



Climate Strategies

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Review



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Author for correspondence:
Barbara Bodenhorn
e-mail: bb106@cam.ac.uk

[†]Present address: Pembroke College,
Cambridge CB2 1RF, UK.

Climate strategies: thinking through Arctic examples

Barbara Bodenhorn^{1,†} and Olga Ulturgasheva²

¹Department of Social Anthropology, University of Cambridge, Free School Lane, Cambridge CB2 3RD, UK

²Department of Social Anthropology, University of Manchester, Oxford Road, Manchester M13 9PL, UK

 BB, 0000-0002-1704-0450

Frequent and unpredictable extreme weather events in Siberia and Alaska destroy infrastructure and threaten the livelihoods of circumpolar peoples. Local responses are inventive and flexible. However, the distinct politics of post-Soviet Siberia and Alaska play a key role in the pragmatics of strategic planning. The Arctic is a planetary climate driver, but also holds the promise of massive resources in an ice-free future, producing tensions between 'environmental' and 'development' goals. Drawing on material from Siberia and Alaska we argue: (i) that extreme events in the Arctic are becoming normal; material demands are in a state of flux making it difficult to assess future material needs. We must consider material substitutions as much as material reduction; (ii) local-level responsive strategies should be taken into account. Core/periphery thinking tends to assume that answers come from 'the centre'; this is, in our view, limited; (iii) we suggest that 'flexibility' may become a core survival value that is as important for city planners and public health officials as it is for Siberian reindeer herders. In this, we see not only the simultaneous need for mitigation and adaptation policies, but also for a concerted effort in promoting such capacities in young people.

This article is part of the themed issue 'Material demand reduction'.

1. Introduction

In *Tipping Point for Planet Earth*, paleobiologists Barnosky & Hadly [1, p. 68] suggest three ways in which 'reduction' needs to be at the heart of strategic responses to the global changes confronting us. *Per capita*

consumption needs to go down; new builds need to be constructed with a zero carbon footprint; and we need to be able to imagine an economic model that is not based on infinite growth. Each of these exhortations is not new; none is realizable in any straightforward way—as evinced by recent events in both the UK and the USA.¹ What we wish to highlight from these authors, however, is the painstaking way in which they approach the question of tipping points which intersect and mutually influence each other as the world's resource base(s) grow ever more tenuous—climate affecting and being affected by a number of other factors. Two sorts of tipping points emerge in tandem: geopolitical as the desire for resources outpaces availability and increased mechanization changes the nature of 'work'; and ecological, as the exploitation of such resources has so many negative knock-on effects to surrounding ecosystems. Together they contribute to the vast movements of people as well as political conflict and instability (Bodenhorn and Ulturgasheva would add—increasingly short-term crisis/panic thinking as opposed to long-term strategic thinking).²

Barnosky & Hadly emphasize the foolhardiness of continuing present consumption rates, and detail the toxic effects of many contemporary production processes, but they also see individual initiatives that—with a multiplier effect—could have real impacts in reducing emissions.³ At least some businesses realize that it makes economic sense to cut back on emissions as they produce material goods and do not need to generate political will to do so.⁴ This resonates strongly with Allwood *et al.*'s [10] pragmatic-but-urgent calls for multiple ways in which humans could modify practice to lessen impact: longer-lasting products; modularization and remanufacturing; component re-use; designing products with less material (p. 362). Government support can of course play a central role in the success or failure of these goals, but it is clearly not the only key agent.

Within social anthropology, there is a relatively small, but growing body of work that joins attention to materiality, consumption and environmental processes (e.g. [11–15]). Barnosky & Hadly's multi-scalar, multi-disciplinary approach strongly resonates with the work of both Ulturgasheva and Bodenhorn; it is the approach we propose to take, but in our case, using detailed ethnographic material to explore events, consequences and responses that fold 'climate' into a matrix of factors, each of which influences and is influenced by others. In doing so, we pay particular attention to the material ways in which responses are generated and enacted, without losing sight of the importance of the non-material as a tool for dealing with the unexpected. By focusing on Eveny and Iñupiaq peoples, we pay attention to Arctic vulnerabilities (social and ecological) which bring small-scale (alternative) and large-scale (industrial) processes into mutual view.

Callison [16] recently noted the relative infrequency with which 'the Arctic' was mentioned at COP21. In fact, it was not mentioned in the final Paris agreement at all. If one considers (as the authors do) that the Arctic is an uncontroversial planetary driver of environmental conditions—and that as a minimal ecosystem its particular vulnerabilities render changes impactful at dizzying speeds, this is worrying; if one regards the region as the potential source of (ever-more) tantalizing resource riches in an ice-free future, there is considerable interest in toning down what is often dismissed as sensationalist rhetoric.⁵

¹At the time of this writing, President Trump has indicated that he intends to dismantle existing environmental protections [2,3].

²See also [4,5]; and a podcast of the Forum on Climate and Security [6].

³See also Urry's [7] discussion on what he defines as neo-liberal exemplars of excessive consumption and Moore's [8] account of what he calls the Capitalocene.

⁴The authors take Lego as a case in point; Allwood [9] has had similar experiences with the aluminium industry. Kemp [6] made the same point in a more general way.

⁵One reviewer queried 'planetary driver' as a term describing the Arctic's position in global ecological processes, saying they thought the Arctic was a recipient rather than a driver. Ecological systems consist of series of feedback loops; sending and receiving impacts are mutually related. However, several characteristics of the polar regions play a crucial role shaping planetary conditions. The albedo effect (in which the sun's energy is reflected back into space rather than absorbed by the Earth) is a function of those areas most covered by ice and snow. Arctic ice helps to shape the 'conveyor belt' of ocean currents as well as acting as a significant carbon sink (in the form of permafrost as well as the polar icecaps). In this sense, the Arctic is a planetary driver. Both ocean and air flows also bring vast amounts of pollution to the Arctic, which in turn, shapes the

This invites consideration of a number of challenges. Drawing on comparative material from northeastern Siberia, and the Alaskan Arctic, we engage with Allwood *et al.*'s [10] call for innovation by offering for discussion a series of factors which we feel need to be taken into account when generating strategies for confronting rapidly changing conditions.

- In the Arctic, the effects of already existing climate changes are constant and require just as constant responses—material and non-material.
- Because these impacts are the result of rapidly changing conditions, the what, where and how to respond are unpredictable, rendering calculations of material reduction difficult. Exploring alternative ways to engage with materiality, on the other hand, is inviting. In this, we concur wholeheartedly with Allwood *et al.* [10] as well as Barnoski & Hadly [1] when they propose different ways in which ‘the material’ may be modified.
- The effects of these extreme events are as much a function of politico-economic processes, past and present, as they are of environmental conditions. The extent to which responses are realizable depends on the creativity, ingenuity and determination of people who must cope with the conditions around them. But they also reflect geopolitics—the possibilities as well as the limits that are shaped by global processes. In this case, we examine some of the ways in which Siberia and Alaska share similar ecological conditions and distinct socio-political realities.
- This in turn invites attention to social, political and scientific knowledge; no set of mitigation strategies will develop ‘teeth’, so to speak, without this.
- Many of the globe’s most vulnerable areas, as well as its most resource-rich areas, are homeland of what Swift [21] called ‘encapsulated peoples’. Here we argue two points regarding marginalized peoples who live in remote areas: circumpolar peoples are not a homogeneous ‘they’ whose views and aspirations can be assumed to be unified; nor should they be considered ‘peripheral’ to some imaginary ‘core’ and therefore on the receiving end of technical solutions to complex challenges. We need to imagine a more fluid mode through which ideas and innovations move across regions, peoples and ecosystems.
- We also suggest that it is urgent to engage young people as they develop ‘action positions’ concerning what they perceive to be ‘their’ environment. If part of our challenge is to foster human capacities to change behaviours, this is key.

2. Background

Both Ulturgasheva and Bodenhorn are social anthropologists with extensive field experience among Eveny reindeer herders and Iñupiaq hunters, respectively. In both cases, concerns over changing environmental conditions as well as recognition of the need for strategies designed to deal with them have been the subject of local-level conversations since the last decades of the twentieth century. Throughout the circumpolar regions (Siberia, Alaska, Canada, Greenland, Iceland and parts of Scandinavia), inhabitants are experiencing local manifestations of global warming: thinning sea ice; melting permafrost, disappearing glaciers, rising sea levels; changes in salinity and water temperature; shifts in wind patterns; changes in precipitation; transnational impacts of increasingly extreme forest fires, the unfamiliar phenomenon of tundra fires; changes in animal and plant populations; coastal erosion; intensifying autumn storms and the like.⁶

Impacts are likewise multiple. They affect the built environment (as of September 2016, for instance, approx. 30 Alaska Native villages are in need of relocation due to sea-level rise and coastal erosion); and transportation links (many of which are ice-dependent in both Siberia and Alaska). Public health is at risk through water contamination; exposure of animals to new diseases; increased vulnerability to existing disease because of temperature change; knock-on

conditions which subsequently affect us globally—more often than not due to melting ice in all its forms. See [1,4] for general discussion; Winton [17] on the albedo effect; Rahmstorf [18,19] and Alley *et al.* [20] on sea ice and ocean currents.

⁶For Alaska, see the EPA [22] and Liu *et al.* [23] on tundra fires; see also [24,25] for a more circumpolar overview.

effects of factors which have negative impacts on animals' health which in turn lessen the quality of the human food supply chain; air pollution that is intensified as ice melts and as forest—and tundra—fires become more extreme, creating knock-on effects across the circumpolar north.⁷ We shall explore some of the ways in which local residents are responding to these rapid changes which pose intense challenges to daily survival.

At the same time, striking socio-political as well as ecological differences between post Soviet Siberia and post Alaska Native Claims Settlement Act Alaska offer fruitful comparative material through which to consider variations in human understanding as well as the particularity of responses to extreme changes in environmental processes. As we will explore in further detail below, for the Eveny reindeer herders with whom Ulturgasheva works, the collapse of the Soviet Union has meant, among other things, a decrease in the amount of governmental support available to the herders and an increased need for mobile and innovative self-reliance on the part of the herders themselves. The conditions these reindeer herders are facing, as well as the resources they have to call on in order to do so, are quite different from those to hand in Alaska. Most of the North Slope villages where Bodenhorn has worked are sites with a permanent Iñupiaq presence since well before the arrival of Europeans at the end of the nineteenth century. As semi-nomadic hunters and whalers Iñupiaq developed the techniques for building both permanent structures (ice cellars as well as houses) and mobile technologies, to which they added the technologies of the commercial whalers and those who followed them as they arrived in the Arctic. Since the late twentieth century, the region has benefited from the power to levy property taxes on oil installations on the northern coast and Barrow is relatively prosperous as a consequence. Today snow machines have replaced dog teams and high-powered rifles have become common. Many households have cars, televisions, computers and microwave ovens and many Iñupiaq fly to warm places for vacation. Still, skin parkas are perceived to protect humans on the ice more efficiently than commercially produced parkas. Skin boats remain the material technology of choice in the spring ice, whereas aluminium engine-powered boats are the preferred vessel in the fall. Materialities are tested, rather than being automatically judged as 'traditional' or 'modern'. As Briggs [29] pointed out some time ago, as a general rule, Inuit engagement with the material world is experimental; instead of asking what something is for, it is more common to hear speculation about how *else* an object might be used.

Our joint 'take home message', reflecting the views of a number of our interlocutors on both sides of the Bering Strait, is the importance of teaching young people not what to do in specific circumstances, but rather, how to be calmly flexible in the face of uncertainty. This implies an explicit value on experimentation with alternative materialities as well as a recognition that the ability to change behaviour is an asset. At the same time, there is little agreement, and much anxiety, about how to balance the desire to gain from short-term economic exploitation of non-renewable resources and the desire to protect renewable resources over the long term.

As we turn to more detailed Siberian material, we offer two views—one as a phenomenological account of current extreme events and people's response to them. We then turn to an examination of these same processes and their impacts on regional infrastructures which, Ulturgasheva argues, invites us to consider 'infrastructure' in new ways.

(a) Case example: change as predictable unpredictability—a phenomenological account

Keimetinova *et al.* [30] are Eveny reindeer herders from the taiga region of northeast Siberia. They constantly follow their animals on migratory routes which shift between high mountains, where glaciers provide refuge from the summer heat, and lower altitudes during the winter, where life is easier for both humans and their charges. At the London conference mentioned above, Keimetinova showed a video (recorded between August 2015 and May 2016) of startling and disturbing developments: collapsing mountains which threaten human and animal life; floods engulfing campsites in minutes; intense temperature rises which threaten reindeer driven to

⁷See Chapin *et al.* [26] for Alaska; Box [27] on US forest fire impacts on the Greenlandic ice sheet; Juday [28] on the intensification of forest fires in Alaska's boreal forest.

distraction by heat and mosquitoes because they can no longer retreat to glacial ice for refuge; thinning river and lake ice making human as well as reindeer travel perilous; ‘refugee’ bears (fleeing Russian forest fires) whose behaviour cannot be predicted and who do not follow local rules of human/animal interaction. Virtually every aspect of daily life has been rendered unpredictable. As the need for fast response times becomes ever more urgent, the pace of their lives has speeded up. They are building on their already mobile lifestyle: making lighter structures in order to pack up camp and move within minutes; shifting routes for moving across the landscape; and using every possible predictive method available to them. Sharing information is key, as is watching the reindeer closely (who can often sense an extreme event before humans can); observing cloud formations, and engaging in traditional divination practices. Keimetinova emphasized the importance of teaching their young people how to react calmly to such happenings, even if they feel panicked inside. It is an exemplary account of resilience without ever trivializing the enormity of the events confronting these and other residents of the Siberian boreal forests.

Although this is clearly an account of developing adaptive rather than mitigating strategies, it also illustrates points we feel are worth mentioning: the talk never turned on debates about who was responsible (and therefore, should pay) for the negative consequences that people were experiencing. Instead, the discussion revolved around impacts of those increasingly extreme events and strategies developed at the local level to respond to local conditions.⁸ People were explicit in their recognition that no single response could be assumed to be effective in all conditions—that they needed to develop a ‘stash’ so to speak of strategies that could be called upon in different configurations. No one expected a technological quick fix that would mean that their own individual behaviours could continue unchanged. And the outlook was largely ecological in that the focus was neither humano-centric, nor focused purely on ‘the natural’ and included equal attention to non-material and material resources as crucial to effective response.

(b) Take two: Siberian Eveny perspectives on ‘infrastructure’ or can post-Soviet infrastructure properly respond to the latest environmental pressures?

The local scenarios of calamity we have just described often represent a chain of entangled events and co-occurrences where one environmental disaster drives a sequence of other destructive events which are increasingly very hard to predict. We have seen how the warm winters which foster erratic behaviour of migratory wild animals, often exacerbated by forest fires, can also trigger permafrost melt that in its turn causes frequent flash floods and landslides which then prompt snow avalanches in mountain areas; the chain of co-implications continues in multiple and unpredictable directions. In this section, we shall examine how all of the above is contributing in one way or another to the further collapse of an already fragile and worn-out post-Soviet Siberian village infrastructure with gradually failing communication systems and transport connections.

We examine ‘The Siberian Village’ as a particular form of Soviet infrastructural project through the history and current situation of two almost identical Eveny villages, Sebyan and Topolinoye. Both were constructed during the 1960s and 1970s and were intentionally designed to transform (primitive) ‘natives’ into ‘civilized’ citizens of the Soviet state, reflecting the larger ideological project of socialist development [34]. Soviet era modernization and industrialization predominated from the 1930s through to the 1970s. In Siberia, this was linked to forced collectivization and the suppression of armed opposition by some ethno-territorial groups. In the 1930s, indigenous labour was co-opted into state enterprises or collective farms; they were involved in mass relocations and were subsumed by the broader policy of settling

⁸One reviewer suggested that we move beyond the anecdotal to make a more general argument about the increasing rapidity and intensity of extreme events as part of climate change. We believe that this is by now conventional wisdom (see [27,28]; see also Sobel [31] and Ghosh [32] for contemporary accounts as well as Davis [33] for a nineteenth century global view). We wish to reiterate our intention, however, to listen to people describe their particular experiences—pointing precisely to the different conditions as they play out in the Arctic.

nomadic peoples. Stationary village infrastructure in both villages was to signify local indigenous populations' 'leap from antiquity into socialism' ([34], p. 12–13). This policy was informed by popular imaginings of nomadic movement as random, irrational and even directionless.⁹

The structure of both villages was (and is) very similar to any Soviet village, with a central village administration surrounded by one- or two-storey residential houses. They mirror those classic settlements which, according to Slezkine [34], organized production and provided well-being—economic as well as cultural—during Soviet times. Today the villages remain focal points for reindeer herders returning once or twice a year to see their children and elderly parents, receive salaries, seek medical care and pay housing bills. Village organizations still include the school, hospital, village administration, including housing maintenance, a post office, and heating and electric stations.

The socialist era came to an end with the collapse of the Soviet Union in 1986. The state's withdrawal of its generous subsidies in the early 1990s contributed to the consequent disintegration and gradual breakdown of the infrastructure in both villages, promoting increased isolation of these population hubs. At the same time, the 1990s transition from the socialist planned economy to a market economy was accompanied by drastic falls in living standards; increases in economic and social inequality; and significant rises in levels of frustration and violent death rates [36–39].

Let us, briefly, consider specific communities. The vulnerability of the village of Sebyan has been intensified by annual floods that are caused by heavy and prolonged summer rains. These floods drastically exacerbate the conditions of already poorly maintained wooden buildings, cracked and covered with mould. The Soviet infrastructure already described was originally designed for milder climates; it has little resilience in the face of intensified storms, increased precipitation and stronger winds.

The dissolution of the Soviet modernist project in the 1990s and the latest environmental pressures we have just described now reveal the capacities of remaining village infrastructure as lacking the robustness, flexibility and dynamism required to engage with the rapidly changing environment. This is not to argue that the surviving village infrastructure is irrelevant. The villages remain the only nodal points of transport, healthcare, food supplies and communications technologies, vulnerable as they are.

This brings us to two points. The infrastructural needs for these communities are urgent; their lack may be at times life-threatening. Their inadequacies are a joint function of the (relatively predictable) impacts of shrinking state support for remote settlements and the more unpredictable consequences of increasingly intense and frequent climate events in those same regions. A straightforward commitment to material demand reduction (a position we clearly support as a general proposition) is probably not adequate for these villages' material needs. Rather, we note a range of alternative solutions that—contrary to the Soviet development strategy—include rather than exclude local actors and their long-term environmental knowledge. As such, this builds on rather than diminishes forms of local expertise that focuses on technologies of survival and adaptation—expertise that has been developed and sustained by Eveny reindeer herders and hunters despite all odds.

We turn to a very specific case example of a recent bridge collapse (figure 1). In the summer of 2016, a calamity struck the village of Topolinoye which resulted in its complete isolation from the outside world for several months. A long-distance road constructed by Gulag prisoners and Soviet contractors in the 1960s had served as the only land connection between the village and the district centre of Khandyga for more than 70 years. The road has always been rough and in bad condition due to harsh climate conditions and rugged landscape but this time flash floods—caused by melting permafrost—dismantled a major chunk of the road. One of the most important bridges over a wayward and stony river collapsed. As a result, the main lifeline of the village, especially for the delivery of food supplies, medical care, fuel for village tractors

⁹This stereotype, unsupported by empirical evidence, was not limited to the Soviet project. The settlement of nomadic peoples in the Americas was usually justified in the language of 'civilization' (e.g. [35]).



Figure 1. Bridge collapse over Minkule River, Siberia. August 2016. Photograph: Olga Ulturgasheva.

and boiler-houses, was cut. Local responses included creating a small boat chain to ferry people across the river. The collapsed bridge, which in the recent past stood as an assertive articulation of the Soviet modernist ideology, now signifies the intrinsic fragility and vulnerability of local infrastructural systems.

This bridge offers us an analytically productive possibility to address what has been ignored by Soviet constructors and designers, namely, Eveny reindeer herders' knowledge of risk mitigation and adaptation strategies. One of the features that characterize the Eveny technique of survival has been always special emphasis on lightness of their material technologies which stands in sharp contrast to heaviness and immobility of Soviet and post-Soviet infrastructural arrangements. The lightness of tents, lightness of luggage and belongings and preparedness to move instantly has ensured that people had more chances to survive and stay safe in the taiga. Mobility, specifically movement with their domestic reindeer, has been a predominant framework through which Eveny experience and understand the world and central component of their traditional economies revolve around seasonal cycle of reindeer migration. Reindeer, sledges, tents and skis have been the core aspects of their livelihoods; the idea of moving along one's family migration route is meaningful to both Eveny living in reindeer herding camps in the forest and those living in small villages and urban centres.

Difficulties in getting from the village to the reindeer herding camps and pastures and vice versa continue to condition logistical and psychological preparedness for risky situations. As one Eveny reindeer herder said to Ulturgasheva, 'You have to travel lightly but make sure you bring all necessary staff yourself. The people who are able to survive are the ones who move between camps a lot and always have a tent, a bunch of ropes, variety of light leather and plastic bags,

a reindeer skin mat to sleep on, kettle, tea, drinking mugs, axe, knife and a box of matches. All of that has to be neatly organized so that you can pack your stuff within minutes' (A Neustroev 2015, personal communication). Such emphasis on lightness, constant alertness, organization of things inside the tent and readiness to flee the onset of disaster have been shaped in response to the need to escape environmental dangers including floods, landslides and forest fires in time.

What we can learn from Eveny ways of dealing with recent environmental changes is that logistical and infrastructural arrangements centred on mobility are enabled by a state of mind that assumes the necessity for modifying technology, for moving and surviving. This is accompanied by the need for recognizing individual expertise: everyone is responsible for continuous observations and reporting on changes of behaviour of reindeer, birds, insects and the condition of plants as well as colour of clouds; not only knowledge but a readiness to share it prepares every reindeer herder to strategize and respond to changes accordingly. It is Ulturgasheva's contention that this constant awareness provides a space for flexibility and the development of responsive risk mitigation strategies. Eveny combine this set of strategies to generate a temporal gap which they can use in order to quickly devise an appropriate strategy for dealing with forthcoming disaster and retain flexibility in the face of increasing environmental uncertainty. The hardwired infrastructure has little capacity to generate a space for this type of flexible strategy. Thus, Ulturgasheva argues, a successful approach towards infrastructure requires shifting parameters and conceptual reshuffling of the frames for its applicability; this dynamic adaptation to harsh and rapidly changing environmental conditions has been overlooked and often intentionally ignored by the Soviet modernist project.

(c) Case example: Arctic Alaska and clashes from within: climate and geopolitics

If the Eveny presentation was primarily an account of collective responses to collectively experienced extreme events, this second example is more fractured. Iñupiaq residents of the North Slope of Alaska continue to define themselves as hunters—with profound value placed on whaling. Since the mid-twentieth century, they have also engaged with the oil industry—seeking a path that provides them with some kind of oversight over activities that they hope meets the aims of oil companies without imperilling the health of the marine mammals with which they have a moral as well as an economic relationship.¹⁰

Iñupiaq hunters began talking to Bodenhorn about environmental unpredictability during the mid-1990s—'something is happening with our ice that we don't understand' she was told.¹¹ At that time, shore fast ice did not have ample time to thicken before fall storms swept the coastline with eroding waves; spring ice was 'too thin' to whale safely and it had become increasingly difficult to predict when rivers would break up in the spring. These processes have only intensified over the past decades in ways we have already described. Like Eveny, Iñupiaq have long incorporated mobility into their arsenal of survival skills and oral history as well as archaeological studies suggest that many pre Euro-American permanent village sites have moved in response to encroaching ocean waters. Today (as in many parts of the low-lying world) such movement is urgent and requires total displacement rather than a gradual shift with all of the material (re)construction that implies. With the presence of permanent structures such as hospitals, energy plants and airports, these moves cannot be taken lightly. We would like to mention two ways in which Iñupiaq material inventiveness resonates with our Eveny ethnography. Recently, Hansmen [43] published in the *Guardian* a picture of a house built in Anaktuvuk Pass (the only inland North Slope village), which has been built on sledges in order to make it mobile; as such it represents a new take on an existing technology. Similarly, ice cellars are a long-standing material Arctic technology which enables food storage over the course of a winter. Changing environmental conditions have now made them vulnerable to permafrost melt,

¹⁰See, for instance, Reiss [40], Wohlforth [41] and Bodenhorn [42] for different accounts of how Iñupiaq have sought to balance these pressures.

¹¹The first time Bodenhorn heard this statement explicitly was from Raymond Neakok Sr in 1994 as she was introducing him to a team of National Science Foundation researchers. 'You're scientists,' he continued. 'Do your job!'

the intrusion of salt water and the build-up of toxic gases—any one of which can render an ice cellar useless in short order. People are using their existing knowledge to consider where new cellars might be built, and are experimenting with new forms of construction as well as new materials to make them more resistant.¹²

But this is by no means a collaborative idyll. Our final point has to do with fractured communities involved in arguments about how to proceed in a changing universe. Whereas debates on the North Slope at the end of the twentieth century seemed to Bodenhorn to revolve around who would be most effective in putting Iñupiaq interests forward in the (inter)national political landscape, today they revolve with increasing intensity around what those interests might be. And shifting environmental conditions play a central role in the discussion. Some voices reflect a strong concern that increasing oceanic exploration in the face of a melting ice sheet is bad for the health of the ocean, marine life, and therefore Iñupiaq sociality; others say, ‘the ice is going to melt no matter what we do; if we’re not at the (development planning) table, we’ll be lunch’ (R Edwardson 2015, personal communication).

At the London conference, Edwardson [44], a young Iñupiaq oral historian and film-maker, spoke of what she considered the destructive impact of ‘silo thinking’ at the community level, where questions about how to think about the future of subsistence hunting and the future(s) of non-renewable resource development are bitterly contested within families and across local institutions. And they falter on what we call ‘epistemological framing’—forms of knowing that shape further understandings. Edwardson articulated the belief that whales give themselves up to whaling crews who are respectful and generous; the practice of returning whale skulls to the ocean after butchering, allows the whale *ĩnuá* (spirit) to communicate with others about their treatment—the assumption is that the whale spirit will animate another whale body and return if it has been treated well.¹³ Echoing Patrick Attungana (a whaling captain), Edwardson noted that if the spirits of both whales and humans reincarnate, then her grandchildren may well eat of the same whale as her own grandparents; such an awareness and explicit valuing of intergenerational sharing poses a different kind of understanding of responsible action than that underpinning institutions organized to realize profit in the short term. In this case, Edwardson is not talking about outsiders imposing their points of view on Iñupiaq insiders, but rather of the extent to which powerful decision-makers in Barrow reflect the position that ‘value’ reduces to monetary equivalents—and that short-term financial gain trumps long-range non-financial benefit.

Edwardson herself recognizes the extent to which local corporations emerging from the Alaska Native Claims Settlement Act (the Arctic Slope Regional Corporation in particular) have often used the funds they gain through their participation in global economic ventures for the benefit of their Iñupiaq shareholders: education, medical services, housing and general infrastructure all bear the imprint of their support. She appreciates those contributions without accepting them as blanket permission to pursue policies now that seem to threaten the core of Iñupiaq life-ways. ‘Our children, and our children’s children need to have the chance to make choices about their lives’, she asserted. ‘We do not have the right to take that from them’ [44, p. 23].

In a sense, these positions seem to reflect some of the tensions between those who are developing mitigation strategies versus those who are focused on adaptation. It is not clear to us that one can be considered without the other.

3. Discussion and reflections

Throughout much of the circumpolar north, environmental vulnerabilities—whose intensity and unpredictability are of explicit concern to circumpolar residents—create challenges for effective planning regarding sustainable material uses. At the same time, geopolitical factors play a role in the extent to which governments either can or will take the lead in opting for sustainable solutions when major reconstruction efforts must be undertaken. As we have shown for the

¹²Personal communications from Barrow whalers: R Glenn 2008; P Brower 2011; Q Harcharak 2015.

¹³See for example Attungana [45], Bodenhorn [46], Hess [47] on the moral relationship between Iñupiaq and whales.

Alaskan case, environmental concerns more often than not take a back seat to non-renewable resource exploitation. This holds for Siberia, Canada and Greenland as well as Alaska. Ecological and geopolitical processes are thus simultaneously bringing enormous pressure to bear on local inhabitants. What the Eveny material in particular invites us to consider is how, in the face of increasingly extreme events, local responses rely on local knowledge and local materials to cope.

At the same time, these examples also illustrate the extent to which one cannot assume that the conditions experienced by Siberian Eveny in the post-Soviet era are the same as those in play in Alaska. Neither ‘the Arctic’, nor its residents should be assumed to represent homogeneous entities—either in terms of the conditions that exist across the circumpolar north, nor in terms of the views local people have of their worlds. To consider effective strategies requires both a recognition and an inclusion of local-level knowledge, thinking and practices. What we have seen in these two examples are considerable forms of innovation and adaptation.

In terms of what non-Arctic peoples might learn from this points to the importance of both Iñupiaq and Eveny *attitudes*. Values of self-reliance and a willingness to shift gears; of exploring the use and re-use of available materials to modify existing material technology; of recognizing the importance of individual observation and of institutionalizing the sharing of knowledge; of avoiding the blame game and assuming responsibility at collective as well as individual levels; and of engaging with the modern world without assuming that ‘more’ or ‘new’ is always ‘better’—all of these show robust examples of ways of thinking that are necessary for the sorts of behavioural changes envisioned by Allwood *et al.* [10], Barnosky & Hadly [1] and we might add, many others. Without resorting to noble-savage at-one-with-nature stereotypes, the authors suggest these examples illuminate living practices which are not only imaginable but being carried out. Miller [48] challenged many of the basic assumptions behind core/periphery models in his examination of Trinidad as a participant in global systems. The present material suggests ways in which the movements of materials, people, ideas, and attitudes are best conceptualized as multi-directional flows.¹⁴ We are with Miller in recognizing that all people live at the centre of their own experience. In addition, however, if we recognize the central role of the Arctic in global processes, we should also recognize the independent knowledge developed by Arctic residents and ask to what extent those knowledge forms may have potential to become central to our own understandings of climate processes wherever ‘we’ live.

This brings us to our final assertion. Eveny parents talked about the importance of teaching their young people the value of flexibility; Iñupiaq parents have talked about the importance of fostering an appreciation of Iñupiaq knowledge as something to learn alongside conventional science. UK teachers as well as conservationists have talked to Bodenhorn about the ‘disconnect’ they perceive between 10 year olds who feel a strong engagement with the world, and adolescents who are more disdainful of it. This is not inevitable. Barrow young people who participate in hunting are well aware of the moral responsibilities they have towards the animals they hunt; they learn with their parents the value of reusing snow machine parts and of watching the birds for information about the ice. They are less committed to turning off their car engines when going to the store. Young Ixtlán de Juárez community members (Oaxaca, Mexico) with whom Bodenhorn has also worked over the past several years, on the other hand, increasingly tend to value ‘sustainability’ as they mature into young adults. That is how the village is defined (whose patrimony is a sustainably managed forest) and that is how they come to think of themselves. For us to consider how we as a complex set of collectives are going to manage the behaviour changes necessary to reach emissions reductions goals (or even to recognize that those goals are worth striving for!), we need to start young. And we need to be as inventive with the materials we use to teach as Eveny and Iñupiaq are when moving across their shifting terrain. Drawing on their experiences might be a place to start.

¹⁴Copus [49] also talks about ‘polycentric’ flows. Both Copus [49] and, more recently, Kühn [50] recognize that peripherality has both spatial and non-spatial aspects. Kühn suggests that peripheralization, as process, rather than periphery, as an implied spatial zone, captures twenty-first century developments more accurately. The peoples with whom the authors work are often defined as peripheral by ‘their’ countries—both because, in geographical terms, they live ‘on the edge’ and in demographic terms they are defined as outside of the mainstream.

Ethics. During fieldwork, both Bodenhorn and Ulturgasheva develop collaborative projects with local people; interlocutors identified by name in this text have given their consent for this to happen.

Authors' contributions. The shape of this paper was developed collaboratively by both authors; B.B. has worked in Alaska and Mexico, which is reflected in her contribution here; O.U. has contributed ethnography and analysis of her work in Siberia. Both authors have drawn on information provided at a conference on Anthropology, Weather and Climate Change at which they co-moderated a panel on 'Northern Futures?' They each contributed substantially to the text, although B.B. was responsible for its final shape. It has been reviewed and approved by both authors.

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