic texts:

"Winter, the hardest time for working people, Sakha personify in the form of a white bull with blue spots which has huge horns and frosty breath. When this bull traveled to the spacious Sakha homeland, all in nature froze and the people and animals suffered from the cold. At the end of January, winter reached its peak. The day before the end of January, a mighty eagle arrived from the south, child of the warm sky, he scooped up snow in his nest and let out a loud cry. From the eagle's cry, the bull of winter stepped back and his horns, one by one, fell off, then, as spring approached, his head rolled off. During the ice flows, the trunk of the bull of winter swims at the bottom of the Lena to the Arctic Ocean, and the ice flow takes away the spirits of dead people and herds" (Ergis 1974, 123–24).

"Jil Bull is the personification of winter in the form of a bull. Sakha believe that he comes every year from the Arctic Ocean and brings with himself cold, starvation, need, and etc. In spring, near Afanasii Day, he loses one horn, then near the second Afanasii day, he loses the other.

---

Whether he dies in the spring or returns to the Arctic Ocean—the Sakha either forgot or did not know" (Kulakovskii 1979, 45–46).

"The freeze is definitely a bull and he has 2 horns—the first falls off on the first Afanasii Day (5 March), the second on the second Afanasii Day (24 April) and on the third Afanasii (14 May) the whole body falls (these dates are according to the old calendar so in our calendar would be 19 February, 10 April, 30 April, respectively)" (Seroshevskii 1993 [1896], 26).

"Creating the world, the Gods asked humans, 'Do you want winter to be longer or summer?' The humans answered, 'Ask our friends—the horse and bull.' The horse wanted summer longer because in winter its legs and hooves felt very cold. But the bull wanted winter longer because in summer heat its nose got wet. Then the Gods made winter longer and summer shorter. Having got angry, the horse kicked the bull in the nose and knocked out its upper teeth. The bull butted the horse into its side and pierced through its bile. Since that time horse have not bile and horned cattle no upper teeth" (Sivtsev 1996 [1947], 131).

10. All quotes are anonymous, except for birth year and gender.

11. I use the term "culture" to refer to both the series of prescribed human activities and the prescribed symbols that give those activities significance; both the specific way given people classify, codify, and communicate experience symbolically and the way those people live in accordance with beliefs, language, and history. Culture includes technology, art, science, and moral and ethical systems. All humans possess culture, and the world is made up of a diversity of cultures. Accordingly, I use the term in both its singular and plural forms.

both in the field and at home in response to the cultural implications of unprecedented climate change.<sup>12</sup>

My aim in this article is to bring to light the cultural implications of climate change and to identify theoretical frames and research approaches that can both tap into anthropology's particular ways of knowing and move anthropologists conducting research with indigenous communities and global climate change from impartial observers into the realm of action-oriented researchers. In the process, I also hope to explore our roles as scholars, advocates, communicators, and activists in our work on global climate change.

I first orient the reader to frames of existing research on adaptive capacity, vulnerability, and resilience, the main approaches used to address global climate change and indigenous populations. I next detail the cultural implications of global climate change, explore the subfields of anthropology most appropriate for global climate change research, and suggest a preliminary research agenda. I ground my discussion in Viliui Sakha elders' observations of and insights into the local effects of global climate change. In conclusion, I propose a research scenario based on both the empirical case and the theoretical foundations established earlier.

## Adaptive Capacity, Vulnerability, and Indigenous Peoples in Global Climate Change Research

The resilience of human and nonhuman systems in the face of change is a function of those systems' adaptive capacity (Berkes, Colding, and Folke 2003). In contrast to other biological systems, human-environment interactions are highly complex, involving multiple feedbacks that generate new effects and outcomes (Gunderson and Holling 2002). Humans often negotiate these complex relationships via intricate systems of belief (Berkes 1999; Rappaport 1984). Indigenous peoples possess a relatively high capacity for adaptation to uncertainty and change because of both a generalist and time-tested knowledge of subsistence survival and a propensity for innovation in the context of environmental, sociocultural, political, and economic change (Berkes 1999). Despite this, they are also highly vulnerable to exploitation by more technologically advanced groups. History clarifies how events in-

12. These implications as I see them have to do with people and power, ethics and morals, environmental costs and justice, and cultural and spiritual survival. Scholars are beginning to address the equity and justice implications of climate change (see, e.g., Thomas and Twyman 2005). On a temporal scale, the effects of global climate change are the indirect costs of imperialism and colonization—the “non-point” fallout for peoples that have been largely ignored. These are the same peoples whose territories have long been dumping grounds for uranium, industrial societies' trash heaps, and transboundary pollutants. This is environmental colonialism at its largest scale, with far-reaching social and cultural implications. Global climate change is the result of global processes that were neither caused by nor can be mitigated by the majority of the regions now experiencing most of its effects. Thus, indigenous peoples find themselves at the mercy of changes beyond their control.

teract with adaptive capacity and vulnerability (Crumley 2001, 1994; Egan and Howell 2001). History shows Viliui Sakha to have a high level of adaptive capacity (Crate 2006a). Their Turkic ancestors adapted their southern horse and cattle agropastoralist subsistence to the subarctic environment, an adaptation dependent on an intricate web of plant, animal, and spirit relationships. Sakha's bull of winter testifies to the resilience of that sacred belief system to this day.

In the post-Soviet context, Viliui Sakha have adapted to the rapid change from a socialist centralized system to decentralized household-level production (Crate 2003b, 2006a). Robert Netting's analyses of smallholder systems provide many examples of similar adaptive strategies in Nigeria, China, Japan, Bali, Java, and the Swiss Alps that parallel Viliui Sakha's post-Soviet system, based on household and interhousehold production (Netting 1993). Research in the circumpolar North also shows how groups have adapted to recent environmental and socioeconomic changes, similarly emphasizing the centrality of household-level production in indigenous communities of Greenland, northern Russia, Alaska, and Canada (Caulfield 1997; Nuttall 1998; Ziker 2002).

Adaptation has been widely discussed in boardrooms, living rooms, and government offices, often as a substitute for mitigation of the human-induced effects of global climate change (Adger, Arnell, and Thompkins 2005). International forums and discussions on global climate change use a specific language to talk about how humans and biological systems will be affected by and can adapt to local effects. Below is a brief primer to that language based on recent and past Intergovernmental Panel on Climate Change (IPCC) reports.<sup>13</sup>

*Adaptive capacity* is the potential or ability of a system, region, or community to adapt by adjusting to, moderating the potential damages of, taking advantage of the opportunities created by, or coping with the effects of global climate change. To the extent that new knowledge and other means can increase any or all of those mechanisms, adaptive capacity can increase and thereby increase the coping range (Smit and Pilifosova 2003). *Vulnerability* is defined as the extent to which a natural or social system is susceptible to or unable to cope with global climate change's adverse effects. Vulnerability is a function of the sensitivity of a system to changes in climate (the degree to which a system will respond to a given change in climate, including beneficial and harmful effects), adaptive capacity, and the degree of exposure of the system to climatic hazards (IPCC 2007, 20). Within this framework, a highly vulnerable system would be a system that is very sensitive to modest changes in climate, where the sensitivity includes the potential for substantial harmful effects, and for which the ability to adapt is severely constrained. *Resilience* is the flip side of vulnerability—a resilient system or population is not

13. I am using the framework for these terms laid out in the fourth IPCC report (IPCC 2007). These terms are also used extensively in recent special issues of journals focusing on the issue of climate change (see, e.g., *Global Environmental Change* 17[2]).

sensitive to climate variability and change and has the capacity to adapt (McCarthy et al. 2001, 89).

Important to our discussion, to date the most recent assessment, the fourth IPCC report, states that the most vulnerable societies are those in high-risk areas (coastal and river floodplains, extreme environments, etc.) and those whose economies are closely linked to climate-sensitive resources (IPCC 2007, 7). In this context, indigenous subsistence-based communities are among the highly vulnerable.

Many indigenous groups in areas where global climate change is having the most profound effects are questioning their ability to adapt: "The projected magnitude of climate change would stretch this [our] adaptive ability to the breaking point" (Watt-Cloutier 2004, 2). Indigenous peoples are not passive victims of the effects of global climate change. In fact, there has been a groundswell of advocacy by indigenous peoples in response to the local effects of global climate change. One example is the petition to the United States by the Inuit Circumpolar Conference (ICC) for consideration of global climate change in the Arctic and the United States' role in reducing greenhouse gases as a way to mitigate global climate change (ICC 2005). Past president of the ICC Sheila Watt-Cloutier's (2004) testimony explicitly frames global climate change as a human rights issue:

Inuit are taking the bold step of seeking accountability for a problem in which it is difficult to pin responsibility on any one actor. However, Inuit believe there is sufficient evidence to demonstrate that the failure to take remedial action by those nations most responsible for the problem does constitute a violation of their human rights—specifically the rights to life, health, culture, means of subsistence, and property.

A second example is the yearly restatement of the 2000 declaration by indigenous peoples at the annual Conference of the Parties to the United Nations Framework Convention on Climate Change. Here is an excerpt from the 2004 conference in Buenos Aires:

We request the urgent need to continue to raise awareness about the impact of climate change and approaches of climate mitigation and adaptation measures on Indigenous peoples and request a High-Level Segment on "Indigenous Peoples and Climate Change" be held during the 11th session of the Conference of the Parties. Panelists on this High-Level Segment shall include representatives of the UN Permanent Forum on Indigenous Issues.<sup>14</sup>

Clearly, many indigenous groups are actively expressing their concern that the local effects of global climate change

14. [http://www.tebtebba.org/tebtebba\\_files/susdev/cc\\_energy/buenosaires.html](http://www.tebtebba.org/tebtebba_files/susdev/cc_energy/buenosaires.html). For the original indigenous declaration on climate change, see [http://www.treatycouncil.org/new\\_page\\_5211.htm](http://www.treatycouncil.org/new_page_5211.htm) (accessed June 1, 2006).

may exceed their adaptive capacity and threaten the survival of their communities and cultures.

#### *Global Climate Change Research and Knowledge Gaps*

Research and collaboration in the Arctic provide substantial insight for formulating effective research agendas for indigenous peoples and global climate change (Berkes and Jolly 2001). Much of the research to date focuses on understanding community perspectives of the local effects of global climate change (Berkes 1999; Cruikshank 2001, 2005; Fox 2002; Krupnik and Jolly 2002; Nuttall 2001; Riedlinger and Berkes 2001). Newer research efforts show increased interest in communication and connecting local communities with larger systems (Duerden 2004). Other projects pursue participatory vulnerability assessments to identify adaptive strategies that are feasible and practical (Smit and Wandel 2006). These efforts frame adaptive capacity as a subset of vulnerability, the vulnerability of a system being a function of adaptive capacity and exposure (Ford and Smit 2004; Ford, Smit, and Wandel 2006).

Perhaps the most comprehensive source for addressing global climate change and indigenous peoples research in the Arctic to date is the 2005 Arctic Climate Impact Assessment (ACIA 2005), which provides solid and comprehensive analyses of the existing state of such research and highlights gaps in knowledge and further research needs. In chapter 3, "The Changing Arctic: Indigenous Perspectives," the authors emphasize the need for further research to (1) facilitate local empowerment through the devolution of authority and capacity so that communities can respond more effectively, given their specific contexts, and (2) obtain appropriate information to address the climate parameters that affect local people and ecosystems directly and to enable appropriate response (Huntington et al. 2005, 95). They emphasize the urgent need to "develop the collaborative [research] model, from small projects to large research programs and extending from identifying research needs to designing response strategies" (p. 94).

The authors of chapter 12, "Hunting, Herding, Fishing, and Gathering: Indigenous Peoples and Renewable Resource Use in the Arctic," adopt a more urgent tone in their recommendations for further research. They conclude that although Northern peoples have proven a high level of adaptation and resilience to climatic change over the millennia, the rate and extent of current and projected change challenge their adaptive capacity (Nuttall et al. 2005, 685, my emphasis):

As the climate changes, the indigenous peoples of the Arctic are facing special challenges and their abilities to harvest wildlife and food resources are already being tested. . . . The rate and extent of current and projected change give *cause for alarm*. Adaptation refers to the potential to react in a way that mitigates the impacts of negative change. Becoming

resilient to climate change, and preparing to respond, cope with, adapt to, and negotiate climate change and its impacts, risks, and opportunities will *require urgent and special attention*.

The chapter 12 authors emphasize the need to take a multiple-stressors approach and to understand global climate change in the context of the other challenges facing Arctic communities, including other environmental change, rapid social and cultural change, and globalization. Additionally, it needs to be recognized that Northern people's adaptive capacity is often restricted because of their settlement in permanent communities, which prevents them from moving in response to shifts in the pattern and state of their resource base. They conclude by highlighting the following gaps in knowledge: (1) how climate change affects social relations in indigenous communities; (2) how climate change affects the broader contexts of rapid social and economic change and how to discern between them; (3) how much change can be accommodated by the existing ways of indigenous life; (4) resilience and limits to adaptability in the face of climate change; and (5) the utility of comanagement and governance institutions in increasing a people's capacity to deal with change. Lastly, they stress that projects need to be collaborative and community-based to address the given population's research priorities (Nuttall et al. 2005, 685–86).

More recent reports emphasize that the capacity of both natural and human systems to adapt to the local effects of global climate change remains insufficiently researched (IPCC 2007). The urgency of such research cannot be overemphasized exactly because as global climate change unfolds, it will bring inevitable surprises on regional and local scales (Berkes and Jolly 2001, 13). One area not addressed in the above recommendations is research explicitly focusing on the cultural implications of global climate change. I argue that this research area is especially important to adaptive-capacity research and that anthropologists who conduct fieldwork with affected communities can play an essential role in such research efforts.

### *The Cultural Implications of Global Climate Change and Indigenous Peoples*

The effects of global climate change are not just a matter of communities' or populations' capacity to adapt and exercise their resilience in the face of unprecedented change. Global climate change means relocations of human, animal, and plant populations. Take the recent resettlements of indigenous refugees to safer ground (Tuvalu, Shishmaref). Lost with those relocations are the intimate human-environment relationships that not only ground and substantiate indigenous worldviews but also work to maintain local landscapes. In some cases, moves also result in the loss of mythological symbols, meteorological orientation, and even the very totem and mainstay plants and animals that ground a culture.

We need not be overconfident about our research partners' capacity to adapt. "Eveny are highly adaptive. Sometimes they joke, 'This is our home. If the climate gets too hot, we'll just stay and herd camels'" (Vitebsky 2006, 10). Although it is plausible that highly adaptive peoples such as the reindeer-herding Eveny of northeastern Siberia will find ways to feed themselves even if their reindeer cannot survive the projected climatic shifts, as anthropologists we need to grapple with the implications of the loss of the animals and plants that are central to a people's daily subsistence practices, cycles of annual events, and sacred cosmologies. The cultural implications could be analogous to the disorientation, alienation, and loss of meaning in life that take place when people are removed from their environment of origin, for example, when Native Americans were moved onto reservations (Castile and Bee 1992; Prucha 1985; White 1983). The only difference is that the communities experiencing the effects of global climate change are not doing the moving. As the earth literally changes beneath their feet, it is vital to understand the cognitive reverberations and cultural implications for a people's sense of homeland and place.

If we agree, as Keith Basso convincingly argues, that human existence is irrevocably situated in time and space, that social life is everywhere accomplished through an exchange of symbolic forms, and that wisdom "sits in places" (1996, 53), then we need to grapple with the extent to which global climate change is transforming these spaces, symbolic forms, and places. It follows that the result will be great loss of wisdom, of cosmologies and worldviews, and of the human-environment interactions that are a culture's core (Netting 1968, 1993; Steward 1955). As anthropologists, we need to look closely at the cultural implications of the changes that global climate change is bringing.

## Formulating Anthropological Research Approaches

Considering anthropologists' recent encounters with global climate change and their indigenous research partners,<sup>15</sup> and given the cultural implications of global climate change, I contend that we can be most effective by using the tools of applied, advocacy-oriented, and public anthropology. The practice of applied anthropology reaches back at least 75 years (Gould and Kolb 1964, 32). Its central aim is to help solve human problems and facilitate change (Chambers 1985, 8). Its genesis cannot be separated from "the birth and evolution of the discipline [of anthropology] as a whole. . . . As such it deserves a repositioning to 'serve as one of the frameworks for the discipline's goal of pragmatic engagement'" (Rylko-

15. "Anthropologists' recent encounters" refers to the diversity of papers presented in our panels for the annual 2007 meetings of the Society for Applied Anthropology (SFAA) and the American Anthropological Association. Some of these papers are forthcoming in *Anthropology and Climate Change* (Crate and Nuttall 2008).

Bauer, Singer, and Van Willigen 2006, 178–79). It shares many goals with public anthropology except that the latter takes the processes of solution and facilitation into the public realm (Borofsky 2006):

Public anthropology demonstrates the ability of anthropology and anthropologists to effectively address problems beyond the discipline—illuminating the larger social issues of our times as well as encouraging broad, public conversations about them with the explicit goal of fostering social change. It confirms our responsibility, as scholars and citizens, to meaningfully contribute to communities beyond the academy—both local and global—that make the study of anthropology possible.

A public-anthropology approach is appropriate for anthropologists working in Western societies to transform consumer culture and facilitate social change explicitly to reduce the local effects of global climate change in our research partners' homelands and other vulnerable areas of the world.

In the past two decades, while anthropology has increasingly adopted applied and public approaches, there has also been an increase in anthropologists' acting as advocates as they witness ethical and human rights abuses in the field (Nagengast and Vélez-Ibáñez 2004). Advocacy has a strong history and many success stories (Rylko-Bauer, Singer, and Van Willigen 2006, 181). Advocacy has a similar place in global climate change research as it has had in other cases of environmental justice. Considering our witness to the local effects of global climate change for our research partners, I echo Stuart Kirsch's sentiment regarding anthropologists' responsibility to the communities in which they work—that neutrality is not an option (Kirsch 2002, 175). Advocacy is key not only to our collaborative relationship with communities but also to representing their best interests in policy and other advocacy contexts.

Although indigenous peoples are actively advocating for themselves in many parts of the world, not all local contexts are alike. There are places, such as northern Russia, where civil society and advocacy lack the legacy that they have in Canada, Greenland, and Alaska, where indigenous groups are proactive on local issues such as global climate change.<sup>16</sup> In

16. I am not implying that it is necessary to install "civil society" in Viliui Sakha communities from scratch, but Inuit and other Northern communities are far more successful when it comes to expressing their concerns and interests to the wider (global) public. Since the fall of the Soviet Union there has been a gradual increase in political institutions, NGOs, and researchers-cum-advocates in the Russian North. For example, in the case of the Eveny, local elites can articulate their concerns—at least to some extent—via the Russian Association of Indigenous Peoples of the North (RAIPON). Vasilii Robbek and his team of researchers in Yakutsk have been trying to address several politically relevant issues in their research, and at least with some success (see <http://www.sitc.ru/ync/narod1.htm>). Places and spaces for self-determination in Sakha and the Russian North in general are very different from those in Alaskan or Canadian Northern communities. Local educational institutions such as schools, libraries, houses of culture, etc., do play a significant role in

these contexts, anthropologists have key roles. We can work as communicators both to our indigenous research partners (understanding and potentially providing information they need about global climate change and in proper form[s]) and also as facilitators of advocacy by sharing the experiences of other indigenous groups and seeking out the local, regional, and national channels to express local concerns and inform policy. Similarly, we can link our research partners with other place-based communities of risk that have gone through similar disasters (Cutter and Emrich 2006; Hoffman and Oliver-Smith 2002; Oliver-Smith 1996, 2005; Thomalla et al. 2006).

Considering the cultural implications of global climate change, one approach to a research agenda incorporating applied and advocacy approaches begins with understanding how our research partners perceive the change that is occurring. Once their perceptions are accounted for in whatever ways our research partners see fit, we can reframe and inform them to encourage positive change.<sup>17</sup> Thereby our work becomes applied.

#### *Developing Cultural Models: Accounting for the Emic*

The first step in this process is to listen, share, and accommodate our research partners' ways of knowing and observing (Krupnik and Jolly 2002, 1) and construct cultural models of how they perceive the local effects of global climate change on their world and worldview. With their seminal publication *Weather, Climate, Culture*, Strauss and Orlove underline both anthropology's legacy and its continuing work in deciphering how peoples, as cultural beings, relate to, talk about, and frame their perceptions, in this case, of weather and climate (Strauss and Orlove 2003, 3):

Unlike other animals, humans have unusually varied and elaborate forms of social life and communication that are made possible by language and by culture. Our complex forms of collective life influence the way we are affected by weather and climate, creating both forms of vulnerability and capacities to reduce impacts. Our highly developed cognitive capacities allow us to recall the past and anticipate the future.

This work and related research on cultural models and cognitive framing provide the tools to enter as closely as possible the world of "the other" and access our research partners' frames of reference. In-depth understanding of the locale and the culture are critical to this effort and will help us to locate

---

ecological/environmental education and campaigning, and these institutions should be considered and included in the process of local "capacity building."

17. For example, Jim Siegel emphasizes the need to (1) spread the word to the American citizenry about Arctic peoples' plight; (2) demand that national and international forums more fully consider that plight when addressing issues and formulating legislation and policy; and (3) facilitate broad public support for indigenous peoples' rights so that they can make their own decisions and control their own destinies (Siegel 2006, 27).

potential distortions where they exist (Henshaw 2003, 219). Oral history is a key source for understanding adaptive strategies and a people's collective understanding of global climate change (Cruikshank 2001, 2005).

The theoretical frame of cognitive anthropology enables us to "study the relationship between human society and human thought, and how people in social groups conceive and think about objects and events, both abstract and concrete, which make up their world" (D'Andrade 1995; Kempton 2001). In the case of the Viliui Sakha, who, like the Nuer, construct their daily acts and spiritual orientations around the needs of their bovine companions (Crate 2006a, 2003b; Evans-Pritchard 1940),<sup>18</sup> global climate change is transforming the natural grassland and taiga ecosystem of northeastern Siberia to the extent that cows may not be able to live there. Knowing the centrality of cows to rural Viliui Sakha subsistence and cosmology, I found it difficult to fathom how my research partners could adapt to the loss of an animal that is the foundation of their culture. Similarly, Northern reindeer-herding peoples are realizing an increasingly difficult subsistence as their herds are progressively restricted by impervious ice beneath the snow where they routinely do their winter foraging.

These peoples *can* adopt some other mode of subsistence—perhaps turn to fishing as more and more of their landscapes give way to increased saturation and cryogenic lakes expand to cover more and more of the land. Less is known about how the local effects of global climate change will play out in terms of a people's cultural predilections, the restacking and appropriating of their belief systems, and their cognitive orientation—their perceptions of and assumptions about "home," that cyclical arrangement of annual changes that supports the variety of plants, animals, and ecosystems. Perhaps for Viliui Sakha, both their horse and cattle subsistence and their bull of winter will morph into new metaphors that will explain how life was before. In the field, we need to understand how our research partners frame the local effects of global climate change in order to tease out these cultural implications.

### *Informing Local Knowledge: Introducing the Etic*

The development of cultural models and cognitive frames is one starting point for our work—but it is not enough to take into account only our research partners' expertise (Huntington 2002, xxv). We also need to provide information that will complement local understandings and facilitate positive action. Work in Sachs Harbour, Canada, combining indigenous and Western scientific knowledge shows that despite the problem of finding compatible terminology, indigenous knowledge can verify Western scientific measures and, in the process, work to build local capacity (Nichols et al. 2004). To

18. I recognize that this sentence portrays contemporary rural Viliui Sakha as unengaged in the modern world. This is not my intent.

do this, our research approach must be inherently collaborative and locale- and culture-specific.

With these basic understandings of global climate change, adaptive capacity, global climate change research with indigenous peoples, and anthropology's unique role in what I term a cognitive/perceptual research approach in mind, I next ground these understandings inductively through Viliui Sakha elders' observations of and insights into the local effects of global climate change that I heard in the summer of 2005. It is essential to understand how Viliui Sakha are framing their concerns of global climate change—what they are seeing these climate perturbations *with*—how they are framing these changes (Quinn and Holland 1987).

## Encountering Global Climate Change in Viliui Sakha Communities

Since 1991 I have worked and conducted research with Viliui Sakha communities, native agropastoralists inhabiting the Viliui River regions of northwestern Sakha Republic, northeastern Siberia, Russia (fig. 1). Before delving into Viliui Sakha's contemporary encounters with global climate change, I will first establish the historical and cultural context.

### *Historical and Cultural Background*

Sakha are a Turkic-speaking people whose ancestors migrated from central Asia to southern Siberia around 900 and then moved northward along the Lena River to their present homeland beginning in the 1200s. They inhabit a subarctic region characterized by continuous permafrost and annual temperature fluctuations of 100°C, from -60°C (-76°F) in winter to +40°C (104°F) in summer.<sup>19</sup> Viliui Sakha have a high adap-

19. In the early Tertiary period, 50 million years BP, Eurasia's climate was warm, and it was home to a diverse flora and fauna (Okladnikov 1970, 9). Southern Eurasia was moist and tropical, with species such as laurel, palm, eucalyptus, fig, sequoia, and a broad range of evergreen tropical plants. Fossilized remains found in the tundra of Northern Sakha of beech, hornbeam, alder, birch, elm, maple, oak, and walnut show the former deciduous forests. In the late Tertiary/early Quaternary, the climate grew markedly colder and more humid across the earth. The Northern fossil record shows a shift from deciduous forest to cold-thriving species. This climatic change was partly due to tectonic transformations that produced extensive mountain ranges and the submersion of the Bering land bridge (Okladnikov 1970, 12–16; Suslov 1961, 187–89). Increased precipitation brought heavy accumulations of ice and snow in formerly temperate areas, destroying formerly rich flora and fauna. Many parts of Eurasia were covered with ice, which reached a depth of 2 kilometers (1.24 miles) in some places.

Siberia was the exception. With its protection from oceanic humidity and precipitation by high mountains to the east and south and by the cold Arctic Ocean to the north, glaciation of northeastern and central Siberia during the last ice age lagged behind that in Europe. Most of eastern Siberia remained free from above-ground ice shields and provided refuge for many plant and animal species that were "iced out" elsewhere. Siberia was affected by underground ice or permafrost. Mammoth, woolly rhinoceros, wild horse, and musk ox remains date the permafrost formation to that time (Suslov 1961, 145). The eastern Siberian permafrost



Figure 1. The contemporary Sakha Republic, showing its location within the Russian Federation and, to the right, the location of the capital city, Yakutsk, the Viliui River, and two of the four research villages, Elgeei and Kutana.

tive capacity. With their northern move, Sakha adapted their horse and cattle breeding subsistence to the subarctic climate by keeping their cows in barns nine months of the year and harvesting winter fodder during the brief summer. Russians began colonizing the Viliui regions in the mid-1600s, annexing indigenous lands, taking resources, and demanding fur tribute from all local inhabitants. This burdened native inhabitants, since part of the energy they expended toward their already energy-intensive subsistence practices had to be redirected to trapping fur-bearing animals for the state.

Far greater challenges for Viliui Sakha came in the past century of Soviet and now post-Soviet regimes. Sovietization involved both regional industrial exploitation and the transformation of kin-based household-level production systems first into collectives and then by the mid-1950s into agro-industrial state farms. Collectivization changed settlement patterns from extensive to concentrated and can be seen on the landscape to this day. The mapping of contemporary elders' birthplaces shows a scattering across the landscape of homesteads that have since been abandoned for life in the village centers (Crate 2002). Collectivization also brought changes in subsistence practices—from an indigenous, time-tested, and ecologically based subsistence to an agro-industrial

is a relic of the last ice age—a surrogate of the massive ice covers that were characteristic of adjacent high-latitude areas. This protection also explains why Siberian permafrost extends farther south—in some cases to the same latitudes as Kiev, Paris, and Vienna—than permafrost in other parts of the contemporary world (Jochelson 1933).

production system. Other effects of collectivization and state farm consolidation include (1) the loss of indigenous ecological knowledge, (2) the loss of the use of vast areas of land, rendered too distant from farm centers, (3) dependence on modern transportation to reach necessary resources, (4) environmental stress in populated areas due to the concentration of wastes, (5) the radial depletion of adjacent resources, and (6) the dissolution of family/clan interdependence to redirect labor to the state farm, whose sole objective was producing meat and milk for the diamond industry.

Soviet industrialization for Viliui Sakha meant diamond mining, which, like all Soviet-period industrialization, was not confined by environmental laws and regulations (Peterson 1993, 175). This resulted in contaminated water and air: local drinking water with heavy metals and phenols and local air with nuclear fallout (Crate 2003a). Because large amounts of electric energy were needed for the mining industry the government built the Viliui GES (hydroelectric station), the reservoir of which flooded 356,000 acres of prime fields and woodlands containing haying, pasturing, and hunting areas and economically valuable timberlands. The government imported workers from western parts of the USSR, mostly from Ukraine, Byelorussia, and European Russia, to supply the manpower. This increased the overall population of the Viliui regions and diversified their ethnic makeup.

In the early 1990s, with the collapse of the Soviet Union, the majority of local and regional state farm directors in the Viliui regions agreed to disband their farms. Overnight, village



populations went from conditions of near full employment and ample larders to unemployment and empty shelves. In response, Viliui Sakha communities reinstated household-level food production via a system termed “cows-and-kin,” which focused on keeping cows and exchanging labor and products with kin (Crate 2003*b*, 2006*a*). A typical cows-and-kin arrangement involves the interdependence of an elderly parental household that keeps cows and performs all daily tasks with one or several young households, usually the elders’ children’s, that receive all their needed meat and milk products in exchange for performing the labor-intensive work of harvesting annual forage for the herd. Cows-and-kin, in some ways a return to pre-Soviet subsistence, represents a unique adaptation that is historically founded, environmentally sustainable, and culturally resilient, and it offers a sound mode of household-level food production for contemporary rural Viliui Sakha.

Today, households continue to rely heavily on subsistence production, supplementing a mainstay diet of cow meat and milk products with food from gardens and greenhouses, foraging (hunting, fishing, and gathering), and domesticates, including horses, pigs, and chickens. Village households depend on a mixed cash economy, with most of their cash originating from state transfer payments in the form of state subsidies and pensions. Monetary resources are freely shared; most often, elders’ pensions are shared freely with young kin households. Since the 1991 fall of the Soviet Union, inhabitants have had more or less open access to Western media sources and a full array of consumer goods. Sakha in both urban and rural communities partake increasingly of a “consumer lifestyle.” Consumption has become a means to asserting one’s identity and status within the community.

### *Global Climate Change Encounters*

From 2003 to 2006 I facilitated a National Science Foundation project entitled “Investigating the Economic and Environmental Resilience of Viliui Sakha Villages: Building Capacity, Assessing Sustainability, Gaining Knowledge” by engaging local Viliui Sakha communities in defining sustainability and identifying barriers preventing them from realizing their definitions (Crate 2006*c*).<sup>20</sup> Barriers are many, but the local effects of global climate change were what we found most difficult for local communities to perceive ways to adapt to. In our 2004 survey, 90% of the participants expressed their concern about local climate change.<sup>21</sup> When we probed further, par-

20. This was a collaborative project involving myself, a research assistant from the United States, a research assistant in each of the four villages, and the communities themselves.

21. We administered surveys to a stratified sample of 30% (Elgeei:  $n = 63$ , Kutana:  $n = 24$ ) of all households that I had surveyed in 1999–2000 (Elgeei:  $n = 210$ , Kutana:  $n = 79$ ). We completed surveys in an interview context to gather demographic, economic, and employment data and to track the past decade of post-Soviet cow-keeping activity, soliciting information concerning access to land, time input for daily cow keeping and seasonal bottlenecks, kin networks and dependence on them for labor, land, and resources, changes in herd size, cash inputs,

participants said that they were seeing unheard-of changes in their local areas and perceived them as a threat to their subsistence.

Part of the three-year community sustainability project was an elder-knowledge component that brought village youth together with their elders to record and use elder knowledge to bolster local definitions of sustainability (Crate 2006*b*).<sup>22</sup> In response to our 2004 survey results, in summer 2005 we worked with village youth to interview 33 elders about their local observations of climate change.<sup>23</sup> We asked a simple set of questions about what elders observed, how their lives were affected, what the causes were, and what the future would bring. We found that elders possessed ecological knowledge about how the climate was and how it has changed. In lieu of comprehensive local climatic data,<sup>24</sup> village elders’ knowledge is vital. Most elders offered testimony similar to the following statement (male, b. 1938):

The climate is definitely different from before. When I was little, the winters were very cold, minus 50–60 degrees. When we spit, it froze before it hit the ground, and flying birds sometimes would freeze and die. The summer was a wonderful hot temperature, and the hay you just cut would dry very quickly. In the past few years the climate has changed. We have rain, rain, rain all the time, and winter comes late and so does spring. For people who live with a short summer when there needs to be the right weather to accomplish everything for the winter and there is cool rainy times so that the hay does not dry and has to sit and sit and the quality is bad because of that, it is the right time for haying but the conditions are all wrong.

So what are the changes elders are observing? Sakha elders reported that they could not read the weather anymore (female, b. 1942):

From long ago we could read the weather and know what weather would come according to our “Sier-Tuom” [Sakha sacred belief system]. But we can’t do that anymore. Before we could tell from the star constellations, from the direction that the moon rose, where the moon is in constellation

and annual production amounts of meat, milk, and other products. The survey instrument was developed on the basis of both the communities’ definitions of sustainability generated during the first field season of the project and standardized questions used in the Survey of Living Conditions in the Arctic project (<http://www.arcticlivingconditions.org/>).

22. In each of our four research villages we worked with a village research assistant who identified and invited elders in that village to participate in the project. The village research assistant was also tasked with working over the winter months with seventh- through eleventh-grade students to interview, transcribe, and present the elders’ stories within their communities (Crate 2006*b*).

23. I worked with village youth in the Kutana village and on my own in the other three villages. We approached every elder in the original elder-knowledge project ( $N = 43$ ), and, with 10 either unavailable or declining, we interviewed 33.

24. There are regional stations that provide data on a republic-wide level. However, these data are not translated into public information specific to the villages where these elders live.

patterns. Now if you try and read based on that old way, you cannot predict the weather. It does not follow the old patterns. It used to explain everything for us but now it can't tell anything.

This is particularly urgent in the extreme environment of the Arctic, where each day of summer is crucial to winter survival. Elders also commented that the timing of the seasons had changed. Spring and fall now come several weeks late (female, b. 1939):

When I was little, we finished school on the 18th of May. It was 1949–1950 and on May 18th, there was already new grass and the cows were grazing. Since then spring has been later and later and later. Back then on the 9th of May the river ice would flow. Now it doesn't flow until the end of May or early June.

This change of seasons jeopardizes winter survival. In addition to the seasons' arriving later, elders said that the climate had softened, with winters being not as cold and summer not as hot. It was during these testimonies that elders referred again and again to Sakha's legendary bull of winter (male, b. 1925):

The climate has softened. Winters have warmed and summers are not so warm. All is softer. The North is especially warming, I think. Then it will be cold in the winter and suddenly get warm in the winter. It was never like that when I was a child. Strong cold held for months. We have the legend about the *bull of winter losing its horns*.

Additionally, two qualities of the climate, both critical to survival in the North, are reported to be different: a tendency toward long periods of calm and a relative lack of humidity. An elder (male, b. 1938) commented,

The weather changes very, very suddenly. For example, this year it was hot in June then very cold and windy. Fall is also sudden. Snow will suddenly fall and then there will be very warm days. Then, in winter it was  $-40$  degrees and the next day, very suddenly, it was  $+3$  or  $+4$  degrees.

In other words, the heat has a different quality now. It is no longer dry heat but laden with moisture: "Before it got very hot also, like it does now, but there was air—now it gets hot and you can't breathe (humidity)." Both the lack of calms and the increase in humidity make the Viliui Sakha's environment much more challenging. Although these barriers are still surmountable, elders report that their family members are spending more time in the cyclical work demands because of the increased challenge that these climate changes pose.

Several elders commented on the arrival of new species from the south and the loss of familiar species (female, b. 1944):

Birds are now coming that we have never seen before. We saw cranes come through, and this year the school kids saw a strange bird that was red and yellow. And some strange

ducks came through. A lot of unknown birds and animals are coming this way. They are following the warmth. The Sakha Republic has warmed, and the animals are coming this way.

The arrival of new species includes a variety of insects that prey on many of the garden and forage plants that Sakha depend on.

Elders talked about other common observations of changes in their local environment, including increased rain during the haying season, too much winter snow, increased occurrences of thunder, a change in the quality of sunlight, and many new insects. Many also correlated these changes with their people's health.

When we asked how the climate change was affecting people's daily lives, first and foremost elders talked about the effects on harvesting forage for their animals (male, b. 1932):

It ruins the hay harvesting when it rains for two months solidly. There is no winter forage for our cows and horses. If you keep animals you are to find food for them, and for us that is hay. And even if you plan to work every day at the hay, the weather keeps you from it. Every day it is raining. The land is going under water, and the hay lands are smaller and smaller, and if you keep a lot of animals, it is very hard. So tied with the climate change, the most challenging moment is the hay lands shrinking, going under the water. The first problem is that the land areas are shrinking, and the second problem is that the quality of the hay is worse. The hay itself has less nutrition, and then when it is cut and lies and gets wet and dries many times, it also loses its nutritional value.

Then they talked about the effects on their gardens (female, b. 1930):

It is bad for the garden to have so much water. Potatoes rot in the ground, and because there are many new insects that you can't get rid of, the greenhouse vegetables grow very poorly with the cold nights and too much water. The garden was very late. The water and cold kept us from planting potatoes until mid-June, and we usually plant then by Nicole [May 22].<sup>25</sup> Other people had lots of water in their field and didn't plant the potatoes until July.

Next, elders talked about how difficult it had become for their horses, which spend all winter outside and dig through the snow to find fodder. In the past decade, elders have witnessed increasing amounts of snow, due to warmer winter

25. May 22 (new style) is St. Nicholas Chudotvoretz/Thaumaturge. Actually, there are two holidays devoted to this saint; see <http://www.calend.ru/holidays/0/0/1354/>.



Figure 2. A growing lake in Khoro village center.

temperatures,<sup>26</sup> and an impervious ice layer beneath the snow, from a freeze/thaw that occurs commonly in the fall with warming, that prevents the horses from reaching fodder (male, b. 1935):

Then in the fall, the snow falls early and then it melts and makes a layer of ice under the snow and the horses cannot feed. They can't get through the ice. It also affects them in mid-winter when they have just foaled and they can't find food. This year there was so much snow that lots of animals died, horses especially that could not get through the deep deep snow to find their food. It is warming.

Elders then expressed concern about hunting, a supplemental source of food for many contemporary households, especially in the post-Soviet context in which there is an increased reliance on household-level food production (male, b. 1933):

We hunters can't hunt. There were about the same amount of rabbits as in other years this winter. I hunt them and we eat them, I share with neighbors, send them to Suntar and to the capital. I caught over 50 this year. I go trapping in January when the snow is thinner. But as the snow is deeper I can't go, and the deep snow is bad because dogs can't run and horses can't walk. Then in spring and fall, before the snow, hunters also can't hunt when there is so much mud and boggy land.

26. Typically, it snows in these areas from mid-September to mid-November and then again from mid-February to mid-March. In the deep winter, the extreme temperatures make snowfall rare. In the past decade or so, as winter temperatures have become milder, it tends to snow for longer periods in both the fall and spring, and the cold period of no snow is increasingly briefer.

Not only are hay, hunting, and foraging areas diminished because of flooding, but all land areas are threatened. In one of our four research villages, there is deep concern about the flooding of the grazing and gardening areas in the village center, another source of sustenance in these communities: "All the water ruins the usable areas near our homes—it diminishes all our land—with all the water, no one has any land anymore" (fig. 2; for a color version, see the online edition).

Elders also mentioned that they noticed that the land was sinking in places; "the flat fields are sinking in, and we want to know why—perhaps the permafrost is melting?" The most graphic of these land-sinking accounts were about an island near the village of Kuukei (female, b. 1933):

There is one strange thing I want to mention. We have an island in the lake, but now it has fallen. My deceased husband used to say the island will start to have all those depressions as the ice melts and go under water, and then a few years later the island will cease to be. I have been watching that island for the past ten years and I see this happening.

However important it is to understand whether the island is in fact sinking because of permafrost melting and whether the melting is in fact due to climate change,<sup>27</sup> when I heard these testimonies I was more concerned and curious about how the perception of the land's actually sinking was affecting how Viliui Sakha orient themselves to their environment.

27. Many of the pastures of the Viliui Sakha communities are located in thermokarst depressions known locally as *alaas* (Crate 2006a, 9–11). *Alaas* are characterized by very specific processes of freezing and thawing, permafrost degradation, and permafrost buildup (see Washburn 1979, 274).

Their sense of place and their understanding of “homeland” are both directly tied to an ecosystem dependent on water in its solid state. Although feeling “at home” in such icy realms is foreign to most of us, it is the familiar and the understood territory of comfort for inhabitants of the North (Nuttall 1992). This was clear when we asked, “Isn’t it good that it is not so cold in winter and not so hot in summer?” In response, elders unanimously stated the opposite (female, b. 1929):<sup>28</sup>

It seems that it would be for people’s comfort and for using less wood in the winter and not getting so hot in the summer. It is not bad to have warm winters, for an old person, it is great! But as Sakha people, we need strong cold here. It is how our lives are organized and how nature works here. The big cold is good. The diseases are gone. When it is warm it snows too much and it is not warm or cold. The winter warmth affects people’s blood pressure. And the heat in the summer is different, humid and very hard for people to go. It is bad for the way of life here and for survival; nature, people, animals, and plants here are supposed to have very cold winters and very hot dry summers. That is the best for all life here.

One of the arguments of misinformed critics who deny urgency to act on global climate change is that Northern peoples are probably happy that their home temperatures are not so cold. This view is naive. Humans live in and thereby learn a sense of place in a homeland regardless of its physical conditions. They may grow to prefer different conditions, but their sense of place and perception of home are bound to the places where they spent their formative years. This is clear with Viliui Sakha elders, who often joke that the softening climate will bring them relief but in fact are fully aware that the climate regime their ancestors were used to is key to perpetuation of the subsistence of their people and the survival of local flora and fauna.

When we asked elders how they thought these changes would affect the future, all said that conditions would progressively get worse (male, b. 1936):

It will get warmer and warmer and we will go under water. And as it gets warmer and warmer, the permafrost will melt, and our land will be a permanent bog swamp and we won’t be able to do anything. Then it will make a big problem for Sakha. There will be no pastures, no hay fields, just the high areas will remain and they will also fall down. If it continues, then the permafrost areas will stop being frozen and it will all melt. Verkhoyanski, Muoma, and those northern regions they say are melting now.

28. Granted, shorter winters may actually be beneficial for cattle and horse breeding. Horses and cattle will spend less time in the stables and barns (and more time on the pastures) if the annual average temperature increases. However, more precipitation (snow) and a higher frequency of freezing/thawing events will have an adverse effect.

Many also made the connection between warming and its effects on health (female, b. 1944):

The worst part is that diseases will multiply in the future if it continues to get warmer and warmer. People’s lives will get shorter with all the disease, and no one will be able to keep animals here anymore.

Some elders made a link between the local effects of global climate change and the breakdown of the contemporary social fabric (female, b. 1930):

People’s attitudes will get worse and worse, and things will go crazy. People’s character is already changing. The way they relate to others has changed, and I think it is because of the climate change. When I was young, Sakha didn’t kill each other, and when people beat each other up it was big news. The way people are so violent these days I think is connected to the change in the air and climate.

Making such connections is not unfounded. Similar cases of people’s linking changes in the natural environment with changes in their social environment can be found in different local settings in northern Russia (Karjalainen and Habeck 2004; Simpura and Eremitcheva 1997). There are also studies in the field of biometeorology that are making such correlations in other cultural contexts.<sup>29</sup>

We also solicited elders’ perceptions of the causes of global climate change. Many cited the presence of the reservoir of the Viliui hydroelectric station—constructed in the 1950s to supply electricity mostly for the then-nascent diamond-mining industry. However, studies have shown that the presence of the reservoir only results in a microclimatic change that would not include the extent of the changes observed by the elders. Most elders agreed that the climate was changing for a host of other reasons (male, b. 1933):

They go into the cosmos (outer space) too much and are mixing up the sky. When I was young they didn’t go into the cosmos and we knew the weather. It rained when it was supposed to. It seems like it is already the fall season. There are lots of black flies already. It is all mixed up. Maybe from the mining activity and the electricity makers, the hydro stations, it all affects. They say the Sea [hydro-station reservoir] affects us, but I don’t agree. The natural climate is all mixed up.

When Viliui Sakha experience too much rain at the wrong times, leading to poor hay harvests, winter warmth that causes increased animal diseases, and an impervious ice layer that prevents animals from foraging beneath the snow, they assign the blame either to nature or to humans but more often the latter. When Viliui Sakha elders talk about the human causes, it is important to remember that in their lifetimes they have

29. For a broader picture of the influences of climate on psychological factors, see the *International Journal of Biometeorology* and <http://biometeorology.org/>.

seen the introduction and widespread use of technology. They were born and raised on remote homesteads without electricity and now live surrounded by technology. It is an easy step to relate the changes in their physical environment to the entry and advancement of this technology. Explaining the changes as “caused by nature” also makes sense given that they live in a highly variable climate to begin with and know that there have been climatic changes in the past. Individuals commented that climate change had both natural and human causes.

The natural causes that the elders talked about included the changing direction of the earth and all the planets—each with a magnetic pull that is affecting us—changing sky and clouds, and the melting of the ice on the Arctic Ocean, bringing lots of clouds and rain. The human causes that they mentioned included the “breaking” of the atmosphere by rockets and bombs that go up into the sky and by humans’ going into the cosmos too much and mixing up the sky; the changing of the atmosphere that makes it all very warm and everything that the *technika* people are using that fouls the air; the holes in the ozone and the other damage done with all our technology; and too many atom bombs.

Although at first consideration, some of the contributing factors these elders mention seem irrelevant to Western scientific thought on the subject, their ideas are tangentially relevant and culturally provocative.

Some elders provided explanations that related to phenomena other than global climate change. One elder commented, “The elders said it was like this last century also, and they say that every century the same conditions come around—100 years ago also the land was under water.” Sakha also have a cultural understanding of there being dry and wet years (male, b. 1932):

They said that we would be having dry years now, but it is the opposite. Very wet years have come, lots of rain. Not in the spring when we need it, but in the summer when it gets in the way. There are many times as much water as there should be in the wet years, and if it continues like this, we will all go under water. We had the wet years, and so it should be dry by now.

These are important historical events that need further investigation in order to tease out just how Sakha’s ancestors adapted to and survived these cyclical changes before the Soviet period. Additionally, several explained that the waterlogged fields had more to do with Sakha’s contemporary neglect of the land: “Before—in the Soviet time and before that—since our ancestors first came to these parts, we would make the fields so they were free of water, but not now” (fig. 3; for a color version, see the online edition). However, the inundation of fields in the context of all the other observed changes refutes these explanations.

Many of the elders’ testimonies revealed that they were understanding local climate change not only on the basis of their observations but also by integrating knowledge from



Figure 3. A field canal dug in the Soviet period to drain hay fields.

other sources. One source was an ancient Sakha proverb, “Tiiekhtere ool uieghe, khachchagha Buus baiaghal irieghe,” which means “They will survive until the day when the Arctic Ocean melts.” Several elders recollected this proverb when they heard of the 2005 summer catastrophic flooding of the Yana River in the north of the Sakha Republic. Three villages were so severely flooded that the residents had to permanently relocate. Reports of this incident substantiated it not as an isolated phenomenon but as directly related to the fact that the Arctic Ocean is no longer freezing up completely in the winters, which results in increased water regimes for the entire Sakha Republic.

In the summer of 2005, I identified only two media sources addressing global climate change that reached the villages. One was the British Broadcasting Company’s airing of *The Day After Tomorrow*, the 2004 action/adventure, science fiction/fantasy thriller on midday local television aired several times that summer. It is likely that many of the elders’ comments about the global implications of local climate change were based on images and sound bites from this film.

The second media source was an article in the republic-wide *Komsomolskaia Pravda v Yakutii* by Trofim Maksimov, a biologist and climate scientist in Yakutsk (Ivanova 2005).<sup>30</sup>

30. The *Suntaar Sonunnaar*, the regional paper that most inhabitants subscribe to if they get any paper, was lacking in information on climate change from 2003 to 2005.

Maksimov has worked for several decades on climate change in the Sakha Republic. His research shows that average temperatures have risen by 2°–3.5°C in the past 100 years. In addition, average winter temperatures for the same time period are 10°C warmer. This corresponds directly with the elders' observations of warming. His findings also document the movement of floral species northward, with Dahurian larch, the common tree species of the Sakha taiga, moving toward the tundra and more temperate species coming into the republic from the south. Again, elders have observed similar movements of familiar species that have gone north and new species that have arrived from the south. Maksimov is outspoken that the warming taking place is irreversible and demands everyone's foremost attention. Because only a handful of Viliui inhabitants subscribe to this newspaper, his message does not reach Viliui Sakha, and a lack of outside information about the extent and causes of global climate change explains the elders' lack of understanding of the subject.

Viliui Sakha elders' testimonies of the local effects of global climate change reveal no debate about whether climate change is occurring. Like most indigenous peoples they are, by default, ethnoclimatologists. With a continuous stream of experiential data, they know that things are changing. What is less clear is how they are perceiving and framing these issues.

## Developing Cultural Models

Viliui Sakha elders understand the causes of climate change as either natural or human. One approach to understanding what they are seeing these climate perturbations with is by using the frame of Sakha's spiritual worldview (fig. 4).<sup>31</sup>

According to Viliui Sakha's cosmology and contemporary practice, Aan Alakhchyn (the earth deity) and the Ereke-Jereke (the hay-wood spirits, considered her children) give people hay in direct accordance with their observance of specific rituals, most notably the cyclical feeding of the earth spirits, the annual gifts to Aan Alakhchyn during Yhyakh (the summer fertility festival), and their hard work and diligence in caring for their lands (Kulakovskii 1979, 42–44). In other words, humans have more or less direct control over how abundant their hay harvest is. The climate perturbations resulting from global climate change interfere with that direct relationship. Control is no longer in the hands of the individual, kin group, or community.

We can develop similar models based on contemporary dynamics such as climate sensitivity of subsistence practices, land tenure arrangements, income disparity, and gender, to name a few. Once we have models of how our research partners are fitting climate perturbations into their cosmological and practical understandings of how resources are given, in

what areas their lives are constrained, and what capacity they have to adapt, we can take the next steps toward filling out their information to facilitate positive change.

## Extrapolating Research Scenarios

With Viliui Sakha elders' testimonies on the local effects of global climate change, a preliminary cultural model, and my long-term engagement with these communities in mind, I propose the following scenario for conducting research with indigenous communities confronting the local effects of global climate change. The first step is to be sure the targeted research communities are interested in working on climate issues. It is also important to have longevity in the given field/research communities and a working knowledge of the local language. Next, we need to gain the necessary approvals. After these initial steps, we can begin working within the greater community to set a research agenda. Here, we are already listening to how our research partners talk about weather and climate in their cultural context.

It is important from the beginning of this research process to be sensitive not only to the way our research partners frame global climate change but also to the way we frame global climate change with them. One colleague recently commented, "Climate change has become such an overused term in Alaskan villages that I avoid it, in order not to lead every discussion in one particular direction." Perhaps it is best not to label what our research partners are experiencing as "climate change" but to discover and use emic terms and expressions. Here, our role of cultural interpreter is key to teasing out our research partners' culturally bound understandings, interpretations, and observations. In our 2003 surveys, we did not have a problem using the Sakha word for "climate change," perhaps because northern Russia has far fewer researchers and far less interaction with the larger world in terms of access to media and technology than Alaska.

Once we have collectively set a research agenda, our first task is to account for the emic by assessing and documenting community observations, knowledge, and perceptions about the local and global effects of global climate change. Appropriate methods include focus groups, semistructured interviews, oral history, and secondary data analyses. Considering their history on the land, another important early step is to learn how our research partners' ancestors adapted to climate perturbations (from village elders and by reconstructing climate histories from community oral history and archival and written sources)<sup>32</sup> and to identify what of that knowledge is relevant to their contemporary climate challenges. Listening can take the form of daily conversations, oral history, and focus group discussions to map out collective cultural models of what is changing and why. We need to engage all com-

31. I thank Michael Paolisso for his diagrammatic representation of Chesapeake Bay watermen's cultural modeling for blue crab management (2003).

32. For more on reconstructing past climate histories, see the work of Astrid Ogilvie (<http://instaar.colorado.edu/people/bios/ogilvie.html>) and Jones et al. (2001).

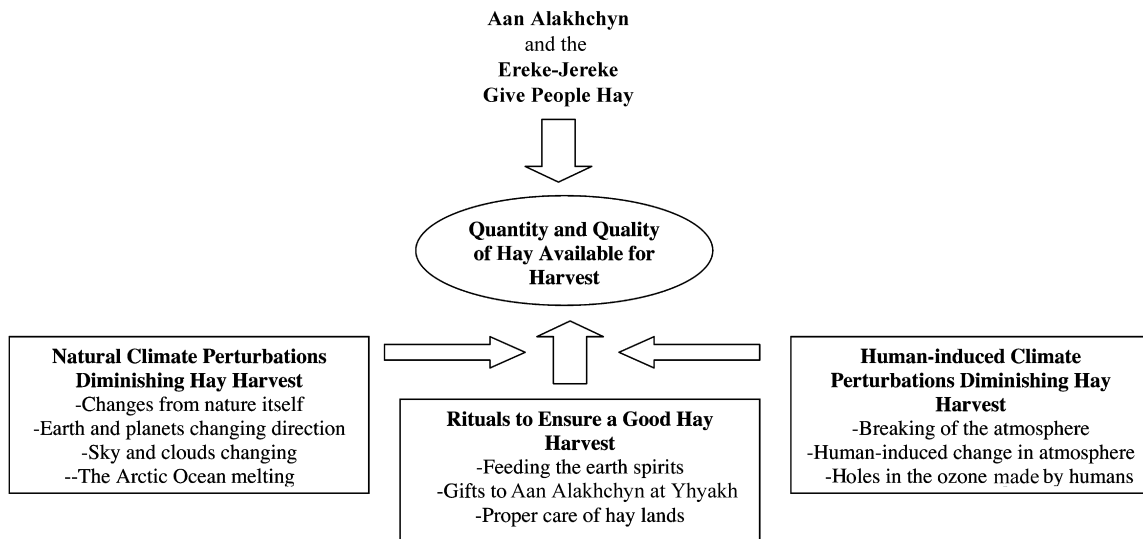


Figure 4. Viliui Sakha's practical and cosmological understanding of how hay is supplied.

munity members and especially youth, both because it is important to get to know the village youth's assessments and opinions of climate change, since they are moving into leadership roles in their villages and greater communities, and to enable them to advance the project efforts once field research is done. With these data we can develop cultural models based on the way our research partners understand climate cycles in their cosmology and their contemporary lives.

With a solid grounding in local perceptions and cognitive models, the next step is to introduce the etic, to find information on a global scale that can "fill in the blanks" in the local climate picture in ways that empower communities toward positive social change. They need to have access to appropriate information to understand that climate change is global in scale and also to decipher which local changes are due to global climate change and which are the result of other stressors. We first determine what information about global climate change from Western scientific sources our research partners are already aware of. For Viliui Sakha, one important information source would be the continuing research findings of Trofim Maksimov. With a fuller understanding of the global implications of local changes, our research consultants can better innovate and possibly expand existing adaptive strategies to increase their coping range.<sup>33</sup> A great source of empowering knowledge for Viliui Sakha communities is that what they are observing as the local effects of global climate change is remarkably similar to the changes observed in other Northern indigenous communities (ACIA 2005; AHDR 2004;

33. Ideally, a key source of this would be downscaling global models to show how projected climate change effects will play out in the specific local contexts of our research partners. Many Arctic researchers are hoping that such a tool will soon be available (T. Callaghan, personal communication, 2007).

Helander and Mustonen 2004; Krupnik and Jolly 2002; Turi 2000, 2002).

Once we develop both a solid account of local understandings and perceptions and a roster of useful global-scale information, we can then use the most effective modes of communication to relay that information. This may include town meetings, engaging our research partners in developing and presenting the materials for their communities. To the extent that local television broadcasting occurs, such presentations can also be broadcast to those who cannot attend meetings. For Viliui Sakha, one means to communicate information is to develop elder-knowledge programs focusing on climate change, with youth first documenting elder observations and past climate perturbations and then exchanging Western science information with them.<sup>34</sup> It would also serve to document and disseminate within the communities elder knowledge (both life experience and narrative from parents and grandparents) about the way their people adapted in the past to climate perturbations and its relevance to their contemporary climate challenges. Similarly, it would also engage village youth in the community process of grappling with global climate change.

A critical next step is the formulation of adaptation strategies. Viliui Sakha communities have adapted successfully in the past, but they, like their circumpolar indigenous counterparts, are at an impasse with regard to global climate change. The bull of winter story and the cultural transformation that the loss of that story represents is testimony in

34. Granted, the implementation of an "elder-knowledge program" may potentially be in the interest of the whole community, but it will probably be appropriated by different factions in different ways and to different ends.

itself to an uncertainty about limits to adaptation apparent in other circumpolar contexts (ACIA 2005, 10). In addition to working with communities to develop adaptation strategies, there are other research needs that could be addressed at this point in the field research process. Although those other research tools are as vital as the cognitive/perceptual approach described here, there is not sufficient space in this article to address them. I hope this article serves to open the dialogue among anthropologists.

Because climate change is global, our awareness of and actions with regard to its local effects demand a multisited analysis to expand the context from a "committed localism" and to explore the complex interactions of the larger world system that shape the local system (Marcus 1998, 8). Accordingly, we need to consider connecting our research project to policy by assessing efforts at the local, regional, republic, and national levels for their applicability to local community contexts and making recommendations accordingly. Once existing policy is known, the next task is to evaluate the local level of climate change policy awareness and applicability. We can then draft policy recommendations that are both realistic and applicable, given local communities' day-to-day experiences with the local effects of global climate change. To inform this process, we can bring in examples of other circumpolar countries' global climate change interventions firsthand through collaborations with similar research projects and secondhand through information sharing among indigenous councils. We can then find creative ways to present those policy recommendations to the appropriate bodies.

Depending on our research partners' desires, we can also work to advocate with them through whatever political channels are deemed appropriate. Sharing the work of other indigenous groups that are already advocating for themselves empowers this experience. Comparative and collaborative work with other anthropologists and their research partners can further our research partners' capacity for advocacy. Our elder research partners' more than 50 years of personal long-term observations are potentially valuable to Arctic scientists. There could be a great advantage to inviting research partners to participate in a climate conference to testify and answer questions from scientists.

Recent literature has begun to address the understanding that many, if not most, of our global ecological crises are a result of human attitudes, values, ethics, perceptions, and behaviors and that the best, if not the only, way to bring about a change in those qualities is through the reconnection of communities to their landscape and their lives as an active community<sup>35</sup> (Leigh 2005). This is congruent with the ACIA recommendation to "facilitate local empowerment through the devolution of authority and capacity so that communities can respond more effectively given their specific contexts" (Huntington et al. 2005, 95). Working as a community is a

35. By "reconnection of communities to their landscape and their lives as an active community," Leigh means that people need to regain a relationship with the earth and with each other.

challenge in some research areas. One such area is the post-Soviet context, with only a recent break from a centralized and paternal relationship to the state. Our research partners time and again expressed their regret that they could not somehow come together and work toward definitions of sustainability as a community, although their reference regularly was to the way they had worked together on the state farm of the Soviet period.

Our research partners also said that no one trusted anyone outside the immediate kin group, explaining why community efforts often failed.<sup>36</sup> With the disbanding of the state farm, the community has lost an important site for the creation of local solidarity and communal identity, and individual and collective possibilities for taking action have shifted to other arenas. The collective must be reimagined and retained not in terms of a Soviet template but in terms of some amalgamation of local loyalties and external restraints (Humphrey 1998, 482). It would be fruitful for anthropologists working in post-Soviet contexts to investigate how post-Soviet villages can recapture the community activeness of the Soviet period without reinstating a socialist mode in doing so, to move toward local action on global climate change.

## Conclusion

Anthropologists have yet to take an effective role in climate change research with indigenous communities. Considering the types of changes witnessed by Viliui Sakha elders and shared by their Northern counterparts, the Arctic ecosystem is undergoing unprecedented change that may not allow for future habitation of peoples and their key plants and animals. Similarly, other climate-sensitive areas of the world and their inhabitants are under threat (IPCC 2007). To date, adaptive capacity is considered the main mechanism to deal with those threats. Because of the extent of present and projected change, researchers and indigenous communities alike are questioning the applicability of that coping strategy.

Research on climate change, the bulk of which to date is in the Arctic, does not address global climate change's cultural implications. Encounters with the cultural implications of Viliui Sakha communities' observations and perceptions of the local effects of global climate change reveal a need to develop research projects focusing on the cognitive/perceptual orientations of communities. Here, anthropologists can play a unique role. We are trained as cultural interpreters, translators, advocates, educators, and mediators. Many of us already work in the various academic fields of global environmental change. We can use the tools of applied, public, and advocacy-oriented anthropology to work on behalf of our indigenous research partners.

36. We did observe some intervillage variation in terms of coming together as a community. We worked with four villages with populations of 3,500, 1,000, and 400 (2). The medium-sized village was small enough for people to know one another, yet not small enough for it to be controlled by a certain extended kin group. This was also true in the two villages of 400.



Awareness and empowerment are a necessary first step toward the goal of addressing the issues of indigenous communities confronting unprecedented climate change. We need to develop collaborative research projects with other social and natural scientists, adopting a multiple-stressors perspective (to include socioeconomic, political, and other environmental challenges), integrating notions of adaptive learning, generating policy-relevant insights, and linking findings to the larger question of community sustainability.

This is the work we are called to do. In sorting out these issues for those most affected, we are doing the necessary homework to reframe and reappropriate cultural worlds and senses of “home” for other communities near and far that have yet to be as noticeably affected. “Climate change is amplified in the Arctic. What is happening to us now will happen soon in the rest of the world. Our region is the globe’s climate change ‘barometer.’ If you want to protect the planet, look to the Arctic and listen to what Inuit are saying” (Watt-Cloutier 2004). Now that many of our research partners are actively listening to their elders, the time is ripe for those elders’ messages to inform the world and for anthropologists to take to heart our responsibility to act on behalf of all of us. In the end, we discover that each culture has its own “bull of winter” that not only is central to the way that culture orients its daily/seasonal activities, worldview, and cultural identity but also is part of the ethnodiversity that, like biodiversity, is essential to the robust health and continued human, plant, and animal habitation of the planet.

## Acknowledgments

I thank the people of the Viliui regions of western Sakha, Russia, who have made my ongoing research possible. This material is based on work supported by the National Science Foundation (NSF) under grant no. 0532993, “Investigating the Economic and Environmental Resilience of Viliui Sakha Villages: Building Capacity, Assessing Sustainability, Gaining Knowledge.” Any opinions, findings, and conclusions or recommendations expressed in this material are my own and do not necessarily reflect the views of the NSF. I gratefully acknowledge and thank the NSF. I thank Rob Cole, Anne Henshaw, Barbara Rose Johnston, Luke Eric Lassiter, Jean MacGregor, Katherine Metzko, and Sarah Strauss for their constructive feedback on earlier drafts. I also thank Ben Orlove and six anonymous reviewers.

---

## Comments

### Niels Einarsson

Stefansson Arctic Institute, Borgir, Norðurljóð, 600 Akureyri, Iceland (ne@unak.is). 10 IV 08

Susan Crate’s paper is a thoughtful and timely reminder of the role anthropology and anthropologists can and should

play with regard to global climate change and its impacts on human cultures and human development. Without going overboard, she takes an activist stance, something liberal anthropologists are known for doing. In *Advocacy and Anthropology*, Robert Paine (1985) quotes Anthony P. Cohen as saying, “An anthropologist without concern is no anthropologist at all.” Not all anthropologists would be comfortable with this statement, but many could surely empathize.

The ongoing and future prospects and impacts of global climate change must surely be a reason for immediate concern for the discipline of anthropology. Through the findings of the United Nations Intergovernmental Panel on Climate Change and other credible scientific bodies, we have overwhelming evidence for a major anthropogenic global environmental sea change. This change poses imminent threats to the livelihoods and welfare of hundreds of millions of humans, not least the already underprivileged and poor. The impacts on global human welfare have been clearly demonstrated in the 2007/2008 United Nations Human Development Report titled “Fighting Climate Change: Human Solidarity in a Divided World” (HDR 2007).

In my view, anthropology has a moral obligation to take a stance with regard to global climate change. It also has a special role to play, as few other disciplines possess the intellectual, conceptual, and theoretical tools anthropology has collected through its existence. Especially valuable is a holistic approach that sees local and global human and environmental forces and processes as interacting and in which human and biophysical systems are interlinked and interconnected in a historical process.

The Arctic has sometimes been called the Earth’s canary in a coal mine. Changes taking place in the region’s environment and with some human groups in the Arctic have received considerable media attention, not the least of which is the image of iconic polar bears clinging to melting ice. The effects of climate change will indeed be felt sooner and faster in the high north compared to more southern latitudes. Problems include various infrastructure damage, increased pollution related to melting permafrost, appearance of new diseases and insects, damaging effects of increased ultraviolet radiation on human health, and dangers facing Arctic inhabitants forced to use weaker and less predictable ice for their hunting and travel. These are all serious issues that add to the already existing stress and rapid change associated with globalization and external influences of a social, economic, and political nature. A main conclusion of the Arctic Human Development Report (AHDR 2004) was indeed that, although Arctic societies have through history shown significant adaptive capacity and resilience, they have now reached the point that the rate of combined environmental and socioeconomic change has crossed a critical line for their well-being.

In her paper Crate describes how the Sakha Viliui respond to the environmental change taking place in their homeland in northwestern Siberia. She worries about the upbeat response from some of her research partners, as she chooses to

call the people she works among, that they will adapt to coming changes. They have done so before. According to Crate, changes to the Viliui resource use activities will pose an imminent threat to their cultural survival, as the two are inseparable. Some anthropologists would argue that such an understanding of the concept of culture is unnecessarily rigid, even reified or protectionist, and that cultural change is nothing new—or even an especially negative aspect of human existence—at least as long as culture continues to bring meaning into people’s existence and everyday life. Form can change, but function remains. Crate disagrees with Piers Vitebsky’s seemingly (but not necessarily so) lighthearted quote from his adaptable Eveny reindeer herders that if it gets too hot, they’ll simply turn to camel herding. Arctic peoples are known for their use of humor, possibly as an adaptive cultural mechanism helping them to cope with stressful, trying, and tough conditions in an often hostile environment.

I wonder about Crate’s mission of Western scientific knowledge transfer to the Viliui, who she claims lack proper comprehension of global climate change. I understand that this shortage must be the source of frustration for her work and her will to empower the people she obviously cares so deeply about. However, from the eloquent ethnography Crate presents in her paper, it seems to me that many Viliui already possess subtle and sophisticated understanding of the impacts of global climate change in their lives. A capacity-building program such as the one Crate describes may well help to develop a knowledge base that could turn her research partners into full-fledged activists who could make rightful claims to have their voice heard and their experience witnessed by a world that seems to care little and listen even less. If anthropology can do its bit to help this process, then it can justifiably state that it has risen to the occasion. If not, then it can at least say that it documented, analyzed, and published extensively on how humankind destroyed itself.

---

**James D. Ford**

Department of Geography, McGill University, 805 Sherbrooke Street W, Montreal, Quebec H3A 2K6, Canada (james.ford@mail.mcgill.ca). 8 IV 08

Since the release of Krupnik and Jolly’s (2002) “The Earth Is Faster Now,” studies documenting indigenous knowledge on climate change in Arctic and subarctic regions have proliferated. The Arctic Climate Impact Assessment (ACIA 2005), for example, contains a chapter dedicated to indigenous perspectives on climate change, and the Fourth Assessment Report of the IPCC (IPCC 2007) utilizes indigenous knowledge together with instrumental data to illustrate climate change impacts and vulnerabilities. Crate’s documentation of the indigenous knowledge of Viliui Sakha on climate change impacts is an important contribution to this expanding body of literature. Many of the changes documented in this region are strikingly similar to what has been noted in other northern

regions, providing further evidence of the sensitivity of the Arctic and subarctic to climate change. Most interestingly, however, the paper documents and assesses the cultural implications of climate change, an area largely neglected in human dimensions of climate change research.

First, as Crate notes, human-environment relationships ground and substantiate indigenous worldviews. As research elsewhere in northern regions has highlighted, disruption and even loss of such relationships as a consequence of climate change and other societal changes can have wide-ranging implications for cultural and social life. The paper highlights how observed changes are already affecting sense of place and links to culture in northeastern Siberia. Documenting the cultural implications of climate change is a strong argument for taking actions on climate change necessary to uphold the fundamental human rights of indigenous peoples.

Second, debate about what constitutes “dangerous climate change” and whether there are absolute barriers to adaptation are key questions being asked by scientists and policy makers. In February 2008, for example, a major international climate change conference in London was framed around the question, Are there limits to adaptation? Ultimately, culture will determine what constitutes dangerous climate change, and cultural dynamism and flexibility will specify limits to adaptation beyond which community responses are no longer able to maintain acceptable socio-cultural-economic goals. Crate’s paper tangentially addresses these issues. For example, Crate questions the perception in the climate change vulnerability literature, and sometimes among communities themselves, that shifting resource use patterns and modes of subsistence represent adaptations to climate change if intimate relationships to the environment are fundamentally altered. This important observation could be substantiated with a discussion on the adaptive strategies being used by Viliui Sakha and their level of success in reducing the negative impacts of climate change and taking advantage of new opportunities.

Third, as Crate demonstrates, investigating the cultural dimensions of climate change is an area in which anthropologists can actively contribute to climate change research. The paper argues that applied and advocacy anthropology are particularly important in climate change research, where field researchers need to fully enter and understand the world of “the other.” Indeed, active engagement of local peoples in the climate change research is increasingly recognized as essential to understanding climate change effects and vulnerability in a number of disciplines.

If I have a criticism, it is that the paper could be strengthened by extending the analysis of the cultural impacts of climate change beyond documenting directly observed changes and their effects. For example, are there any positive cultural impacts of climate change? Furthermore, it remains unclear if all Viliui Sakha are being equally affected by climate change. The research documents the perceptions of elders regarding climate change impacts and cultural effects, yet

there is little discussion of whether younger generations share the same cultural norms and aspirations as their elders, and if they do, how strong this cultural connection is. Evidence from other communities in the Arctic and subarctic reveals significant cultural shifts that are differentiating exposure to climate change impacts by age and socioeconomic characteristics. The paper does note that contemporary Viliui Sakha are increasingly partaking in a “consumer lifestyle” but stops short of exploring what this means for the cultural implications of climate change. Moreover, it remains unclear if the cultural impacts of climate change for Viliui Sakha are being moderated or exacerbated by nonclimatic stresses. Toward the end of the article, for instance, a lack of trust outside of immediate kin is noted. In other contexts, weakening social networks have been identified as determinants of vulnerability, and the article could benefit from an analysis of these societal changes alongside climatic changes in northeastern Siberia.

Overall, this is a valuable contribution to the emerging literature on climate change vulnerability and adaptation in Arctic and subarctic regions, stressing the importance of cultural dimensions of climate change and the role of anthropology in climate change research. A number of key areas remain unexplored and should provide impetus for future research endeavor.

---

### Myanna Lahsen

Center for Earth System Science, National Institute for Space Research (INPE), Av. dos Astronautas 1.758, Jd. Granja—CEP: 12227-010, São José dos Campos, São Paulo, Brazil (myannal@gmail.com). 16 IV 08

Cultural anthropology’s contributions to the study of global environmental change are still marginal. However, as climate changes are increasingly perceived by communities around the world, the discipline is gearing up to enhance its engagements and contributions in this area of research and policy. Susan Crate’s article “Gone the Bull of Winter?” is an example of anthropology’s potential to make a difference in the face of global climate change.

If the goal is how “we” cultural anthropologists can *best* design effective research approaches, as Crate suggests, I would like to stress the need to broaden the scope of analysis. Though Crate sets out to “detail the cultural implications of global climate change,” she limits her analysis to a subset of the important cultural dimensions of environmental degradation, namely, those related to how so-called local (read: less empowered) peoples are affected by climate change and how they do adapt to it or might adapt to it. To truly enhance our effectiveness and overcome our marginality in scholarship and policy arenas related to global change research, we need to study all types of relevant “locals” and especially those populating institutions of power. That means overcoming our abated but continued aversion to studying power brokers such

as scientists, governmental decision makers, industry leaders, journalists, and financial elites, all of whom are much more important in shaping climate change and associated knowledge and policies than are the marginal populations we are accustomed to studying, even if we succeed in assisting the latter in the ways Crate proposes. Climate-related cultural dynamics among these population segments have long been rampant, but few anthropologists have engaged them in their research, despite pioneer Steve Rayner’s now nearly two-decade-long provocation that we “stop fiddling while the globe warms” (Rayner 1989). We have marginalized ourselves and lost important opportunities to do research and to intervene farther “upstream” in arenas where knowledge and policy are produced because we have been insufficiently inclined to revise our own cultural (disciplinary) inclinations.

Environmental disaster is a function of environmental stress combined with societal inability to adapt to and absorb the stresses. Governance—decision making—is central to both in all societies and internationally, including to those guiding the involvement of the heterogeneity of above-mentioned actors who use the media and other means to impose their preferred interpretations of the threat of climate change and its implications. Decisions in governments bear in especially crucial and direct ways on measures to reduce greenhouse gas emissions, creating the preconditions—or the lack thereof—for successful societal adaptation and resilience, including the knowledge we have of the threat in the first place; if governments do not sponsor the right kinds of knowledge (e.g., climate vulnerability and adaptation studies), we may not know what we need to know to better meet the associated challenges. Yet we know very little of the cultural dimensions of governmental decision making, despite suggestions that cultural perceptual filters and microdynamics at that level can be crucial obstacles to remedial policy action (Jasanoff and Wynne 1998; Lahsen 1999, 2005a, n.d.; O’Riordan, Cooper, and Jordan 1998; Rayner et al. 2002; Thompson and Rayner 1998) and also can shape our very understanding of the threat through science (Lahsen 2005b; Lahsen and Nobre 2007) and its adjudication in international scientific and political arenas (Fogel 2002; Lahsen 2004, 2007).

Anthropological work is uniquely capable of opening black boxes and revealing the cultural worlds within them. As such, it is optimally placed to provide currently missing insight into key obstacles to environmental knowledge and effective policy at national and international levels. To achieve this, we must broaden our scope as suggested above, and that means also attending to cultural dimensions of imaginations (i.e., assumptions, fears, or the lack of such, etc.) and scientific projections, scientific assessment processes such as those of the United Nations Intergovernmental Panel on Climate Change, and international negotiations and politics. It is also essential that anthropologists analyze and help alter cultural ways of acting and thinking that result in environmentally destructive consumption patterns and obstruct more effective, forward-looking action to reduce the threat and its impacts. Though

anthropologists' proclivities encourage study of environmental activists more than studies of scientists and decision makers, the cultural dimensions of social movements and their strategies for action are also underexplored by anthropologists (Roncoli, Crane, and Orlove 2008).

To summarize, the program for research and action that Crate proposes is very important, and it is heartening to see increasing anthropological engagement with global climate change. However, it is important to understand that Crate's program for anthropological research and engagement addresses only a subset of the cultural dimensions of global climate change and of the research and action needed. Anthropologists can help build the needed societal reflexivity, policies, and societal resilience in the face of global environmental stresses and uncertain threats, but to deepen our impact we must broaden the scope of our analyses and devote more central attention to institutions and populations of power and provide rich accounts of how knowledge and policies are produced and absorbed in all relevant domains. By doing so, we will be more effective in our efforts to enhance societal responses and understanding of the sociopolitical dimensions of climate change and other global environmental challenges with which we are faced.

---

**Michael Paolisso**

Department of Anthropology, University of Maryland,  
College Park, MD 20741, U.S.A.  
(mpaolisso@anth.umd.edu). 4 IV 08

Anthropologists engaging in research on the causes and consequences of global climate change have much to contribute. How to contribute, where to focus our energies, and what we hope to accomplish are questions that have rapidly surfaced over the past few years as we employ theory and ethnography to understand the cultural and community dimensions of global climate change. It is through case studies of the local effects of global climate change on communities that we most productively have gained a sense of what anthropology has to contribute and what are the challenges and opportunities in realizing our work. These local and community effects, with their broader policy and research implications, are currently most visible in Arctic regions.

Crate's study of the local effects of global climate change on the rural Viliui Sakha, native horse and cattle breeders of northeastern Siberia, is a solid example of what we expect from ourselves—and others expect from us—in the study of global climate change. Her account of the Sakha, describing the softening of their climate—less frigid winters and warmer and more humid summers—that makes it more difficult to harvest enough hay to overwinter their herds, is representative of what we as anthropologists have traditionally done best: documenting the effects and consequences of declining natural resources, reduced economic opportunities, and loss of social traditions and cultural identities for local communities.

Increasingly, drawing upon currents in applied or public anthropology, we have also attempted to effect changes that are positive to local peoples for whom the environment, economy, and sociocultural world are being changed by outside forces.

Crate warns us that some of the research frames we have been deploying—adaptive capacity, vulnerability, and resilience—may be woefully insufficient. She has grave doubts that the Sakha's coping mechanisms will be sufficient to adapt to the environment that is changing “beneath their feet,” and they, like other Arctic groups, are skilled at adaptation. The rate and magnitude of environmental change is just too great.

What is needed, she argues, is more research on the cultural implications of global climate change. She links the cultural to a sense of home and place. The local effects of global climate change result in a loss of “intimate human-environment relationships that not only ground and substantiate indigenous worldviews but also work to maintain local landscapes.” She situates this cultural approach within the frames of cognitive, cultural model research.

A key question raised by this cultural model approach to global climate change focused on local knowledge is not whether it is necessary but whether it is sufficient. And here I think it is not. It is consumption and policy making in industrialized and industrializing countries linked to fossil fuel use and environmental degradation (e.g., deforestation) that is the driving engine of global climate change. Given this fact, it is critical that we focus our cultural analysis also on the human, political, and socioeconomic processes in industrial countries where most of the anthropogenic drivers of global climate change are found. We need to understand the cultural knowledge of the groups that affect global climate change, not only those that are affected. Consumers, policy makers, environmentalists, industry representatives, and others will all bring existing cultural knowledge about the environment to frame and help them interpret the scientific information about global climate change. Some of that information will be explicitly political and economic. But there will also be strong currents of implicit, tacit knowledge that individuals will use to frame the scientific, political, and economic arguments for certain actions on global climate change. As Crate asks of the Sakha, we need to ask of ourselves, What implicit and tacit cultural models of knowledge and values are deployed by different groups as they seek to understand and respond to the challenges of global climate change? In my own work on natural resource restoration for the Chesapeake Bay, I have applied cultural model research to identify the knowledge and values that scientists, environmentalists, policy makers, and the general public use to understand Bay restoration issues. By doing so, I have been able to argue that we all bring implicit knowledge and values to our environmental actions to restore the Bay, and those of consumers or scientists are comparable to those of farmers and commercial fishermen in the communities where I began my research (Paolisso 2006).

We need anthropology to study global climate change at

the global and local community levels. As Crate has demonstrated so well, we are very skilled at the local. We should not abandon that focus, but we need to expand and focus on other communities of global climate change stakeholders to identify how they understand their community's (e.g., neighborhood, profession, government) relationship to global climate change and what they could and should do about it. Underlying it all will be core cultural beliefs and values about the environment, drawn from different domains of human experience, that we can use to build collaborative efforts to address global climate change that include the Sakha and your neighbor next door.

---

### Günther Schlee

Max Planck Institute for Social Anthropology, P.O. Box 11 03 51, 06017 Halle/Saale, Germany (schlee@eth.mpg.de). 12 IV 08

Crate deals with an apparent paradox. The Sakha moved down the Lena centuries ago, adjusting their way of subsistence and becoming the northernmost cattle- and horse-based economy on earth (apart from being the northernmost Turkic-speaking group). One might expect them to welcome global warming because, in some ways, conditions are beginning to resemble those of the regions farther south where the Sakha originated and where keeping cattle is not nearly as arduous a task. Crate convinces us that things are not so simple. Rising temperatures cause problems, such as sinking permafrost land, inundations, and rain that interferes with hay making.

Crate has a category for people who disagree with her, namely, "misinformed critics who deny urgency to act on global climate change." In order not to be put into that category, I hasten to say that, quite apart from the cattle of the Sakha, there are indeed many good reasons all over the world for reducing energy consumption and carbon dioxide output. Also, Crate's point about the Sakha is basically well taken. But there must be some ways in which the Sakha benefit from rising temperatures and that they have mentioned to Crate. As an Africanist who has never been to Siberia, I have to engage in pure speculation, but it may be, for example, that there are more berries or more mushrooms or other little things, even if these kinds of benefits are outweighed by the negative effects Crate describes. The statement that the Sakha now need less firewood in winter is immediately qualified, and the information that "shorter winters may actually be beneficial" to cattle and horses—which sounds like a concession to reviewers—is hidden in a footnote and is immediately followed by counterarguments. Granted that hay making has become more difficult because of rainy summers, don't the animals also need less hay now that the winters have become shorter? From researchers at the Siberian Studies Centre at my institute, I have learned that the *alaas* thermokarst depressions, if they thaw and are not flooded, produce lush grassland. If Crate had mentioned these kinds of

complex effects of changing temperatures and had taken beneficial elements more seriously, without playing them down at the same time, the presentation of her evidence would have looked less selective and would have been more convincing.

My other point is about "cultures" and has implications that go beyond the Sakha and their cattle. In observing anthropology, especially as a European observer of the American scene, one is struck by the degree to which the discipline has split into diverse schools or branches that have stopped communicating with one another. From scholars of "ethnicity" and "identity/identification" we have learned to reject the concept of "cultures" as bounded units. Cultural forms travel and combine—a belated tribute to diffusionism. Social units such as clans, ethnic groups, and nations are presented as the results of recurrent processes of construction and transformation. "Culturalists" are warned of the intellectual and moral risks of "othering." Crate, on the other hand, is among those who gather around concepts such as "indigenous rights" and "advocacy," who have no difficulty with talking about "cultures" in the plural, who treat cultures as separate entities, and who stress the uniqueness of forms of adaptation (perceived as slow processes). For these scholars, cultures display stability over time, if conditions permit, and adjust only with great difficulty when conditions change rapidly. In the jargon of the deconstructionists, such a position would be called "essentialist," "naturalizing," "primordialist," "romantic," or whatnot. Personally, I think that such polarizing polemics would not lead us very far. What strikes me, however, is that Crate and those others who take a similar position do not even bother to contradict the deconstructionists. Instead, they write about culture as if the critique of that concept had never taken place. Crate celebrates Sakha "culture" as having a "core," comprising "sacred cosmologies" and being grounded in "mythological symbols" and "totem" animals and plants.

It seems that people who are lucky enough to have a culture of this sort cannot be wrong. Crate explains her "cognitive/perceptual research approach" by saying, "Once their [the Sakha's] perceptions are accounted for in whatever ways our research partners [the Sakha] see fit, we can reframe and inform them to encourage positive change. Thereby our work becomes applied." "Reframing," I suppose, means phrasing Sakha understandings in the categories of the dominant society and global institutions, a necessary step in successful advocacy, and "informing" means backing up such rephrasing with corroborating evidence. Apart from that, Crate proposes to move straight from local "cultural" or emic perception to political action. Do we need to conduct a thought experiment with "American culture" to show that this is a problematic approach? Popular "culture" in America, as everywhere else, is full of beliefs which do not stand up under close scrutiny, for example, incorrect assessments (on the low side) of the risk involved in using automobiles and inaccurate beliefs about Muslims. We can only hope that not all such emic views find their way straight into American politics. Should that way be shorter for Sakha beliefs?

## Reply

I am grateful for the diversity of and common themes across the comments and to *Current Anthropology* for making dialogue a priority—and giving authors the opportunity to respond.

Several commentators contest my use of the term “culture.” I recognize that although “culture” has gone through a deep critique in anthropology in the last several decades (Abu-Lughod 1991; Agar 1996; Clifford 2004), it still remains a useful and important concept, central to our field. To quote James Clifford, “Culture is a deeply compromised idea I cannot yet do without” (1988, 10). In addition, my orientation and training is in the Steward/Netting school of cultural ecology, and thus I orient my argument also on the concept of culture core (Netting 1968, 1993; Steward 1955). I am also trained as an applied anthropologist, and I do gather around rights and advocacy of cultures. Culture change is a given and necessary process of all human societies as they adapt, in our era, to a variety of effects including globalization, environmental degradation, land issues, climate change, and others—but what is essential to a culture—the core aspects, for place-based peoples (and I would argue for all peoples), their significant human-environment interactions with specific lands, plants, animals, and even ecosystem characteristics, that shape their ways of being, cosmologies, beliefs, and daily/cyclical orientations. Who of us can draw the line in the sand to show when a culture has gone beyond the natural and healthy change and maintained its function of bringing meaning, as Einarsson points out?

In the context of my central argument in the article, I hold that what social scientists, and anthropologists in particular, need to advocate for in their climate change research is the preservation of the ethnosphere and of global ethnodiversity, on the same grounds that natural scientists promote protection of the biosphere and global biodiversity. Wade Davis points out that it is in fact the very “sacred cosmologies” and the being “grounded” in “mythological symbols” and “totem” animals and plants that are part and parcel to that ethnodiversity (Davis 2001).

Schlee’s point, and to some extent Ford’s, that I need to also talk about beneficial effects of climate change is a moot point. This is the same overly simplistic and dangerous territory of the losers and winners argument that some engage in regarding global climate change. My background in ecology and environmental anthropology has trained me to see the forest for the trees. Yes, I understand well the cyclical nature of *alaas* systems (Crate 2006a, 9–11). Pre-Soviet Sakha routinely drained *alaas* lakes specifically to take advantage of their productivity, summoning a shaman first to conduct the proper rituals to subdue the lake spirit. With climate change there are more, as Schlee calls them, “little things,” including new insect pests, never seen before, that wipe out households’

subsistence gardens. There are multiple effects that, depending on who you are, could be considered bad or good. For example, some consider an ice-free Arctic a good thing because it means easier shipping, while others consider an ice-free Arctic to be bad since the ice is critical to maintaining the worldwide temperature regime. If we know that Viliui Sakha have adapted a horse- and cattle-breeding subsistence to an extreme environment, and that environment changes quickly to render a very different ecosystem that cannot support those animals, what then? How can more berries replace the substance of livelihood based on cattle? Do you know many cultures underpinned by berry picking? If we go this route, the bigger picture is lost. Yes, climate change brings new opportunities, but the question is whether these opportunities can sustain people and sustain their culture. We need to accept that the changes that climate change will bring in time if no action (or not enough) is taken will make us all losers.

“Whose knowledge/knowledge for whom?” is also an important point of discussion. As Einarsson rightly points out, Viliui Sakha elders have “subtle and sophisticated” understandings of the impacts of global climate change. As anthropologists, we have the skills of “being there” (Roncoli, Crane, and Orlove 2008) that allow us to recognize those subtle and sophisticated understandings. We can identify the underlying reasons, the implicit and tacit and cognitive. Our work is not about “right” or “wrong” knowledge or about tailoring knowledge systems to each other but about identifying the unbounded, changing, nonessential, not static cultural knowledge—a people’s dynamic system of learning and shared knowledge and values about, for example, climate change—that frames people’s perceptions and behaviors. Additionally, if we see that people are receiving information based not on sound knowledge but on hype (in Viliui Sakha’s case, repeated television showings of *The Day After Tomorrow*), it is important to advocate for bringing knowledge of global processes—first and foremost by scientists in that same culture who are generating the data. This is one main objective of my 2008–2010 National Science Foundation (NSF) project.

In Viliui Sakha villages, as in a majority of Arctic villages, there are the same common trends of a proliferation of “global” phenomena, including satellite disks, cell phones, and HIV-AIDS and the apparent cultural rift in and unwanted out-migration of young people.

Like many Northern village contexts, Viliui Sakha villages are a strange combination of yesterday and tomorrow (Crate 2002, 134):

On a given day I would leave an elder’s house after a two-hour interview, enter the street, and for a few moments had the sense that time stood still. Local inhabitants worked stacking manure and tending cows, skidding containers of drinking water from the river on small sleds, and splitting and stacking firewood. . . . In the next moment I was catapulted into a different present, when a group of teenage girls strolled by with orange, blue, and purple dyed hair,

wearing six-inch platform heels, bell-bottoms and skimpy shorts revealing pierced navels. Time both stood still and raced forward.

Out-migration is not due to loss of interest in the village but is more related to lack of employment (Crate 2006b). Young people want to stay in their villages but lack jobs. Based upon my empirical research, I believe that building local sustainable economies is more the issue at stake for keeping young people engaged in their communities. Like the 2003–2006 community sustainability project, for the 2008–2010 summers, my new project will work with all age groups in Viliui Sakha villages to investigate local perceptions and responses to climate change.

It heartens me greatly that the most consensus across commentators was on the need to broaden our approach—that in the issue of climate change, our vast discipline of anthropology has, and we as anthropologists have, a veritable myriad of subdisciplinary approaches, skill sets, analytical tools, and venues for collaborations across those subdisciplines and in multiple interdisciplinary contexts. My intent was not to advocate one approach but to take my readers through my own inductive process in how I came to working on climate change. In the three years since I wrote this article's first draft, I have been on a fast-moving train with my thinking and research pursuits. It is the human dimension, both in cause and effect, that we are tasked to understand and find ways to address. And it was my frustration with the lack of attention to climate change at our main meetings that prompted me to organize multiple sessions at the last few years of AAAs and SFAAs—and to develop an edited volume on the topic—to explore our role(s) and open this urgent dialogue (Crate and Nuttall 2008). I commend Lahsen for the important work she and other anthropologists/social scientists are doing in addressing the cultural implications in contexts of power brokers, policy makers, and others in places of power. How can powerful institutions fund activities that cause climate change and, at the same time, fund efforts to ameliorate the issue? For example, in February 2008, the World Bank held a workshop, the “Social Dimensions of Climate Change”—the same World Bank that funds oil and gas projects that contribute to the problem. Perhaps Lahsen and others with a similar focus can inform these paradoxes. Other anthropologists have been quietly doing this important work for years. Willett Kempton's work on vehicle to grid transportation and offshore wind power comes to mind. Additionally, several contributors in our upcoming volume are working in the domestic and international policy realms, on issues of consumer behavior, institutional greening, and car culture (Crate and Nuttall 2008).

One important point that none of my commentators mentioned but that should be addressed is the issue of multiple stressors. In every research context there are multiple interplaying factors, on both the physical and sociocultural levels, that need to be teased out and understood. Garry Peterson,

at the 2008 Tyndall climate conference in London, gave a powerful presentation illustrating the multiple factors and feedbacks interplaying on a physical level in the climate change phenomenon (Peterson 2008). We as anthropologists are tasked with the same challenge—to tease out the multiple factors and feedbacks interplaying on a sociocultural level. Schweitzer and Marino's (2008) research showing the importance of “not talking about climate change” makes some indirect points to these ends. Our forthcoming edited volume, *Anthropology and Climate Change*, also presents multiple cases to this effect (Crate and Nuttall 2008). In sum, we should not be so hasty to assume either that all environmental change is a result of climate change or that the communities we work with have our same understanding of what the term “climate change” means.

My final point is an appeal for anthropologists to come together. The big picture of climate change that a groundswell, at least in the United States, has finally “gotten” (not that they are taking necessary actions yet) is that there is nothing positive about our planetary emergency. Alarmist as it sounds, so be it. Perhaps it is time to admit that we need to be alarmist—start a new subdiscipline of “alarmist anthropology.” At the same time, climate change is not all gloom and doom. As Ben Wisner, Barbara Rose Johnston, and their coauthors state, “Ironically, climate change offers humanity an opportunity for a quantum leap in sustainable development and in peace making. If international cooperation (as opposed to competition) is strengthened” (Wisner et al. 2007). Similarly, I argue, it can help us as anthropologists rise to the occasion—to use our unique skills and tool kits to do the work before us and stop engaging in petty skirmishes and subdisciplinary and even interdisciplinary squabbles that take our energy and talent away from where it is really needed. Without action, all is lost.

—Susan A. Crate

## References Cited

- Abu-Lughod, Lila. 1991. Writing against culture. In *Recapturing anthropology*, ed. Richard Fox, 137–62. Santa Fe: School of American Research Press.
- ACIA. 2005. *Arctic Climate Impact Assessment*. Cambridge: Cambridge University Press.
- Adger, W. Neil, Nigel Arnell, and Emma Thompkins. 2005. Adapting to climate change: Perspectives across scales. *Global Environmental Change* 15:75–76.
- Agar, Michael. 1996. *The professional stranger*. San Diego: Academic Press.
- AHDR. 2004. *Arctic human development report*. Akureyri, Iceland: Stefansson Arctic Institute.
- Basso, Keith. 1996. Wisdom sits in places: Notes on a western Apache landscape. In *Senses of place*, ed. Keith Basso and Steven Feld, 53–90. Santa Fe: School of American Research Press.

- Berkes, Fikret. 1999. *Sacred ecology: Traditional ecological knowledge and resource management*. Philadelphia: Taylor and Francis.
- Berkes, Fikret, J. Colding, and Carl Folke. 2003. Introduction. In *Navigating social-ecological systems*, ed. Fikret Berkes, J. Colding, and Carl Folke, 1–29. Cambridge: Cambridge University Press.
- Berkes, Fikret, and Dyanna Jolly. 2001. Adapting to climate change: Social-ecological resilience in a Canadian western arctic community. *Conservation Ecology* 5:18. <http://www.consecol.org/vol5/iss2/art18> (accessed May 30, 2007).
- Borofsky, Robert. 2006. Conceptualizing public anthropology. <http://www.publicanthropology.org/Defining/definingpa.htm> (accessed May 30, 2007).
- Brown, Michael. 2003. *Who owns native culture?* Cambridge: Harvard University Press.
- Castile, George Pierce, and Robert L. Bee, eds. 1992. *State and reservation: New perspectives on federal Indian policy*. Tucson: University of Arizona Press.
- Caulfield, Richard A. 1997. *Greenlanders, whales, and whaling: Sustainability and self-determination in the Arctic*. Hanover, N.H.: University Press of New England.
- Chambers, Erve. 1985. *Applied anthropology: A practical guide*. Englewood Cliffs, N.J.: Prentice-Hall.
- Clifford, James. 1988. *The predicament of culture*. Cambridge: Harvard University Press.
- . 2004. Traditional futures. In *Questions of tradition*, ed. Mark Salber Phillips and Gordon Schochet, 152–68. Toronto: University of Toronto Press.
- Crate, Susan. 2002. Viliui Sakha oral history: The key to contemporary household survival. *Arctic Anthropology* 39: 134–54.
- . 2003a. Co-option in Siberia: The case of diamonds and the Vilyuy Sakha. *Polar Geography* 26:289–307.
- . 2003b. Viliui Sakha post-Soviet adaptation: A sub-arctic test of Netting's smallholder theory. *Human Ecology* 31:499–528.
- . 2006a. *Cows, kin, and globalization: An ethnography of sustainability*. Walnut Creek, Calif.: AltaMira Press.
- . 2006b. Elder knowledge and sustainable livelihoods in post-Soviet Russia: Finding dialogue across the generations. *Arctic Anthropology* 43:40–51.
- . 2006c. Investigating local definitions of sustainability in the Arctic: Insights from post-Soviet Sakha villages. *Arctic* 59:115–31.
- Crate, Susan A., and Mark Nuttall, eds. 2008. *Anthropology and climate change: From encounters to actions*. Walnut Creek, Calif.: Left Coast Press. In press.
- Cruikshank, Julie. 2001. Glaciers and climate change: Perspectives from oral tradition. *Arctic* 54:377–93.
- . 2005. *Do glaciers listen? Local knowledge, colonial encounters, and social imagination*. Vancouver: UBC Press/Seattle: University of Washington Press.
- Crumley, Carole, ed. 1994. *Historical ecology: Cultural knowledge and changing landscapes*. Santa Fe: School of American Research Press.
- , ed. 2001. *New directions in anthropology and environment: Intersections*. Walnut Creek, Calif.: AltaMira Press.
- Cutter, Susan, and Christopher Emrich. 2006. Moral hazard, social catastrophe: The changing face of vulnerability along the hurricane coasts. *Annals of the American Academy of Political and Social Science* 604:102–12. <http://ann.sagepub.com/cgi/content/abstract/604/1/102> (accessed May 30, 2007).
- D'Andrade, Roy. 1995. *The development of cognitive anthropology*. Cambridge: Cambridge University Press.
- Davis, Wade. 2001. *Light at the edge of the world*. Washington, D.C.: National Geographic.
- Duerden, Frank. 2004. Translating climate change impacts at the community level. *Arctic* 57:204–12.
- Egan, D., and E. Howell, eds. 2001. *The historical ecology handbook*. Washington, D.C.: Island Press.
- Ergis, G. U. 1974. *Ocherki pa Yakutskomy folklori*. Moscow: Science Publishers.
- Evans-Pritchard, E. E. 1940. *The Nuer*. Oxford: Clarendon Press.
- Fogel, C. A. 2002. Greening the earth with trees: Science, storylines and the construction of international climate change institutions. Ph.D. diss., University of California, Santa Cruz. [ML]
- Ford, James D., and Barry Smit. 2004. Framework for assessing the vulnerability of communities in the Canadian Arctic to risks associated with climate change. *Arctic* 57: 389–400.
- Ford, James D., Barry Smit, and Johanna Wandel. 2006. Vulnerability to climate change in the Arctic: A case study from Arctic Bay, Canada. *Global Environmental Change* 16: 145–60.
- Fox, Shari. 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 environment change*, ed. Igor Krupnik and Dyanna Jolly, 15–23. Fairbanks, Alaska: Arctic Research Consortium of the United States/Smithsonian Institution Arctic Studies Center.
- Gould, Julius, and William L. Kolb, eds. 1964. *A dictionary of the social sciences*. New York: Free Press of Glencoe.
- Gunderson, L. H., and C. S. Holling. 2002. *Panarchy: Understanding transformations in human and natural systems*. Washington, D.C.: Island Press.
- HDR. 2007. *Human development report 2007/2008*. Human Development Report Office. New York: United Nations Development Programme. [NE]
- Helander, Elina, and Tero Mustonen, eds. 2004. *Snowscapes, dreamscapes*. Vaasa, Finland: Fram Oy.
- Henshaw, Anne. 2003. Climate and culture in the North: The interface of archaeology, paleoenvironmental science, and oral history. In *Weather, climate, culture*, ed. Sarah Strauss and Benjamin Orlove, 217–31. New York: Berg.



- Hoffman, Susanna M., and Anthony Oliver-Smith, eds. 2002. *Catastrophe and culture: The anthropology of disaster*. Santa Fe: School of American Research Press.
- Humphrey, Caroline. 1998. *Marx went away—but Karl stayed behind*. Ann Arbor: University of Michigan Press.
- Huntington, Henry. 2002. Human understanding and understanding humans in the Arctic system. In *The earth is faster now: Indigenous observations of Arctic environment change*, ed. Igor Krupnik and Dyanna Jolly, xxi–xxvii. Fairbanks, Alaska: Arctic Research Consortium of the United States/Smithsonian Institution Arctic Studies Center.
- Huntington, Henry, Shari Fox, Fikret Berkes, and Igor Krupnik. 2005. The changing Arctic: Indigenous perspectives. In *Arctic Climate Impact Assessment*, 61–98. Cambridge: Cambridge University Press.
- ICC. 2005. Inuit Petition Inter-American Commission on Human Rights to oppose climate change caused by the United States of America. <http://www.inuitcircumpolar.com/index.php?ID=316&Lang=En> (accessed May 30, 2007).
- IPCC. 2007. *Climate change 2007: Impacts, adaptation and vulnerability. Working group II Summary for policymakers*. Geneva: IPCC Secretariat. <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf> (accessed June 11, 2008).
- Ivanova, Ekaterina. 2005. Khvatit gasovat'. *Komsomolskaia Pravda v Yakutii* July 28–August 4, 1.
- Jasanoff, S., and B. Wynne. 1998. Science and decisionmaking. In *Human choice and climate change*, ed. S. Rayner and E. L. Malone, vol. 1, 1–87. Columbus, Ohio: Batelle Press. [ML]
- Jochelson, W. 1933. *The Yakut*. Anthropological Papers of the American Museum of Natural History 33, pt. 2. <http://digitallibrary.amnh.org/dspace/handle/2246/138>.
- Jones, P. D., A. E. J. Ogilvie, T. D. Davies, and K. B. Briffa. 2001. Unlocking the doors to the past: Recent developments in climate and climate-impact research. In *History and climate: Memories of the future?* ed. P. D. Jones, A. E. J. Ogilvie, T. D. Davies, and K. B. Briffa, 1–8. New York: Kluwer Academic/Plenum.
- Karjalainen, Timo Pauli, and Joachim Otto Habeck. 2004. When “the environment” comes to visit: Local environmental knowledge in the Far North of Russia. *Environmental Values* 13:167–86.
- Kempton, Willett. 2001. Cognitive anthropology and the environment. In *New directions in anthropology and environment*, ed. Carol Crumley, 49–71. Walnut Creek, Calif.: AltaMira Press.
- Kirsch, Stuart. 2002. Anthropology and advocacy: A case study of the campaign against the Ok Tedi mine. *Critical Anthropology* 22:175–200.
- Krupnik, Igor, and Dyanna Jolly, eds. 2002. *The earth is faster now: Indigenous observations of Arctic environment change*. Fairbanks, Alaska: Arctic Research Consortium of the United States/Smithsonian Institution Arctic Studies Center.
- Kulakovskii, A. E. 1979. *Nauchni trude*. Yakutsk: Yakutskoe Knizhnoe Izdatel'stvo.
- Lahsen, M. 1999. The detection and attribution of conspiracies: The controversy over chapter 8. In *Paranoia within reason: A casebook on conspiracy as explanation*, ed. George F. Marcus, 111–36. Chicago: University of Chicago Press. [ML]
- . 2004. Transnational locals: Brazilian experiences of the climate regime. In *Earthly politics, worldly knowledge: Local and global in environmental politics*, ed. S. Jasanoff and M. Long Martello, 151–72. Cambridge: MIT Press. [ML]
- . 2005a. Seductive simulations: Uncertainty distribution around climate models. *Social Studies of Science* 35: 895–922. [ML]
- . 2005b. Technocracy, democracy, and U.S. climate science politics: The need for demarcations. *Science, Technology, and Human Values* 30:137–69. [ML]
- . 2007. Distrust and participation in international science and environmental decision making: Knowledge gaps to overcome. In *The social construction of climate change*, ed. M. Pettinger, 173–96. Burlington, Vt.: Ashgate. [ML]
- . n.d. Science and Brazilian environmental policy: The case of the LBA and carbon sink science. *Climatic Change*. In press. [ML]
- Lahsen, M., and C. A. Nobre. 2007. The challenge of connecting international science and local level sustainability: The case of the LBA. *Environmental Science and Policy* 10: 62–74. [ML]
- Lassiter, Luke Eric. 2005. Collaborative ethnography and public anthropology. *Current Anthropology* 46:83–107.
- Leigh, Peter. 2005. The ecological crisis, the human condition, and community-based restoration as an instrument for its cure. *Ethics in Science and Environmental Politics*, April 4, 3–15.
- Marcus, G. 1998. *Ethnography through thick and thin*. Princeton: Princeton University Press.
- McCarthy, James J., Osvaldo F. Canziani, Neil A. Leary, David J. Dokken, and Kasey S. White, eds. 2001. *Climate change 2001: Impacts, adaptation, and vulnerability*. Cambridge: Cambridge University Press.
- Nagengast, Carole, and Carlos G. Vélez-Ibáñez. 2004. *Human rights: The scholar as activist*. Oklahoma City: Society for Applied Anthropology.
- Netting, R. McC. 1968. *Hill farmers of Nigeria: Cultural ecology of the Kofyar of the Jos Plateau*. Seattle: University of Washington Press.
- . 1993. *Smallholders, householders: Farm families and the ecology of intensive, sustainable agriculture*. Stanford: Stanford University Press.
- Nichols, Theresa, Fikret Berkes, Dyanna Jolly, Norman Snow, and the Community of Sach Harbour. 2004. Climate change and sea ice: Local observations from the Canadian Western Arctic. *Arctic* 57:68–79.
- Nuttall, M. 1992. *Arctic homeland: Kinship, community, and*

- development in northwest Greenland*. Toronto: University of Toronto Press.
- . 1998. *Protecting the Arctic: Indigenous peoples and cultural survival*. Amsterdam: Harwood Academic Press.
- . 2001. Indigenous peoples and climate change research in the Arctic. *Indigenous Affairs* 4/2001:26–34.
- Nuttall, M., F. Berkes, B. Forbes, G. Kofinas, T. Vlassova, and G. Wenzel. 2005. Hunting, herding, fishing, and gathering: Indigenous peoples and renewable resource use in the Arctic. In *Arctic Climate Impact Assessment*, 649–90. Cambridge: Cambridge University Press.
- Okladnikov, A. P. 1970. *Yakutia*. Montreal: McGill-Queens University Press.
- Oliver-Smith, Anthony. 1996. Anthropological research on hazards and disasters. *Annual Review of Anthropology* 25: 303–28.
- . 2005. Communities after catastrophe: Reconstructing the material, reconstituting the social. In *Community building in the 21st century*, ed. Stanley Hyland, 45–70. Santa Fe: School of American Research Press.
- O’Riordan, T., C. L. Cooper, and A. Jordan. 1998. Institutional frameworks for political action. In *Human choice and climate change*, ed. S. Rayner and E. L. Malone, vol. 1, 345–439. Columbus, Ohio: Batelle Press. [ML]
- Paine, Robert, ed. 1985. *Advocacy and anthropology, first encounters*. St. John’s, Newfoundland: Institute of Social and Economic Research, Memorial University of Newfoundland. [NE]
- Paolisso, Michael. 2003. Chesapeake Bay watermen, weather, and blue crabs: Cultural models and fishery policies. In *Weather, climate, culture*, ed. Sarah Strauss and Benjamin Orlove, 61–81. New York: Berg.
- . 2006. Chesapeake environmentalism: Rethinking culture to strengthen restoration and resource management. *Chesapeake Perspectives Monographs*. College Park, Md.: Maryland Sea Grant College. [MP]
- Peterson, D. J. 1993. *Troubled lands: The legacy of Soviet environmental destruction*. Boulder: Westview Press.
- Peterson, Garry. 2008. Ecological limits of adaptation to climate change. Paper presented at the Tyndall Centre for Climate Change Research, “Living with climate change: Are there limits to adaptation?” London, February 7–8.
- Prucha, Francis Paul. 1985. *The Indians in American society: From the Revolutionary War to the present*. Berkeley: University of California Press.
- Quinn, Naomi, and Dorothy Holland, eds. 1987. *Cultural models in language and thought*. New York: Cambridge University Press.
- Rappaport, Roy. 1984. *Pigs for the ancestors: Ritual in the ecology of a New Guinea people*. 2d edition. Prospect Heights, Ill.: Waveland Press.
- Rayner, S. 1989. Fiddling while the globe warms? *Anthropology Today* 5:1–2. [ML]
- Rayner, S., D. Lach, H. Ingram, and M. Houck. 2002. *Weather forecasts are for wimps: Why water resource managers don’t use climate forecasts*. Final Report to NOAA Office of Global Programs. [ML]
- Riedlinger, Dyanna R., and Fikret Berkes. 2001. Contributions of traditional knowledge to understanding climate change in the Canadian Arctic. *Polar Record* 37:315–28.
- Roncoli, Carla, Todd Crane, and Ben Orlove. 2008. Fielding climate change in cultural anthropology. In *Anthropology and climate change: From encounters to actions*, ed. Susan A. Crate and Mark Nuttall. Walnut Creek, Calif.: Left Coast Press. In press. [ML]
- Rylko-Bauer, Barbara, Merrill Singer, and John Van Willigen. 2006. Reclaiming applied anthropology: Its past, present, and future. *American Anthropologist* 108:178–90.
- Schweitzer, Peter, and Beth Marino. 2008. Talking and not talking about climate change in northwestern Alaska. In *Anthropology and climate change: From encounters to actions*, ed. Susan A. Crate and Mark Nuttall. Walnut Creek, Calif.: Left Coast Press. In press.
- Seroshevskii, V. L. 1993 (1896). *Yakuti*. Moscow: ROSSPEN.
- Siegel, James. 2006. Arctic National Wildlife Refuge divides Americans. *Anthropology News* 47:26–27.
- Simpura, Jussi, and Galina Eremitcheva. 1997. Dirt: Symbolic and practical dimensions of social problems in St. Petersburg. *International Journal of Urban and Regional Research* 21:476–80.
- Sivtsev, D. K. 1996 (1947). *Sakha fol’klora: Khomyryynn’yk*. Novosibirsk: Nauka.
- Smit, B., and O. Pilifosova. 2003. From adaptation to adaptive capacity and vulnerability reduction. In *Climate change, adaptive capacity and development*, ed. J. Smith, R. T. J. Klein, and S. Huq, 9–28. London: Imperial College Press.
- Smit, Barry, and Johanna Wandel. 2006. Adaptation, adaptive capacity, and vulnerability. *Global Environmental Change* 16:282–92.
- Steward, Julian H. 1955. *Theory of culture change*. Urbana: University of Illinois Press.
- Strathern, Marilyn. 1999. *Property, substance, and effect: Anthropological essays on persons and things*. London: Athlone.
- Strauss, Sarah, and Benjamin Orlove, eds. 2003. *Weather, climate, culture*. New York: Berg.
- Suslov, S. P., Noah D. Gershevsky, and Joseph E. Williams. 1961. *Physical geography of Asiatic Russia*. San Francisco: W. H. Freeman.
- Thomalla, Frank, Tom Downing, Erika Spanger-Siegfried, Guoyi Hand, and Johan Rockstrom. 2006. Reducing hazard vulnerability: Towards a common approach between disaster risk reduction and climate adaptation. *Disasters* 30: 39–48. <http://www.blackwell-synergy.com/doi/abs/10.1111/j.1467-9523.2006.00305.x>
- Thomas, David, and Chasca Twyman. 2005. Equity and justice in climate change adaptation amongst natural-resource-dependent societies. *Global Environmental Change* 15: 115–24.
- Thompson, M., and S. Rayner. 1998. Cultural discourses. In *Human choice and climate change*, ed. S. Rayner and E. L.

- Malone. vol. 1, 265–343. Columbus, Ohio: Batelle Press. [ML]
- Turi, J. M. 2000. Native reindeer herders: Priorities for research. *Polar Research* 19:131–33.
- \_\_\_\_\_. 2002. The world reindeer livelihood—current situation: Threats and possibilities. In *Northern timberline forests: Environmental and socio-economic issues and concerns*, ed. S. Kankaanpää, L. Müller-Wille, P. Susiluoto, and M.-L. Sutinen, 70–75. Jyväskylä: Finnish Forest Research Institute.
- Washburn, A. L. 1979. *Geocryology: A survey of periglacial processes and environments*. London: Arnold.
- Watt-Cloutier, Sheila. 2004. Climate change and human rights. *Human Rights Dialogue* 2(11). [http://www.cceia.org/resources/publications/dialogue/2\\_11/section\\_1/4445.html](http://www.cceia.org/resources/publications/dialogue/2_11/section_1/4445.html).
- White, Richard. 1983. *The roots of dependency: Subsistence, environment, and social change among the Choctaws, Pawnees, and Navajos*. Lincoln: University of Nebraska Press.
- Wisner, Ben, Maureen Fordham, Ilan Kelman, Barbara Rose Johnston, David Simon, Allan Lavell, Han Gunter Brauch, Ursula Oswald Spring, Gustavo Wilches-Chaux, Marcus Moench, and Daniel Weiner. 2007. Climate change and human security. <http://www.radixonline.org/cchs.html>.
- Vitebsky, Piers. 2006. Reply. *Natural History* 115:10.
- Ziker, J. P. 2002. *Peoples of the tundra: Northern Siberians in the post-communist transition*. Prospect Heights, Ill.: Waveland Press.