



CHAPTER 1

Activating Cosmo-Geo-Analytics

Anthropocene, Arctics and Cryocide

Olga Ulturgasheva and Barbara Bodenhorn

In our introduction we laid out several concepts we feel are pertinent to understanding environmental processes in general: the need to recognize multiple worlds and the positions humans actors occupy within them; the urgency of acknowledging that expert knowledge emerges in many forms and that this knowledge may be communicated in many ways; and, finally, how peoples across the globe are experiencing and responding to uncertainty, unpredictability and precarity invites a continuing consideration of ‘risk’ as an analytic.

The present chapter draws upon those ideas but turns readers’ attention more specifically to issues that influence our contributors’ analysis of Arctic conditions. In this we consider the Arctic as a specific ecozone which has generated a significant body of environment-related research, much of it subject to the questions of voice we introduced in the Introduction. We also examine the Circumpolar North as a particular cosmo-political zone which continues to register the nineteenth-century colonial footprints of Russia, the US, Canada and Denmark; these in turn have generated innovative and persistent pushback on the part of local residents across the region. We then explore briefly the extent to which it remains a global hotspot – politically, economically, and ecologically – with tensions between those who want to exploit its non-renewable resources and those who focus more on the protection of its renewable resources which carry moral and spiritual weight in terms of interspecies sociality. The Anthropocene as a concept mobilizes so many of these issues

simultaneously that we have reserved a separate section to discuss this. We pay particular attention to indigenous critiques of the idea, which leads us to consider the Anthropocene with relation to the cosmological as reflected in origin stories. This leads to a section that explores the ways in which people use stories to think through the present. Finally, we suggest the notion of ‘cryocide’ to describe all of the processes described above. Scientists such as Wadhams (2017) and Jamail (2019), mentioned in the Introduction, have paid serious attention to the implications of the disappearance of ice cover in the Arctic. By cryocide, however, we are not only referring to the disappearance of the physical substance, but also to the human and other bio systems that depend on it for their continuity. In this, we strongly agree with Diemberger (Chapter 6) that it is productive to consider ‘people of the cryosphere’ as linked and facing similar challenges. In the contributions that follow, then, readers are invited to consider the implications of world views in which humans are not at the centre; they are urged to listen to voices that reveal new kinds of knowledge and imagine new sorts of connections; and they are confronted with the complex geo-political realities that play major roles in the challenges Circumpolar peoples face on a daily basis.

The Arctic as a Shifting Zone

The news that the Arctic is the fastest-warming region on the planet has not been on the radar of public attention until recently. In public discourse, the Arctic has often been associated with a cold, empty, pristine, ambiguous, even liminal land (see Bravo 2017; Tasch and Tasch 2017)¹ even as it was associated with utterly imaginable riches: gold, baleen, timber, furs, oil. In recent years, reports on global warming and rapidly changing climate have started to transform mainstream perceptions of the Arctic from a remote, uninhabited area into a territory of crucial environmental and geopolitical importance (Pfeffer 2009; Klare 2019).² The Arctic as an ecozone, rather than as an econo-military space, has suddenly become visible as tangible and very fragile. This transformation of the public perception of the region, albeit slow, indicates that it is no longer easy to ignore the fact that the Arctic is changing at an accelerated rate, and global feedbacks to its transformations are emerging through a cluster of environmental disasters simultaneously happening across all continents. Although climate modelling foresaw such phenomena as ‘Arctic amplification’ a decade ago (see Holland and Bitz 2003;

Cohen et al. 2014), polar climate models have consistently underestimated the speed with which the warming has intensified since then (Barnosky and Hadly 2016; Jamail 2019; O'Reilly 2016).

On Knowledge, Collaboration, Voice

Reports from Arctic indigenous communities about the disturbing dynamic with which the weather patterns, lands and animal behaviour were changing have been emerging for several decades. In *The Earth is Faster Now*, Krupnik and Jolly (2002) were among the first social scientists in Alaska to work with local experts to highlight Yup'ik views of how they perceived environmental changes. Conrad Oozeva, from Saint Lawrence Island, teamed up with Krupnik in 2004 to publish *Watching Ice and Weather our Way* (Oozeva et al. 2004). Genuine collaborations which reflect indigenous voices and concerns about the environment rather than simply co-opting them are well established in the North; the extent to which such collaborations include indigenous initiatives should not be ignored (see, e.g., Berkes, Huebert and Fast 2005; Berkes 2012; Bodenhorn 2001, 2013a, 2013b; Brewster 1997, 2005; Cruikshank 2004; Fenge 2001; Fienup-Riordan and Rearden 2012; Ford 2001; Hastrup 2013b; Bodenhorn and Ulturgasheva 2017, 2018; Ulturgasheva 2014; Ulturgasheva et al. 2015; Williamson 2011). The Inuit Circumpolar Conference, the Alaska Eskimo Whaling Commission and the Nunavut government, amongst others, have likewise been key indigenous-led institutions in supporting the gathering together and dissemination of detailed regional evidence of environmental changes. Independent indigenous voices have also made themselves heard in the North: Yup'ik scholar Oscar Kawagley (2006) makes a powerful argument for recognizing the importance of non humano-centric world views; Greenlander Karla Williamson (2011) explores the bases of resilience in 'An Ecology of Stories'; Zach Kunuk (a co-founder of Isuma, a First Nations' owned production company) produced the world's first Inuktituk film on the subject in his 2010 documentary *Inuit Knowledge and Climate Change*.

Despite this wealth of information, these reports have been, for the most part, either dismissed or utilized only in scientific reports intended for use by managerial elites (see Bravo 2009). Looking critically at such selectiveness by the media, in her contribution to this volume Candis Callison highlights that mainstream narratives about climate change tend to obscure the importance of knowledge of and

expertise about the climate change dynamics in the Arctic. Instead, they use the Arctic as a proxy for other issues, such as the expansion of extractive territories by prominent economic stakeholders, a ‘new Cold War’ between the US and Russia, or conflicts between the oil industry and environmental groups. While media reports on the Arctic are abundant in concerns over polar bears, indigenous voices, whether alone or in collaboration with scientists such as the ones noted above, are rarely heard in national and global media; newsmakers habitually reduce the experts from indigenous communities down to subjects for coverage or research instead of holders and producers of active knowledge. Callison writes that ‘the meaning is prescribed by scientists and political or industry figures – rarely by Indigenous and/or Arctic-based experts’ (Callison, this volume). Scientific reports, she continues, which tend to view indigenous expertise as ‘a potential global and scientific resource’, are more often than not entangled with political obstructions and agendas of socio-political institutions that serve as constraints rather than opportunities for indigenous communities’ empowerment and participation in decision-making. Hence, ‘experiments in democratizing science have ironically served to reinstate the authority of science by subtle means involving erasure of the very public being invited to participate’ (Ellis, Waterton and Wynne 2010, cited in Callison, this volume). Such practices persist, pointing to current structures of exclusion which are continuously reproducing a highly territorial ‘silo effect’ that prevents much-needed voices from participating at the centre of knowledge production.

TEK: A Road Paved with Good Intentions?

We would be remiss to ignore the promise and the pitfalls of an institutional effort to ‘bring indigenous voices in’. In *Traditional Ecological Knowledge: Concepts and Cases*, Julian Inglis (1993) provides historical context for the idea, pointing to the importance of Agenda 21 of the Earth Summit in Rio de Janeiro in June 1992 which recognized the contributions of indigenous knowledge holders to environmental understanding. An initial meeting which was attended by indigenous peoples and other experts was held as part of a Common Property Conference and proposed two goals: to facilitate the gathering of knowledge useful at the community level and, more broadly, to promote the incorporation of traditional ecological knowledge (TEK) into policy. A number of local governance entities

saw the initiative as promising, and participated in documentation efforts (see Fenge 2001 on emerging collaborations across a number of Canadian First Nations communities; Ford 2001, whose focus was entirely on Inuit communities; Royer et al. 2013; and Royer 2016, working with Cree communities). But criticisms also emerged from several directions. Cruikshank (2004) argued forcefully against the fragmentary nature of TEK, which flies in the face of the holistic and context-dependent knowledge practices of most Canadian First Nations people. In Cruikshank's view, TEK constitutes 'modernist recasting' of indigenous onto-epistemologies that 'continues to present local knowledge as an object of science rather than as intelligence that could inform science' (Cruikshank 2005: 257). When codified as TEK and incorporated into the frameworks of North American management science, such interactive, lively, experiential knowledge as Athapaskan knowledge about glaciers is recast and labelled into categories within the Western managerial paradigm. Thus, sentient and social spaces in which knowledge is produced and circulated are turned into 'measurable commodities called "lands" and "resources"'. In this regard, Cruikshank has been insistently highlighting that 'indigenous peoples face double exclusion, initially by colonial processes that expropriate land, and ultimately by neo-colonial discourses that appropriate and reformulate their ideas' (2005: 259). And 'double exclusion' has the potential to lead and, historically, has led to complete erasure and denial of the indigenous expertise.

Relatedly, Wenzel (2004) noted that many management and conservation policies being developed for northern Canada made 'selective use' of TEK. These were notable for their omission of any recognition of the spiritual nature of environmental understanding on the part of northern hunters. As an alternative, Wenzel offers *Inuit Qaujimagatuqangit*, the guiding principle of the Nunavut Government which takes the social/moral basis of animal human interactions as a starting point. From Hawaii comes the critique of Wehi et al. (2018) who note that Native Hawaiian teaching is based on story, allegory, and imagery rather than 'facts'.

The increasing intensity of extreme environmental pressures in the region is making visible how important it is to challenge the reproduction of what are in effect colonial practices and to highlight the need to destabilize this hegemonic state of affairs. The original workshop – as well as the present volume – emphasizes the importance of listening to Arctic residents for their local expertise. It is not accidental that the list of contributors to this volume includes Arctic residents

and indigenous scholars, namely, Rachel Edwardson, an Iñupiaq from Barrow (Alaska), Candis Callison, a member of the Tāhtān Nation from British Columbia (Canada), Stacy Rasmus, a Lummi-Athabaskan scholar based in Alaska, and Olga Ulturgasheva, an Eveny from northeast Siberia. But, we hasten to add, the volume neither siloes nor exoticizes ‘indigenous knowledge’ as something apart; instead, it offers a complex account of thinking about the Arctic that includes multiple perspectives, with local voices at the core and not at the periphery of the discussion. The latter also resonates with the urgent need for collaborative, cross-sector, cross-border efforts in looking for insights to inform Arctic-led pathways towards resilience and adaptability; these insights include a recognition of the limitations of a science-alone approach to environmental understanding. While questioning the hegemony of a positivist approach, Wilkinson and colleagues relevantly state:

All knowledge is incomplete and tentative. This is why focusing ‘just on the facts’ as a positivist [scientist] might see them is too narrow a foundation for real-world problem-solving. The key to successful joint problem-solving is to recognize the strengths and limitations of the focus each may have and to create a process wherein many voices and multiple methods and streams of understanding are valued and used. (Wilkinson, Clark and Burch 2007: 23)

It is increasingly recognized that ‘neither Western science nor traditional knowledge is sufficient in isolation to address all complexities of climate change’ (Jolly et al. 2002). Collaborative, cross-sectoral partnership, by enhancing the capacities of the experts and other knowledge holders to comprehend the phenomena of changes in their complexity, has created a stronger potential to provide insights and tools for addressing those changes. Hence, the volume calls for the opening of spaces for collaboration as well as the inclusion of unheard and/or silenced heterogenous voices; we thus urge readers to recognize that ‘the Arctic’ is not a monolith – ecologically, socially or politically. Nor, by the same token, is it as exceptional as it is often portrayed. Although some extreme conditions are unique to the Arctic, the need for rapid, inventive and effective responses to unpredictable events is one facing many peoples across the world. The latter is intrinsically related to the human capacity for adaptability and adjustment to different scales of exposure to the technogenic catastrophes and dramatic environmental transformations associated with climate change (see Petryna 2003; Scheper-Hughes 2005; Ghosh 2016; Weston 2017).

Introducing Feedback Loops as an Analytic

In her discussion of the consequences of the Chernobyl nuclear plant explosion, Adriana Petryna rightly asserts that ‘to enhance our capacities to deal with surprise, we need new models of science and politics that take the word “adaptation” – in all its divergent meanings and human practices – seriously’ (2003: xxvi). In this regard, Veena Das’s discussion of the need for new models in the face of what she calls ‘critical events’ becomes even more pertinent, especially when she exhorts that ‘radical unfamiliarity requires novel forms of thinking – thinking that is often not forthcoming because of the human propensity for reaching for the tried and true’ (Das 1995, cited in Bodenhorn and Ulturgasheva 2018: 109).

Correspondingly, Petryna’s discussion of the atrocious consequences of the nuclear plant explosion calls for new developments in climate-science modelling and practice informed by a ‘user-inspired science’, a strategy that embraces rather than denies the limitations of any scientific account of potential or calamitous environmental disruptions’ (2003: xxvi). Given that worldwide unpredictability is becoming more of a norm rather than an exception, the challenge is to craft a tentative strategy that includes a detailed and balanced consideration of the limitations and productive potential of each account, whether scientific or public. It is the accounts of survival and lived experiences by those who have gone through environmental calamities that become vital for ascertaining human capacities to adapt and negotiate safety. Hence, the contributors to this volume ask what the implications of the Arctic experiences might be for our understanding of human responses to global processes more broadly:

- Can humans adequately respond to multiple threats induced by climate change?
- What types of knowledge and tactics are required to reduce the uncertainty of increasingly erratic climate events and to shape new patterns of adaptability reflexive of and responsive to local particularities?
- How do affected communities make sense of critical events like storms, landslides, wildfires or flash floods?
- Are humans able to mitigate risk situations and calamities when available strategies and resources are getting increasingly unreliable and stretched too thin?
- What preparation and risk mitigation techniques are emerging and being articulated by affected communities? Are humans capable of

predicting potential ecological disasters while experiencing profound uncertainty? Is the latest dynamic adjustable at all, and are human populations likely to be able to adapt? If so, what are the limitations of existing adaptation models and potential occlusions to adaptability and resilience?

Alongside this set of questions, the unsettling and complex dynamic of fluctuations make previous cause-and-effect connections less convincing and unclear. It also interrogates the reliability of the calculations regarding the rate and dynamic of climate change provided by positivistic science (Krebs and Berteaux 2006; Keith et al. 2008; Coreau et al. 2010). For example, if a decade ago any connection between dramatically disappearing ice in the Arctic and the scale of Californian wildfires could be seen as ungrounded by sceptics of climate change, now this previously unlikely connection is increasingly becoming accepted. Two seemingly unconnected disasters have recently pointed environmental scientists to dramatically changing patterns of wind distribution, contributing to the slow distribution of streams of cold air that result in abnormally hot weather for mild climates (Box 2012). It should be noted that a glaciologist and Greenlandic Ice Sheet specialist, Jason Box, has been connecting the circulation of forest fire ash in the jet stream to accelerating ice melt in Greenland since at least 2012. Through his *Dark Snow* project, he has been discussing the impacts of forest fires, focusing on the jet stream carrying ash from Siberia to Greenland and the implications of this dynamic on ice melt for a decade or more. According to his observations and assessments, deceleration of the wind speed and lack of cold air have recently resulted in severe weather fluctuations globally, increasing the likelihood for freezing weather in warm climates and heatwaves in northern areas, extreme rainfall or droughts in the regions closer to the equator, and severe floods or enormous wildfires across the Arctic and Subarctic regions (Barnosky and Hadly 2016; Overland et al. 2019). Changing environmental patterns seem to link apparently unconnectable dots and, by doing so, have the potential to underscore the continuities of seemingly disparate events. Since the linear cause-and-effect connections in understanding the character of change do not suffice anymore, new ways of conceptualizing the connection are required for understanding the implications for dealing with the issues of risks, human security and environmental sustainability. Figuratively speaking, the connection with a new texture, nature and direction is calling for new conceptual models of perceiving it.

What is also becoming increasingly obvious in the light of violent fluctuations induced by warming air temperatures is that the ice-free Arctic is no longer located in the distant future but is lurking just around the corner; indeed, it is here in some parts of the Arctic at certain times of year (see Wadhams 2017). These emerging non-linear and self-modifying cascades of linkages generate new cross-system feedback loops within the Arctic ecosystems. If we look at the 2020 summer reports on Alaskan and Siberian wildfires, the systemic impact of permafrost melt, and the effects of the COVID-19 pandemic on top of all these, we can speak of the severe propagation of risks and uncertainties across the region, making an already fragile cryosphere even more fragile while turning the region into a hot spot for emergencies (Kormann 2020). The regime of ‘run-off’ pressure producing cascades of linkages is indicative of the co-occurrence of poly-systemic feedbacks, i.e. responses to multidirectional and simultaneous effects of the permafrost melt across human and non-human realms (AMAP 2017). This, in turn, will consequently generate all sorts of hindrances for the governance of disaster preparedness, lowering and significantly reducing human capacity for survival and resilience.

This dynamic has been associated with the Anthropocene, i.e. an era of severe environmental destruction continuously induced by a corporate system’s voracious appetite for endless expansion and accumulation of wealth at the expense of natural resources and fragile ecosystems (Eriksen 2016). However, the notion of the Anthropocene and its timescale may not sound sufficiently alarming in indicating the extreme urgency and high ‘run-off’ pressure that will push all sectors of societies, especially military and medical services, to get involved with more and more rescue and relief operations, stretching budgets and interfering with their emergency capabilities.³

The Anthropocene as an Analytic Incorporating Cosmopolitics

As we mentioned in our Introduction, the Anthropocene – like animism – is another term of great controversy as well as great potential for the editors’ understanding of Arctic environmental processes. Crutzen and Stoermer (2000) argued that recent human participation in global environmental processes has been so profound at the geological level that scientists need to conceptualize the earth as moving from the Holocene to the Anthropocene. We humans have

to be recognized not only as a factor in the geological process but as the dominant factor in its current shifting manifestation.⁴ For historian Dipesh Chakrabarty, this argument opened conceptual doors that challenged silo thinking – collapsing social and natural sciences as modes of knowing (2009). More recently, Hastrup and Hastrup (2015: 1) have called for ‘creative undisciplining’ in order to engage anthropologically with rapidly shifting global processes.

But the notion that ‘we humans’ have propelled the planet into the Anthropocene has created quite a bit of pushback. James Moore, for instance, proffers the term Capitalocene (2014) as an alternative to highlight the fact that the impacts are generated not by all human action, but rather by actions that both constitute and are constituted by a capitalist enterprise. And scholars such as Candis Callison (2018), Amitav Gosh (2016) and Zoe Todd (2015), amongst others, robustly point out that the people who are often least involved in capitalist industry are the first to suffer its effects in terms of environmental degradation. The ideology of colonialism needs to be added to that of capitalism. They are linked, but not the same. The Arctic as a geo-political zone dramatically plays out these tensions.

While we agree with the above, we suggest a further reading that recognizes the Arctic not just as a complex of geo-political issues but as a swirling nexus of multiple cosmo-political zones. Before we consider technologies of resource extraction or the political organization of access to those resources, we should consider foundational ideas about human being-in-the-world. From the fifteenth century, the dominant ideology behind ‘Westward expansion’ reflected forms of Christianity, which not only justified conquest in terms of conversion but also assumed that the earth had been created by God to give to humans for their use.⁵ Many traditions of The Book are not only human-centric but humano-privileged. The model that humans are not only separate from the rest of the world but somehow above ‘it’ thus has long pre-capitalist roots. By the nineteenth century this cosmological model had become overlaid with further ideas of evolution – read as ‘progress’ – as well as of assumptions about the inevitable scarcity of resources. This, in turn, underpinned the valorization of private property as a way of saying what is ‘mine’ is not ‘yours’,⁶ and what I have is never enough.⁷

Although the authors of these arguments assume that they reflect universal truths about human nature, we also need to consider the presence of alternative cosmological models that are contemporary rather than prior to these ideas. Most Iñupiat today, for instance, are devout Christians who nonetheless conceive of their position in the

world as one of mutuality and reciprocity with other animals.⁸ So we turn to William Oquilluk and Lauren Bland's accounts of Iñupiaq history in *The People of Kawerak* (1973). According to Iñupiaq oral narratives of northwestern Alaska, the history of the world is the history of nine disasters. It is a story of change, but not progress. And it is a story of human adaptive agency. In an early disaster, the sun goes behind the moon for four days, the earth freezes, and most living creatures die. Only four families survive this disaster, and when they emerge with the return of the sun, everything has changed, and they realize 'they had to think with their minds in order to survive'. They do this, through observation, experimentation and communication. One man watches a spider spin her web and imitates her to invent fishnets; another notices a leaf floating down the river and thinks about how to incorporate that in the form of a boat. A child inadvertently catches a fish when he goes to the river for water in mid-winter, tosses it to one side, and later realizes that the flash-frozen result is edible. The world has changed. People need to change with it; anyone – even a child – may come up with solutions. But you have to share what you are learning with others. That profoundly non-capitalist concept continues to hold sway for many Arctic inhabitants. In Raymond Neakok Sr's words, 'you have to tell what you know – that's one of the rules' (Bodenhorn 1997: 123).

And it offers a model of animal-human morality. In the story of the Eagle-Wolf Messenger Feast, Oquilluk tells how the development of human sociality emerged from the morality of animal-human relations. In this account a single hunter behaves disrespectfully by not returning the heart of a slain eagle to its Mother. The animal spirits do not punish this behaviour but rather teach the hunter how to act properly in a world that includes others. They teach him how to thank the Mother Eagle by singing, dancing and preparing a great feast, and exhort him to share what he had learned with his kin. The first great feast, however, is not exclusive to the group but incorporates others – animal spirits who have taken on human form in order to appear as guests.⁹ In this single collection of stories, then, readers are offered the possibility of thinking about change that is distinct from progress; about recognizing the threats of human action to the well-being of non-humans which can be met by changing human behaviour rather than punishment; about responses to risky conditions which are collective and inclusive rather than assigning blame in order to decide who pays.

We have already talked about 'voice' as a question of politics, pointing in particular to Callison's contribution to this volume. What

we wish to emphasize here is that this is not simply a question of ignoring what people are saying today, but that these models depend on spatial and temporal ‘tricks’ which have the effect of diminishing-whilest-encapsulating peoples and their multiple forms of knowledge. Non-capitalist becomes pre-capitalist and therefore not relevant to contemporary realities. As with our discussion of TEK, forms of knowledge that have developed over generations based on observation and practice become reduced to ‘tradition’ which is often dismissed as exotic and ‘out of date’ rather than being recognized as twenty-first-century observations of twenty-first-century conditions.

It makes a difference for imagining future actions if you begin from a position of humano-privilege or humano-responsibility, if you begin from an assumption of scarcity which drives competition, or plenty which thrives on cooperation, if the earth is conceived of as a resource for human use, or if humans are assumed to be part of a web a sociality that depends on reciprocity for its continuation. It makes a lot of difference if ‘change’ is not always calibrated in terms of ‘progress’. That is what we mean by cosmo-geo-politics. However, whereas cultural theorists such as Douglas and Wildavsky (1982) set out such differences in order to assign characteristics to groups of people, what we emphasize here is the counter productivity of such a move. In the Arctic – as in many other places – these very powerful cosmo-political ideas move, shift and mix up. You can believe in the Bible and in the moral sentience of whales; you can celebrate the whale at Nalukataq (the communal feast to mark a successful whaling season, which is centred on giving thanks to the whale) and disagree with your neighbour about whether or not to work with oil companies. The ideas are cultural in that they are deeply felt, but they do not map easily onto ‘sides’. That is why cosmo-geo-politics renders discussions of the Anthropocene so difficult.

Stories as Scaffolding for ‘Weathering the Storm’

The stories we have been listening to reveal fundamental information about the cosmo-political: how people imagine their place in the world. But, as Julie Cruikshank (1998) noted in *The Social Life of Stories*, narratives may also serve as a sort of scaffolding that frames human responses to events in the present.

In the chapter by Ulturgasheva readers will learn how Eveny reindeer herders draw on their stories, on their spiritual relations with

the animals, on their practical knowledge and on their flexibility in order to respond to extreme and unpredictable environmental events (see also Ulturgasheva and Bodenhorn 2016). It is clear to them they must ‘think in their minds in order to survive’. But the reindeer herders came to London not only to talk about the extremes of mudslides and flooding rivers; they also wanted to talk to others about geopolitics – about the growing interest of extractive companies in their territory. The risky future is not just about ‘climate’ but about ‘environment’ more comprehensively. Rachel Edwardson, born and bred in Barrow, Alaska, and a member of a whaling family, reveals starkly what that future might bring. Barrow families remain committed to whaling as a foundational act that, in Patrick Attungana’s words, ‘holds our families together’. At the same time, however, they rely on the resources of the Iñupiaq Arctic Slope Regional Corporation, whose profits are drawn largely from the oil industry. As Edwardson seeks a way through the dilemmas posed by these competing interests, one hears strong echoes of Iñupiaq stories that tell of whales coming back to people who ‘treat their bodies tenderly’ and with respect. She re-creates the acts of her grandfather in order to imagine what future her son might be able to expect.

The powerful insights offered by Iñupiaq stories resonate as well with the discussion by Stacy Rasmus in this volume, who looks at Alaskan Yup’ik teachings (*qanruyutet*) and ways of living (*yuuyaraq*) to argue that it is the continuity of Yup’ik relational connections to the land, animals and waterways that helps Yupiit to ‘weather the storms’ and sustain the community’s well-being.¹⁰ Drawing from the Yup’ik notion of ‘weathering the storm’, her discussion illustrates that, having moved to the domain of the socio-economic, occupational and political pressures in recent decades, the terms for survival and adaptation have dramatically changed. Young Yupiit need to learn to weather new type of storms. According to Yup’ik elders these storms ‘may not necessarily be the ones causing waves and whiteouts outside on the water and land; instead, it may be the swirling swells of emotion or freezing pangs of lonesomeness one feels on the inside that needs instruction and tools for coping and finding safe harbour’. Rasmus’s account suggests that as long as the human–animal connection upon which Yup’ik teachings are based is sustained and the Yup’ik seasonal harvest continues, resilience and the capacity of the Yup’ik communities to weather the storms will be maintained.

What the Yup’ik account has shown is that continued and systemic insistence on and institutional imposition of cultural homogeneity

and humano-centric ideologies are always intended to reduce human and non-human resilience, i.e. the capacity to live, adjust to and develop with change and uncertainty (Ulturgasheva et al. 2014; Escobar 2018). As Rachel Edwardson's account in Chapter 3 also suggests, the costs – especially for young people – may be tragic, but the roots of resilience are deep, and strategies to foster it continue to emerge. The institutional, systemic and cross-sectoral acceptance of diversity and the existence of distinct worlds where humans and their non-human companions, including cosmologically important non-human actors, would prevent neo-colonial, humano-centric obstructions.

Cryocide

As we stated above, the thrust of technocratic and modernizing economic forms has been driving global environmental changes, which have lately led to threats of the complete loss and disappearance of the cryosphere around the world. These processes are not unique to the Arctic. Chapter 6 by Hildegard Diemberger and Astrid Hovden shows that a similar dynamic is observed in the regions characterized by the largest accumulation of ice outside of the two poles, i.e. the Himalayas and the Alps. Diemberger and Hovden relevantly emphasize that the high-altitude cryosphere of the Himalayas, the Alps and the Arctic can be seen as linked by comparable experiences of human responses to vanishing ice, i.e. the process we shall call 'cryocide'. The process of the cryocide could be compared with a 'ticking timebomb', the effects of which will not stay solely in three high-altitude regions. The effects will accelerate the emergence of the new risks, all of which have the potential of going, literally, viral. And, as the latest pandemic of COVID-19 has shown, the scale for the 'new viral' may exceed human cognitive and infrastructural capacities to contain the onset of new risks. Furthermore, the new risks will turn out to be an old type of risk or a dormant one. What is clear is that carbon dioxide is not the only risk stored in the layers of permafrost. Permafrost has always been an ancient refrigerator for the remains of life that once thrived in the Arctic, including microbes, pathogens, viruses, ancient plankton, insects and amphibia. After being frozen, these ancient species have never completely disappeared, and it is likely that continuous permafrost thaw will soon offer them a chance for a second life. The prospects for various frozen creatures that hibernated in permafrost to re-enter this

world are getting higher, and this includes the possibility for ‘zombie’ viruses now hidden in the sub-surface ground to re-emerge (see Omazic et al. 2019; Evengård and Thierfelder 2021).

In anthropological studies, the focus on interactions between humans and the cryosphere has been peripheral to the anthropological studies of the Circumpolar North and anthropology in general. Although the premise that nature and society cannot be viewed separately and should be understood as mutually implicated has been crucial for Arctic ethnographies since the last century, ice as a methodological and analytical focus through which climate history can be revealed emerged as critical through the works of Canadian anthropologist Julie Cruikshank. Cruikshank’s (2005) monograph *Do Glaciers Listen?* has shown the generative potential of an ethnographic and historical focus on such non-human agents as glaciers. The book’s focus is on the glacial landscape of the Saint Elias Mountains, an area on the border between Canada and the United States, which is homeland for both Tlingit and Tutchone people. Her account offers a penetrating examination of the complex encounters between European colonizers and Athapaskan-speaking groups. The main question posed in the book title reveals how an Athapaskan onto-epistemology of human–glacier relations provides sophisticated guidance and an ‘imaginative grist for comprehending and interpreting *shifting* social circumstances’ (2005: 8). This includes the physical and socio-economic impact of Euro-American settler colonialism’s expansion on glaciological ecology, leading ultimately to the disappearance of glaciers. In our view, Cruikshank’s monograph not only signalled the emergence of an anthropology of the Anthropocene but also foresaw recent methodological developments such as cosmopolitics and multi-species ethnography in which plants, mountains, features of the landscape and cosmologically important animals are indispensable for highlighting central political and epistemological stakes in the field of environmental security and sustainability (see de la Cadena 2010, 2015; Kimmerer 2013).

One of the revelations pertinent to our discussion lies in the details of Cruikshank’s take on the production of knowledge about glaciers by Athapaskan elders and Euro-American scientists. According to Cruikshank, if geophysical science objectifies glaciers as inanimate storages of data about melting, trace metals and biological organisms, Athapaskan narratives about glaciers include them in human–non-human sociality as agents affecting people’s destinies and human history. By examining Athapaskan recollections about the history of human relations with glaciers, Cruikshank elegantly

challenges the concept of the environment as a data depository that can be extracted and operationalized to meet utilitarian demands. While ‘shrinking glaciers’ are now characterized, by scientific journals and international media, as the ‘categorical evidence of climate change’ (Roe, Baker and Herla 2016), Cruikshank’s account has shown that Athapaskan oral traditions have long rendered these ‘advancing and waning’ glaciers as capable of responding to human action. Inspired by Cruikshank’s approach, the contributions by Diemberger, Hovden and Ulturgasheva in this volume also illustrate how distinct and powerful bodies of knowledge about human–glacier or human–permafrost relations need to be appreciated in their totality, rather than fragmented into data.

Another author whose work we feel merits discussion in the framing of this volume is Kirsten Hastrup. She has also focused on the agency of ice while examining the history of climate change but has examined specifically the experiences of a rapidly changing icescape by Greenlandic hunters from a productive angle of the cryolens. Her discussion examines the ways in which various actors, including scientists, early explorers and indigenous hunters, have interacted with Greenlandic icebergs and glaciers. As Hastrup puts it succinctly, ‘it is the ice which holds together the environment, or – indeed – splits it up, and which provides the leitmotif of poetry, story and science’ (2013b: 64). In other words, ice is a powerful force with its own aesthetic, episteme, narrative and social agency. Ice can stand for itself in any argument, so she asserts: ‘ice is its own argument; it is not for us to argue its case’ (51). She looks at scientific perceptions of environmental change from the perspective of the nineteenth-century Arctic explorers who, so to speak, engaged in a complex argument with the powerful non-human agent that is ice. Hastrup’s discussion eloquently shows the difficulties the nineteenth-century explorers encountered while trying to capture the High Arctic topographically. The nature and dynamism of the Greenlandic ice have long resisted explorers’ cartographic attempts, as it actively obscures the process of mapping the icy lands that can appear or disappear as a result of either melting or freezing. Ice defeated explorers’ attempts to signify the icescape, as their representations failed to capture the enormity, energy and power of the ice, intrinsically dynamic, unobjectifiable and unmappable. The ice remains at the heart of Hastrup’s account, exuding presence and continuously deriding early Arctic explorers’ constructions of the region.

Non-scalability of the Arctic Cryosphere and Limits of Human Adaptability

Hastrup's historical perspective provides a critical take on the non-scalability of the entire world of the Arctic cryosphere with its human and non-human inhabitants, as it has already reached a point of no return (Hastrup 2013c, 2020). The continuous activity of extractive industries has not ceased from destroying the Arctic environment, for decades steadily driving environmental disasters and ruining regional landscapes and ecologies. Billions of tons of carbon dioxide coming from fossil fuels that continue to enter the atmosphere annually are amplifying the dynamic of ecological ruination (Le Quéré, Peters and Andres 2014). The regional histories of industrial development, whether it is Alaska, Siberia, Greenland, Canada or Fennoscandia, have often illustrated that after decades of intensive mining and extraction permafrost-bound lands tend to transform irreversibly into environmental ruins. Neither monetary compensation nor new technologies of regeneration, habitat restoration, re-creation or recultivation will be sufficiently effective in returning these landscapes to ecological health, much less to an earlier state.

In our view, this particularly applies to a revivalist project called Pleistocene Park undertaken by Russian scientists (Popov 2020). This dystopian park was established 7 kilometres (4 miles) away from the town of Chersky in northeast Siberia in 2018. The project implementers believe that by populating a stretch of 160 square km (62 square miles) with genetically engineered beasts that are a cross between elephants and woolly mammoths, as well as yaks, horses, sheep and oxen, they will revive the grasslands spread as it was during the Pleistocene epoch, i.e. the glacial geological period that began 2.6 million years ago and ended 12,000 years ago. Reversing that process and reviving the grasslands, they argue, could be the key to preserving permafrost. The plan to reintroduce large mammals that could tamp down moss, knock down trees and churn up the soil is meant to allow the grass to flourish again. In this romanticized view of the Pleistocene era, the grass had the capacity to reflect sunlight and capture more carbon in its roots than today's flora. By reintroducing and reoccupying the area with long-gone mammals, the project – which requires roughly 3,000 animals and \$114 million of investment – hopes to slow down the degradation of permafrost and keep the Siberian tundra frozen (*The Economist* 2020). The project may be a provocative and costly thought experiment,

but just like any technological fix, this looks too simple for a wickedly complex problem.

In these regards, the discussion by anthropologist Kath Weston, of techno-revivalists who aim to resuscitate ecologies across continents and regions, presents quite an important and pertinent take on de-extinction projects of this kind, which more often than not perpetuate the colonialist's gaze (see Weston, in press). According to Weston, what these revivalist projects share is a conviction that older ways of doing things, including the re-creation of the Pleistocene grasslands in the Arctic tundra, might make a difference when it comes to climate change. Often, the desire to tame climate change propagated by such revivalist projects as the Pleistocene Park is woven into the fabric of quest narratives that turn, as Weston puts it cogently, 'the one-way story of technological progress on its head by arguing that sometimes the only way to go forward (so to speak) is to go back'. We concur with Weston that environmental transformations on a geological-epoch scale can never be confined to one isolated activity, such as the grazing habits of large mammals with hooves. One must recognize that myriad other factors influenced and intervened in the course of environmental change, factors that include such disruptions as the multiple forms of development that changed the chemical and organic composition of the soil, flora and fauna irreversibly.

What is missing in the revivalist hype surrounding Pleistocene Park is the voice of Siberian indigenous populations who have been living in this area for eons and who have never been consulted on how this type of ambitious dystopian endeavour unfolding in front of their eyes could impact their livelihoods and sense of security. Nor were they asked how those newly introduced animals might affect either the population of their herds of domesticated reindeer or the hunted animals upon which their entire lives depend. Would those genetically revived animals compete for the areas of habitation and overgraze the reindeer pastures vital for the indigenous communities' well-being and continuance? Would all these regenerational activities take place at the expense of their own lives and the lives of their future generations? As the Arctic indigenous accounts have shown before, there is a world of difference between approaching the permafrost-bound land as a resource to be preserved and approaching the permafrost as a sentient being who weeps with 'firing tears' when it is destroyed, as Ulturgasheva details for the Eveny case in this volume, or who speaks when it breaks, warning Tlingit, who know how to listen, of a flood unleashed in retaliation for insulting treatment (Cruikshank 2005).¹¹

The disappearing cryosphere, as well as dramatic permafrost thaw induced by anthropogenic factors, foreshadows new types of hazards and disasters which will subsume human and non-human, society and environment together. The non-scalability of the Arctic environment prompts us to raise urgent questions regarding how we understand human and non-human capacities to avert risks and hazards; how we take into account the increasing vulnerability of communities; and how we comprehend the relationship of multi-species feedbacks to new and emerging forms of 'normal'. We need to take on board the availability and accessibility of resources, knowledge and strategies that people utilize to deal with the latest challenges associated with climate change, and we need to undertake a careful consideration of the environmental futures that require 'a big enough and right-minded vision' (Jamail 2019: 221).

The narratives of the dramatic change offered by the indigenous inhabitants of the Arctic and international climate scientists (see Krupnik and Jolly 2002; Marino 2015; Crate and Nuttall 2016; Nakashima, Rubis and Krupnik 2018) are ceaselessly pointing to a profound sense of unpredictability and uncertainty generated by the change. These are the reports of the unprecedented extinction rate of animals, birds, insects and plants whose livelihoods have relied on the fragile ecology of the cryosphere. A melting cryosphere accelerates the likelihood for thousands of towns and villages located along the Arctic coastline to be threatened by thawing permafrost, storms, rising sea levels and loss of the sea ice (see Bodenhorn, this volume; Jamail 2019; Ulturgasheva, this volume). All of the above will only intensify in the course of the next couple of decades, with methane released by rapidly thawing permafrost.

Geopolitically, with the dramatic disappearance of the cryo-world, the region is likely to turn into a major point of volatility in the territorial disputes and resource conflicts between nation-states and corporations (see also Klare 2019). One cannot escape foreseeing the glimpses of a militarized future in the Arctic. As the ice is melting away, drilling for gas and oil is intensifying, and new shipping routes are opening, along with the recognition that protection of national and corporate interests will be hard to maintain, as they are neither adequately equipped nor properly aware of the nature of risks in a new and unfamiliar Arctic (Nuttall 1998; Goodell 2017). Although ice melt and the rising waters emerged as major risks several decades ago, there is still no comprehensive plan of what to do about it infra-structurally, politically, economically and ideologically. So far, there is an assumption on all levels (governmental, municipal, international,

local and individual) that when the situation is critical and urgent, somebody else (perhaps scientists) will invent something that will save them from a calamity. But nobody will come up with any solutions unless there is a substantial effort to develop far-reaching plans which include a detailed consideration of potential and most probable risks as well as long-term strategic visions.

The understanding of complex networks of risks and the strategies undertaken to ameliorate them will depend on how they are interpreted and articulated, and by whom. In the time of neoliberal calculations, when risk has quickly become a measure for financial stability or instability serving as a tool for financial technologies through which capital moves, risk comes to be institutionalized, elaborated and analysed in terms of the care of the self. But, as Geeta Patel has earnestly shown, linearity of speculations and calculations from within neoliberal subjectivity, with its obsession with privatized efficiency and commodification of risk, is susceptible to producing and reproducing human and non-human vulnerabilities (Patel 2016: 284–91). An eloquent discussion of the flaws of the monetary disaster response and environmental risk (mis)management has been provided by Elizabeth Marino (2015; see also Marino and Faas 2020) through her work with the Iñupiaq community on the island of Shishmaref, Alaska. She shows how the governmental disaster response protocol applied in calculations of the imminent threat of disastrous flood to the village due to sea-level rise and coastal erosion was antithetical to climate change adaptation and preparation. In the government officials' view, the only sensible response to the imminent threat posed by radical erosion of the island could have been an organized relocation, something the villagers themselves voted for in 2014. However, the estimated costs for relocating the village of Shishmaref to the site preferred by the community amounted to 180 million US dollars (Marino 2015: 45–58), an amount that was deemed unfeasible.

Moreover, there were bureaucratic obstacles to the implementation of this plan, specifically the view of the government that, since the disaster had not happened yet, there was no way emergency funds should be spent on organizing relocation. There was (and still is) no corresponding agency for pre-emptive disaster planning or risk reduction in this type of case where erosion increases exposure to flooding hazards. There is no clear course of action in response to the threat of potentially catastrophic flooding today. But one of the possibilities, or as they call it possible disaster responses, was to rebuild the village 'without improvement'. That is to say, to rebuild with minimal costs. This increases the local population's distrust in

the ability of the government to deal with the environmental degradation and intensifies an ongoing process of marginalization of such communities as Shishmaref. Indeed, as of 2019, four years after the publication of Marino's work, next to nothing had actually taken place to rectify an ever-worsening situation.¹² What we observe in all these cases is the contradiction and even the clash of modernities: on the one hand, there is a constant need for certainty (there is a need to shape a particular policy on the basis of certainty rather than probability as well as a need on the basis for risk assessment); on the other hand, the acceptance of uncertainty becomes more evident (2015: 93–97).

While problematizing the neoliberal model of risk as a matter of calculating costs and benefits, Barbara Bodenhorn examines how risk is perceived and interpreted by Iñupiaq whalers of Barrow, Alaska, and explores the basis for the actions they take when they are involved in complex and uncertain situations that require immediate decisions (see also Bodenhorn 1997, 2013a). In her discussion in this volume she offers a critical review of how social scientists have been looking at the models and processes of identifying risk, assessing it, and creating strategies with relation to its perceived implications. The account shows that risk assessments and considerations of potential hazards are always positioned at the intersections of ethical, cultural, social and political assumptions, all of which affect how the decisions that humans take are modelled and how knowledge is manifested in those decisions. Her account thus illustrates that their decisions involve a multilayered understanding of risk, which they talk about in ways that 'express an acute understanding of connections across a number of systems'. These include but are not limited to the languages of complex calculations, an explicitly moral language of risky relationships between humans and whales, languages of responsibility, timing, shortage and vulnerability.

Cosmo-Geo-Analytics

Risks associated with a melting cryosphere and rapidly disappearing ocean and land ice have important implications for the methodological approach of our volume; the process of melt provides us with a conceptual grid for capturing the dynamic of the latest environmental changes in the Arctic. Such cryo-formations as glaciers, permafrost, icebergs and snowdrifts, which are rapidly disappearing, highlight the crucial roles they have been playing in contributing

to the continuance of diversity and multiplicity of lives and worlds, including that of humans. Conceptually, the changes that are associated with a transition from one form to another, when a solid, well-shaped substance such as ice is transforming into formless and fluid water, create the effects of dissolution, dissipation and substantive changes that may re-emerge in the patterns of resilience and adaptation. These effects are considered in the contributions to this volume. They attend to the impacts of and feedbacks to the melting cryosphere that we have chosen to call cryocide. These include the issues of environmental uncertainty, complexity and risk (Bodenhorn, Diemberger and Hovden); communication, voice and politics of knowledge (Callison, Edwardson); collaboration, adaptation and resilience (Ulturgasheva, Rasmus). The contributions to this volume illustrate how Arctic populations understand and respond to the changes from within distinct horizons of knowledge and modes of sociality; they point to productive moments of collaboration with scientists and other stakeholders. The accounts exemplify the extent to which cosmological, geological and social processes are entangled. They point to the need for shifts in the geopolitical map of knowledge production that view cosmo-geo-social processes as mutually implicated and inter-constituting.

It is the rapidity and scale of destruction wrought by extractivist alliances between states and corporations that make Anthropocenic processes so dramatically visible in the Arctic. The region has been imagined by capitalist investors and other types of predatory extractors as an up-for-grabs economic frontier, and this has proved to be an ecologically damaging conceptualization (Brightman, Grotti and Ulturgasheva 2006/7). We hold that what is currently being damaged are the diverse worlds of other-than-human persons upon which indigenous communities depend. The contributions to the volume show how indigenous concerns about ecological catastrophe are often articulated with cosmologically important animals in mind. As Rachel Edwardson's account has shown, the concerns articulated by Alaskan Iñupiaq hunters in their political negotiations with the oil company over the ocean resource use included whales, whose presence was not recognized by the oil company representatives during the meeting. Edwardson's account involved the whale as a cosmologically central other-than-human, Iñupiaq progenitor and master spirit, and an important political actor. By involving whales, Iñupiat did not mean to prove the reality of whales; what they meant was to show how whales are central to Iñupiaq continuation and survival. Central to Edwardson's argument – and very pertinent to our

examination of social risk – is her discussion of ‘silo thinking’, which characterizes disagreement in her community. Even though most Barrow families are connected to whaling in one way or another, some are more ‘pro development’ than others. ‘If you are not at the table, you’re lunch’ and ‘the ice is going to melt anyway, we need to think about an ice-free future’ are statements Edwardson has heard from whalers who favour oil development over whale protection. For Edwardson, one of the greatest risks facing her children’s future – a future connected to a moral sociality with whales and a strong positive sense of what it means to be Iñupiaq – is the inability within the community to break free of people’s individual silos to think creatively about what is to come.

In a similar vein, the Siberian account of human adaptive agency illustrates the cosmological centrality of reindeer and points to an assemblage of cosmo-geo-ecological sensitivity that has been informing human–permafrost engagement and adaptation strategies for Eveny reindeer herders. The contribution to the volume by Ulturgasheva provides an account of the kinds of expertise, mindset and sensitivity that are required for responding adaptively and dealing with the environmental unpredictability that characterizes living on and from the permafrost-bound land (see also Ulturgasheva 2012, 2016). Eveny reindeer herders’ expertise, which relies on their patterns of mobility, tactics of flexibility and divination rituals, revolves around the complex understanding of the interdependence of human and non-human elements, such as permafrost, lichen, reindeer and humans. The interdependence has been central to reindeer herders’ ability to negotiate their communal safety and well-being.

This expertise has never been static and it evolved in response to all sorts of environmental shifts and perturbations. The need to stay attuned to the rhythms of all interrelated human and non-human elements, as well as the recognition of relational symmetry and interdependence, has been central to the human capacity to survive and quickly adapt to any changes. The ability to survive and thrive has required (and continues to require) not only a knowledge of animals’ predispositions and proclivities, but also a mastery of orientation and movement across the landscape. Crucially, it also requires the capacity to stay attuned to all elements of what Ulturgasheva’s interlocutors called a web of mercifulness: humans have always remained at the mercy of wild and semi-domesticated reindeer; reindeer have been at the mercy of lichen, which in turn has been at the mercy of permafrost which has stayed solid owing to the mercifulness of lichen. Since all elements in this human–non-human community have

been bound by inter-reliance, their safety and continuance have been determined by an asymmetric assortment of cosmo-geo-ecological dependences.

Iñupiaq and Eveny accounts of how human lives and social relations depend significantly on whales and reindeer are ultimately linked to their understanding of cosmology and resource politics. They manifest *silá*-thinking (see Edwardson, this volume) that stands in contrast to the silo-thinking we problematized above. In this regard, we agree with Marisol de la Cadena that indigenous politics often transcend or exceed the boundaries of mainstream politics as an exclusively human domain from which non-human forces are banned (2010: 335). De la Cadena's notion of cosmo-politics (or universal politics), which calls for the inclusion of non-humans (or as she calls them 'earth beings') into political negotiations in the capacity of political subjects, reshuffles the humano-centrism of hegemonic antagonisms pertaining to the domain of the political. Our volume expands this inquiry further into the field of the geo by demarcating a set of much-needed de-hierarchizing, de-silo-ing paradigms of knowledge production. As we shall see throughout this volume, the cosmo-geo-analytics that takes cosmo-knowledge seriously and respect the existence and subjectivities of non-humans is required to activate a more inclusive take on geopolitical processes themselves, as such cosmo-geo-politics could enable political forces to challenge hegemonic biopower thinking that is currently driving official (non)-responses to the irreversible forces of Anthropocene. This volume constitutes an attempt to recalibrate an understanding of the knowledge production process that responds to new horizons of knowledge that are not siloed within agendas of dominant enclaves of scientific knowledge owners. The contributions are instances of how diverse constellations of risks and sudden shocks (e.g. pandemics, extreme climate events such as hurricanes or tsunamis, presidential elections and economic crisis) prompt activation of the cosmo-geo-analytics facilitating the development of novel forms of engagement with complex impacts of climate change. Hence, we propose a cosmo-geo-analytics capable of articulating epistemological configurations that can include non-human beings such as whales, wolves and bears, but also powerful geomorphological entities – hyper-animistic forces such as permafrost or a hyper-object of wildfire – that constitute the cryo-ecologies of the Circumpolar lands. This, we suggest, both engages with and goes beyond some of the current re-examinations of animist thinking that we have already discussed, and offers an analytical perspective that is applicable on multiple scales from the intimate to the planetary. At

a moment when the Arctic and its peoples are at the centre of rapid climate change, we further suggest that it is crucial that we do so when thinking about Arctic futures.

Olga Ulturgasheva is a Senior Lecturer/Associate Professor in Social Anthropology at the University of Manchester, UK. Over the last twenty years she has been engaged in a number of anthropological and cross-disciplinary studies exploring animism, human and non-human personhood, childhood and youth, climate change, resilience and adaptation patterns in Siberia, American Arctic and Amazonia. She is the author of *Narrating the Future in Siberia: Childhood, Adolescence and Autobiography among the Eveny* (Berghahn Books, 2012) and co-editor of *Animism in Rainforest and Tundra: Personhood, Animals, Plants and Things in Contemporary Amazonia and Siberia* (Berghahn Books, 2012). She serves as a Principal Investigator and co-Principal Investigator for two large international, collaborative research projects focusing on the dynamic of climate change in Alaska, Siberia and the Russian Far East funded by the US National Science Foundation and the European Research Council.

Barbara Bodenhorn was Newton Trust Lecturer in Social Anthropology until 2013 and is currently Fellow Emerita of Pembroke College, Cambridge. Her most recent research interests focus on children's environmental knowledge as well as communally initiated responses to environmental change.

Notes

1. See Hastrup 2013b and Callison 2014 for a critical consideration of these constructions.
2. During the Cold War, both the USSR and the US used their Arctic territory as a strategic buffer. George Edwardson recounted to Bodenhorn in 1985 how, when fishing on an inland river, he would watch MIGS fly low and fast along the waterway, testing to see how far inland they could get before being picked up by US military jets. 'I'm sure we were doing the same thing on the other side', he surmised. When oil was discovered, and statehood was established in the 1950s, Alaska became a territory to fight over, not just fly over. The Circumpolar nations have recognized the Arctic for its strategic military importance and for its economic potential for many decades. Even though the USSR, the US, Canada and Denmark/Greenland have separately recognized the presence of 'their' indigenous populations since the mid-1970s, indigenous presences have largely been seen as a hinderance to 'progress'; their views and knowledge have not been solicited. And the

claims they make to their land and resources must be continually defended. Our point here is that the ecology of the Arctic as a minimalist, and therefore vulnerable, ecosystem has only relatively recently become part of the public discourse concerning the region.

3. The US military has been the most consistent arm of the Federal Government to keep track of the consequences of climate change as a matter of national security. See Klare 2019 for an extended discussion of ‘the view from the Pentagon’.
4. See Ehlers and Krafft 2005 for an excellent collection of essays reviewing early twenty-first-century treatments of this concept. In their introduction, the editors trace an awareness of the impacts of human activity on geologic processes from the mid-nineteenth century. They identify Turner and colleagues’ work, *The Earth as Transformed by Human Action* (1990), as pivotal in their bringing together ‘nature’ and ‘society’ as co-drivers of environmental and climatological processes. The concept remains somewhat controversial even in geological circles.
5. This was by no means a monolithic process: Russian Orthodoxy reigned in Siberia, and on Kodiak Island in Alaska; Sheldon Jackson divided rural Alaska up like a missionary pie in order to avoid proselytizing competition; Moravians, Catholics, Presbyterians and others each received ‘their’ territory. Anglo- and Francophone Canada generally followed Protestant/Catholic denominations. Greenland’s colonizers were largely Protestant.
6. See Robert Wright’s (2004) historically informed critique of the trope of ‘progress’ – according to him, one of the most pernicious ideas to inform ‘Western thought’. The book combines well with Fabian’s long-standing exhortation to anthropologists to recognize others as co-eval, and not The Other (1988).
7. The intellectual history behind this is too long to go into here, but Hobbs, Locke, Marx and Weber all develop their arguments from a standpoint that assumes individual human desire is infinite, thus creating inevitable scarcity and competition.
8. See Bodenhorn 2000 for an extended examination of Iñupiaq discussions of this.
9. In a similar way, Robin Kimmerer (2013: 9ff) relates a Potawatomi origin story in which Skywoman falls to earth, is first supported by the wings of geese, then is let down on a turtle shell, and is finally able to settle on Turtle Island due to the generosity of a muskrat, who brings her a fistful of muddy soil from the bottom of the sea.
10. The distinction between Yup’ik/Yupiit follows the same general rule as that for Iñupiaq/Iñupiat: the former is singular and adjectival (Yup’ik skills; Iñupiaq stories) whereas the latter refer to a collective of people (young Yupiit find it challenging to deal with governmental agencies).
11. In *Salvaging Nature*, research sponsored by the UN, Marcus Colchester (1994) details the long – and widespread – history of tensions between conservationists who ‘want to preserve’ lands and indigenous peoples who have, in fact, been preserving them while they have lived there. They are then displaced – generally without consultation – because preserved spaces

are meant to be 'wild' and 'pristine' places that can be enjoyed by tourists rather than inhabitants.

12. As of 2019, no major steps had yet been undertaken to address either environmental threats on the island or the complex needs required for relocation (Hofstaedter 2019).

References

- AMAP. 2017. *Snow, Water, Ice and Permafrost in the Arctic (SWIPA)*. Oslo: Arctic Monitoring and Assessment Programme (AMAP).
- Barnosky, Anthony David and Elizabeth Hadly. 2016. *Tipping Point for Planet Earth: How Close Are We to the Edge?* London: William Collins.
- Berkes, Fikret. 2012. *Sacred Ecology: Traditional Ecological Knowledge and Resource Management* (third edition). New York: Routledge.
- Berkes, F., et al. 2005. *Breaking Ice: Renewable Resource and Ocean Management in the Canadian North*. Calgary: University of Calgary Press.
- Bodenhorn, Barbara. 1997. 'People Who Are Like Our Books: Reading and Teaching on the North Slope of Alaska', *Arctic Anthropology* 34(1): 117–34.
- . 2000. 'It's Traditional to Change: A Case Study of Strategic Decision-Making', *Cambridge Anthropology* 22(1): 24–51.
- . 2013a. 'Meeting Minds; Encountering Worlds: Science and Other Expertises on Alaska's North Slope', in M. Konrad (ed.), *Collaborators Collaborating*. Oxford: Berghahn Books, pp. 225–44.
- . 2013b. Book Review of *Inherit My Heaven: Kalaallit Gender Relations*. *Arctic* 66(4): 500–501.
- Bodenhorn, Barbara and Olga Ulturgasheva. 2017. 'Climate Strategies: Thinking through Arctic Examples', *Philosophical Transactions of the Royal Society A* 375(2095): 20160363.
- . 2018. 'Envisioning Arctic Futures: Digital and Otherwise', *Museum Anthropology Review* 12(2): 100–19.
- Box, Jason. 2012. Interview in *Chasing Ice*. National Geographic documentary with James Blog. Produced by Jeff Orlowski et al. Released November 2012.
- Bravo, Michel. 2009. 'Voices from the Sea Ice: The Reception of Climate Impact Narratives', *Journal of Historical Geography* 35(2): 256–78.
- . 2017. 'A Cryopolitics to Reclaim Our Frozen Material States', in E. Kowal and J. Radin (eds), *Cryopolitics: Frozen Life in a Melting World*. Cambridge, MA: The MIT Press, pp. 27–57.
- Brewster, Karen. 1997. 'Native Contributions to Arctic Science at Barrow, Alaska', *Arctic* 50(3): 277–88.
- . 2005. *The Whales, They Give Themselves: Conversations with Harry Brower, Sr.* Fairbanks, AK: University of Alaska Press.

- Brightman, Marc, Vanessa Grotti and Olga Ulturgasheva. 2006/7. 'Introduction: Rethinking the "Frontier" in Amazonia and Siberia: Extractive Economies, Indigenous Politics and Social Transformations', Special edition of *Cambridge Anthropology* 26(2): 1–12.
- Callison, Candis. 2014. *How Climate Change Comes to Matter*. Durham, NC: Duke University Press.
- . 2018. Keynote speech. International Symposium convened by Dr Candis Callison (University of British Columbia, Canada) and Prof Simon Morrison (Princeton University, USA) on 'Indigenous Communities and Climate Change in North America and Russia'.
- Chakrabarty, Dipesh. 2009. 'The Climate of History: Four Theses', *Critical Enquiry* 35: 197–222.
- Colchester, Marcus. 1994. *Salvaging Nature: Indigenous Peoples, Protected Areas and Biodiversity Conservation*. Geneva: UNSAID.
- Cohen, J. et al. 2014. 'Recent Arctic Amplification and Extreme Mid-Latitude Weather', *Nature Geoscience* 7(9): 627–37.
- Coreau, A. et al. 2010. 'Exploring the Difficulties of Studying Futures in Ecology: What Do Ecological Scientists Think?', *Oikos* 119: 1364–76.
- Crate, Susan and Mark Nuttall. 2016. *Anthropology and Climate Change: From Encounters to Action* (second edition). Walnut Creek, CA: Leftcoast Press.
- Cruikshank, Julie. 1998. *The Social Life of Stories: Narrative and Knowledge in Yukon Territory*. Lincoln, NE: University of Nebraska Press.
- . 2004. 'Uses and Abuses of "Traditional Knowledge"; Perspectives from the Yukon Territories', in D.G. Anderson and M. Nuttall (eds), *Cultivating Arctic Landscapes: Knowing and Managing Animals in the Circumpolar North*. Oxford: Berghahn.
- . 2005. *Do Glaciers Listen? Local Knowledge, Colonial Encounters, and Social Imagination*. Seattle: University of Washington Press.
- Crutzen, Paul and Eugene Stoermer. 2000. 'The "Anthropocene"', *Global Change Newsletter* 41: 17–18.
- Das, Veena. 1995. *Critical Events: An Anthropological Perspective on Contemporary India*. Delhi: Oxford University Press.
- de la Cadena, Marisol. 2010. 'Indigenous Cosmopolitics in the Andes: Conceptual Reflections beyond "Politics"', *Cultural Anthropology* 25(2): 334–70.
- . 2015. *Earth Beings: Ecologies of Practice across Andean Worlds*. Durham, NC: Duke University Press.
- Douglas, Mary and Aaron Wildavsky. 1982. *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers*. Berkeley: University of California Press.
- The Economist*. 2020. 'One Russian Scientist Hopes to Slow the Thawing of the Arctic', 16 December 2020. Retrieved 8 March 2021 from www.economist.com/christmas-specials/2020/12/19/one-russian-scientist-hopes-to-slow-the-thawing-of-the-arctic.
- Ehlers, Eckart and Thomas Krafft (eds). 2005. *Earth System Science in the Anthropocene: Emerging Issues and Problems*. New York: Springer.
- Ellis, Rebecca, Claire Waterton and Brian Wynne. 2010. 'Taxonomy, Biodiversity and Their Publics in Twenty-First-Century DNA Barcoding', *Public Understanding of Science* 19(4): 497–512.

- Eriksen, Thomas Hylland. 2016. *Overheating: An Anthropology of Accelerated Change*. London: Pluto Press.
- Escobar, Arturo. 2018. *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds*. Durham, NC: Duke University Press.
- Evengård, Brigitta and Tomas Thierfelder. 2021. 'CLINF: Climate-Change Effects on the Epidemiology of Infectious Diseases, and the Associated Impacts on Northern Societies', in D. Nord (ed.), *Nordic Perspectives on the Responsible Development of the Arctic: Pathways to Action*. New York: Springer, pp. 49–70.
- Fabian, Johannes. 1988. *Time and the Other: How Anthropology Makes its Object*. New York: Columbia University Press.
- Fenge, Terry. 2001. 'The Inuit and Climate Change', *Isuma* Winter: 79–85.
- Fienup-Riordan, Ann. 2020. *Nunakun-gguq Ciutengqertut/They Say They have Ears through the Ground: Animal Essays from Southwest Alaska*. Fairbanks, AK: University of Alaska Press.
- Fienup-Riordan, Ann and Alice Rearden. 2012. *Ellavut: Our Yupik World and Weather: Continuity and Change on the Bering Coast*. Seattle: University of Washington Press.
- Ford, Violet. 2001. 'From Consultation to Partnership: Engaging Inuit on Climate Change', *Silarjualiriniq* 7: 2–4.
- Ghosh, Amitav. 2016. *The Great Derangement: Climate Change and the Unthinkable*. Chicago: University of Chicago Press.
- Goodell, John. 2017. *The Water Will Come: Rising Seas, Sinking Cities, and the Remaking of the Civilized World*. New York: Back Bay Books.
- Hastrup, Kirsten. 2013a. 'Anticipation in Thin Ice. Diagrammatic Reasoning among Arctic Hunters', in K. Hastrup and M. Skrydstrup (eds.), *Anticipating Nature: The Social Life of Climate Models*. London: Routledge, pp. 77–99.
- . 2013b. 'The Ice as Argument: Topographical Mementos in the High Arctic', *Cambridge Anthropology* 31(1): 52–68.
- . 2013c. 'Scales of Attention in Fieldwork: Global Connections and Local Concerns in the Arctic', *Ethnography* 14(2): 145–64.
- . 2020. 'Emerging Landscapes: Geosocial Relations in Thule'. Paper presented for Arctic Cultures Workshop, Cambridge, UK, 8–9 January 2020 (unpublished).
- Hastrup, Kirsten and Frida Hastrup. 2015. *Waterworlds: Anthropology in Fluid Environments*. Oxford: Berghahn Books.
- Hofstaedter, Emily. 2019. 'Amid an Erosion Crisis, Shishmareff Takes Small Steps toward Expansion'. Retrieved 25 March 2021 from www.knom.org/wp/blog/2019/06/28/amid-an-erosion-crisis-shishmareff-takes-small-steps-toward-expansion/#:~:text=Shishmareff%20is%20a%20san.
- Holland, Marika and Cecilia Bitz. 2003. 'Polar Amplification of Climate Change in Coupled Models', *Climate Dynamics* 21(3–4): 221–32.
- Inglis, Julian. 1993. *Traditional Ecological Knowledge: Concepts and Cases*. Ottawa, Ontario: Canadian Museum of Nature/International Development Research Centre.
- Jamail, Dahr. 2019. *The End of Ice: Bearing Witness and Finding Meaning in the Path of Climate Disruption*. London: The New Press.

- Jolly, D. et al. 2002. 'We Can't Predict the Weather like We Used To: Inuvialuit Observations of Climate Change, Sachs Harbour, Western Canadian Arctic', in I. Krupnik and D. Jolly (eds), *The Earth Is Faster Now: Indigenous Observations of Arctic Environmental Change*. Fairbanks, AK: Arctic Research Consortium of the United States, pp. 9–125.
- Kawagley, Oscar Angayuqaq. 2006. *A Yupiaq Worldview: A Pathway to Ecology and Spirit*, 2nd ed. Long Grove, IL: Waveland Press.
- Keith, D. et al. 2008. 'Predicting Extinction Risks under Climate Change: Coupling Stochastic Population Models with Dynamic Habitat Models', *Biology Letters* 4: 560–63.
- Kimmerer, Robin Wall. 2013. *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge, and the Teachings of Plants*. Minneapolis, MN: Milkweed Editions.
- Klare, Michael. 2019. *All Hell Breaking Loose: The Pentagon's Perspective on Climate Change*. New York: Macmillan.
- Kormann, Carolyn. 2020. 'A Disastrous Summer in the Arctic', *The New Yorker*, 27 June.
- Krebs, Charles and David Berteaux. 2006. 'The Problems and Pitfalls in Relating Climate Variability to Population Dynamics', *Climate Research* 32: 143–49.
- Krupnik, Igor and Dyanna Jolly. 2002. *The Earth Is Faster Now: Indigenous Observations of Arctic Environmental Change*. Fairbanks, AK: Arctic Research Consortium of the United States.
- Kunuk, Zacharias, Ian Mauro and Norman Cohn. 2010. *Inuit Knowledge and Climate Change* (in Inuktituk with English subtitles). Iglulik Isuma Productions.
- Le Quéré, C. et al. 2014. 'Global Carbon Budget 2013', *Earth System Scientific Data* 6: 235–63.
- Marino, Elizabeth. 2015. *Fierce Climate, Sacred Ground: An Ethnography of Climate Change in Shishmaref, Alaska*. Fairbanks, AK: University of Alaska Fairbanks.
- Marino, Elizabeth and A. Faas. 2020. 'Is Vulnerability an Outdated Concept? After Subjects and Spaces', *Annals of Anthropological Practice* 44: 33–46.
- Mitchell, Timothy. 2009. *Carbon Democracy: Political Power in the Age of Oil*. London: Verso.
- Moore Jason. 2014. The Capitalocene, Part I: on the nature and origins of our ecological crisis. Retrieved 20 January 2017 from http://www.jasonwmoore.com/upload/The_Capitalocene_Part_i_June-2014.pdf.
- Morrow, Phyllis and Chase Hensel. 1992. 'Hidden Dissension: Minority–Majority Relationships and the Use of Contested Terminology', *Arctic Anthropology* 29(1): 38–53.
- Nakashima, Douglas, Jennifer Rubis and Igor Krupnik. 2018. 'Indigenous Knowledge for Climate Change Assessment and Adaptation: Introduction', in D. Nakashima, I. Krupnik and J. Rubis (eds), *Indigenous Knowledge for Climate Change Assessment and Adaptation*. Cambridge: Cambridge University Press, pp. 1–22.
- Nuttall, Mark. 1998. *Protecting the Arctic: Indigenous Peoples and Cultural Survival*. London: Routledge.

- Omazic, A. et al. 2019. 'Discrepancies in Data Reporting of Zoonotic Infectious Diseases across the Nordic Countries – a Call for Action in the Era of Climate Change', *International Journal of Circumpolar Health* 78(1): 1601991.
- Oozeva, C. et al. 2004. *Watching Ice and Weather Our Way*. Washington DC: Arctic Studies Center, Smithsonian Institution.
- O'Reilly, Jessica. 2016. 'Sensing the Ice: Field Science, Models, and Expert Intimacy with Knowledge', *Journal of the Royal Anthropological Institute* 22(S1): 27–45.
- Oquilluk, William and Laurel Bland. 1973. *The People of Kawerak: Legends of the Northern Eskimo*. Anchorage: Alaska Pacific University Press.
- Overland, J. et al. 2019. 'The Urgency of Arctic Change', *Polar Science* 21: 6–13.
- Patel, Geeta. 2016. *Risky Bodies & Techno-Intimacy: Reflections on Sexuality, Media, Science, Finance*. Seattle: University of Washington Press.
- Petryna, Adriana. 2003. *Life Exposed: Biological Citizens after Chernobyl*. Princeton, NJ: Princeton University Press.
- Pfeffer, William Tad. 2009. 'People and Place in the Far North: A Vision of Life, Community and Change', in S. Jakobsson (ed.), *Images of the North: Histories, Identities, Ideas*. Amsterdam: Rodopi, pp. 81–90.
- Popov, Igor. 2020. 'The Current State of Pleistocene Park, Russia (An Experiment in the Restoration of Megafauna in a Boreal Environment)', *The Holocene* 30(10): 1471–73.
- Roe, Gerard, Marcia Baker and Florian Herla. 2016. 'Centennial Glacier Retreat as Categorical Evidence of Regional Climate Change', *Nature Geoscience* 10(2): 95–99.
- Royer, Marie-Jeanne. 2016. *Climate, Environment and Cree Observations: James Bay Territory*. Cham, Switzerland: Springer.
- Royer, M.-J. et al. 2013. 'Linking Cree Hunters' and Scientific Observations of Changing Inland Ice and Meteorological Conditions in the Subarctic Eastern James Bay Region, Canada', *Climatic Change* 119: 719–32.
- Scheper-Hughes, Nancy. 2005. 'The Disaster and Its Doubles', *Anthropology Today* 21(6): 2–4.
- Tasch, Jeremy and Weiwei Tasch. 2017. 'Ambiguity in an Ambiguous Region: Risk Conundrums in the Arctic', in R. Kaspersob (ed.), *Risk Conundrums: Solving Unsolvable Problems*. London: Routledge, pp. 147–62.
- Thompson, Andrea. 2012. 'Arctic Wildfire Soot Darkening Greenlandic Ice Sheet', *Scientific American*, 7 December 2012. Retrieved 26 March 2021 from www.scientificamerican.com/article/arctic-wildfire-soot-dark/.
- Todd, Zoe. 2015. 'Indigenizing the Anthropocene', in H. Davis and E. Turpin (eds), *Art in the Anthropocene: Aesthetics, Politics, Environments and Epistemologies*. London: Open Humanities Press, pp. 241–54.
- Turner, B. et al. 1990. *The Earth as Transformed by Human Action: Global Change and Regional Changes in the Biosphere over the Past 300 Years*. Cambridge: Cambridge University Press.
- Ulturgasheva, Olga. 2012. *Narrating the Future in Siberia: Childhood, Adolescence and Autobiography among the Eveny*. Oxford: Berghahn Books.
- . 2014. 'Attaining Khinem: Challenges, Coping Strategies and Resilience among Eveny Adolescents', *Transcultural Psychiatry* 51: 632–50.

- . 2016. 'Spirit of the Future: Movement, Kinetic Distribution and Personhood among Siberian Eveny', *Social Analysis* 60(1): 56–73.
- Ulturgasheva, Olga and Barbara Bodenhorn. 2016. 'Arctic Futures? Climate, Geopolitics and Local Realities', *Witness the Arctic: Chronicles of the NSF Arctic Science Section* 20(3): 23–30.
- Ulturgasheva, O. et al. 2014. 'Arctic Indigenous Youth Resilience and Vulnerability: Comparative Analysis of Adolescent Experiences across Five Circumpolar Communities', *Transcultural Psychiatry* 51(5): 735–56.
- Ulturgasheva, Olga, Stacy Rasmus and Phyllis Morrow. 2015. 'Collapsing the Distance: Indigenous Youth Engagement in a Circumpolar Study of Youth Resilience', *Arctic Anthropology* 52(1): 50–60.
- Vitebsky, Piers. 2005. *The Reindeer People: Living with Animals and Spirits in Siberia*. Boston: Houghton Mifflin; London: HarperCollins.
- Wadhams, Peter. 2017. *Farewell to Ice*. London: Allen Lane.
- Wehi, P.M., M.P. Cox, T. Roa and H. Whaanga. 2018. 'Human Perceptions of Megafaunal Extinction Events Revealed by Linguistic Analysis of Indigenous Oral Traditions', *Human Ecology* 46: 461–70.
- Wenzel, George. 2004. 'From TEK to IQ: Inuit Qaujimaqatuqangit and Inuit Cultural Ecology', *Arctic Anthropology* 41(2): 238–50.
- Weston, Kath. 2017. *Animate Planet: Making Visceral Sense of Living in a High-Tech Ecologically Damaged World*. Durham, NC: Duke University Press.
- . In press. 'Techno-Revivalism: Mobilizing "Tradition" to Address Climate Change', in B. Bodenhorn (ed.), *In the Name of Climate Change: The Politics and Pragmatics of Shifting Environmental Conditions*. Oxford: Berghahn Books.
- Wilkinson, Kim, Susan Clark and William Burch. 2007. *Other Voices, Other Ways, Better Practice: Bridging Local and Professional Environmental Knowledge*. Yale: Yale School of Forestry & Environmental Studies 14.
- Williamson, Karla. 2011. *Inherit My Heaven: Kalaallit Gender Relations*. Nuuk: Department of Culture and Education, Government of Greenland.
- Wright, Ronald. 2004. *A Short History of Progress*. Toronto: Anansi Press.