Indigenous knowledge

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Innovation exceeds fear of climate change in Greenland

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Greenland is central to climate research and research now shows that Greenlanders are far more aware of a rapidly changing Arctic climate than of the underlying global causes. However, their willingness to harness new opportunities exceeds fear of climate change's consequences.

Citizens and policymakers generally hold strong opinions on whether anthropogenic climate change merits mitigative action or not. Yet, scientific consensus indicates that contemporary governance regimes are unable to address cascading risks within existing legal and policy frameworks[1,2]. Through Arctic amplification, northern high-latitude regions are already experiencing increases of ≥3 °C, far above the COP21 Paris Agreement's goal to limit Earth's warming to ≤1.5 °C (refs. 1,3). Arctic residents are therefore well versed in dramatic environmental and socio-ecological changes experienced in recent decades on land and at sea, which substantially affect their lives and livelihoods[4,5]. Now, writing in *Nature Climate Change*, Kelton Minor and colleagues[6] reveal that close familiarity with extreme weather, symptomatic of a warming climate, within a given Arctic populace does not necessarily equate with an understanding of the underlying global causes.

Greenland has become a hotspot of climate change science, because unlike any other Arctic territory inhabited by humans, the impacts of warming on its ice sheet have consequences for the entire planet. People inhabiting the narrow coastal strips in Greenland that are not covered with ice are therefore daily witnesses of ice-sheet dynamics and their implications for adjoining terrestrial and marine ecosystems.

Minor and colleagues' broad and deep analysis of Greenlanders' perceptions of climate change highlights a conundrum. The coastal Indigenous residents most exposed to — and therefore experienced with — the linked social and ecological impacts symptomatic of a warming Arctic climate remain the least aware of the underlying anthropogenic causes. In their extensive systematic review of national and international climate opinion surveys within Arctic countries, two statistics stand out: (1) among Arctic countries specifically, the residents of Kalaallit Nunaat constituted the only previously non-surveyed population; and (2) more than twice as many Greenlanders say they have personally experienced the effects of climate change compared with other Arctic countries with equivalent data. In what the authors call the "science–society gap", Greenlanders are knowledgeable about the changing climate but not about its causes.

These are important findings, as they highlight the potential of indigenous ways of knowing the land for a better scientific analysis of the effects of a changing climate. Although earlier climate change science has often focused on natural science evidence exclusively[7], the implication of Minor and colleagues' results is that Arctic science can benefit greatly if researchers take the perceptions of Arctic residents as starting points for informing a broader scientific agenda. This would make Arctic climate science not only more useful for Arctic residents but also for the rest of the planet.

However, conclusions about the lack of Greenlanders' awareness of the causes of the changing climate may slightly echo popular but biased statements that portray Indigenous Arctic residents as poorly educated, uninformed victims of larger forces that they cannot act upon. This conclusion may be supported by statistics, but we are certain that the authors would strongly agree that such results are not indicative of the adaptive capacity of Greenland's Indigenous population.

'Inuit culture' and 'education', both important variables employed by Minor and colleagues, are from a scholarly viewpoint as potentially problematic as the Western cultural bias of statistical surveys in themselves, creating the image of what Walter and Andersen[8] labelled "deficit indigenes". First, Inuit culture comes across all too easily as essentialized, by scholars and sometimes Indigenous activists alike. An essentialized idea of culture, with its traditionalist orientation towards subsistence and rural settlement patterns, can overlook how diverse and complex Inuit culture is[9,10]. Second, education measured by Western models that consider only formal schooling, overlooks cultural learning, for example, being with mentors on land and sea and learning about socio–ecological–spiritual interconnectedness through joint experience[11].

Along with some existing works[12,13], our own preliminary fieldwork with South Greenlanders (Kujalleq municipality) indicates an exceptional agency and innovativeness of people in both settlements and more remote pastoralist landscapes. Hunters, fishers and farmers (a subsistence category within Greenland unique to the south) are anything but passive victims of larger forces in a changing climate. For example, Inuit took up sheep farming 100 years ago, after the Norse abandoned it in the Middle Ages, evidence of their capacity. They also focused on socio-ecological relationships (Fig. 1); South Greenlanders experiment with new ways of keeping reindeer jointly with feral sheep, exploiting islands as natural barriers for animal dispersal. In addition to their adaptability, these examples also illustrate the self-confidence that Greenlanders possess. They can make the necessary governance decisions to enable implementation. In this way, the South Greenland example teaches us a way of 'thinking outside of the box'. This impressive lesson is combined with careful lobbying for their own cultural diversity, even within Greenlandic society, vis-à-vis the more dominant livelihoods elsewhere in Greenland.

Fortunately, Greenland has published an up-to-date, clear and concise roadmap for research in the next several years that rightly sets a high bar for future research co-development[14]. The area of education is not covered in the plan, which is limited to scientific studies carried out at the PhD level or above. Nonetheless, the milestone document nicely complements the strategies aimed at policy innovation of other Arctic countries, as well as the European Union collectively, in which

Fig. 1 | Depictions of modern pastoralism and its various innovations in South Greenland. Top left: Upernaviarsuk experimental farm in South Greenland, a state-of-the-art Arctic research and training centre to ensure that the next generation maintains long-standing local and regional knowledge of pastoralism and agronomy. Top right: beyond essentialist notions of culture, South Greenlandic pastoralism combines state-of-the-art meat production with Inuit and Norse traditions, seen here at the slaughterhouse in Narsaq. Bottom left: Inuit in South Greenland produce food by combining pastoralist livelihoods with hunting and fishing; here dried cod. Bottom right: in South Greenland pastoralism, sheep and people innovatively adapt to the changing Arctic environment; shown here are sheep returning from free-range winter grazing to their barn at Tasiluk.

indigenous ways of knowing are highlighted as essential to future Arctic research[15,16]. In this respect, studies such as that of Minor and colleagues support the case for indigenous ways of knowing to be better considered in both science and policymaking. However, beyond that, we also argue for more strongly inclusive participatory research, highlighting the capacity of Greenlanders themselves in adapting their already highly dynamic livelihoods to this rapidly changing environment.

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Competing interests
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