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Epilogue. Field Notes from the End of the World: Light, Darkness, Energy, and Endscape in Polar Night

Résumé

This personal essay describes light(s) and darkness(es) in Longyearbyen, Svalbard (Norway) during polar night in January 2019. Drawing on autoethnographic methods, I also seek to describe how I experienced the remarkable lightscapes and darkscapes of the far north during winter. I suggest how the history of energy in Longyearbyen has both shaped and been shaped by the “extreme” light/dark cycle of the high Arctic. In the process, I develop the concept of “endscape” to characterize vestiges of a landscape that has been, and will continue to be, transformed by global climate change, and will eventually disappear. This recent experience illustrates the potential of experiential, reflexive ways of contending with light/dark. It also draws attention to tensions in the academic study of light/dark and the history of energy, and how they play out in practice, in the context of a conference held in a remote location that requires scholars to contribute to the continued extraction of fossil fuels –something that most would otherwise decry. I suggest that Longyearbyen is a useful case study for other endscapes in the early 21st C.

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Figure 1: Map showing Norway (in red) and Svalbard (the archipelago colored red within the circle). This view particularly shows the latter's proximity to the North Pole. Source: Wikipedia, "Svalbard."

- 1 January 2019. I've just experienced almost six consecutive "days" of polar night –a twenty-four-hour period without sunlight– in Longyearbyen, Norway. A small town on the archipelago known as Svalbard (fig. 1), Longyearbyen is located at the 78th parallel –2,000 kilometers almost due north of Oslo and just 1,050 kilometers from the North Pole. In 1906, American John Munro Longyear and his Arctic Coal Company established a coal mine near what became the new "town of Longyear" (Longyearbyen). One mine is operational today, but Longyearbyen is now mostly a tourist destination, hub for scientific research (especially related to global climate change), and outpost of Norwegian sovereignty in an increasingly altered and contested Arctic.
- 2 The six days I spent without seeing the sun is, however, a small fraction of polar night at this latitude. The sun remains below the horizon from October 26 until February 15, what is called the "dark period" (*mørketiden*). "Real" polar night –when the sun is at least 6 degrees below the horizon, so that no twilight illuminates the sky– extends from November 11 to January 30.¹

¹ Spitsbergen-Svalbard, "Midnight sun and polar night," <https://www.spitsbergen-svalbard.com/spitsbergen-information/midnight-s...> (accessed 15 May 2019)

Although I loved my time in Longyearbyen (fig. 2), I could not imagine being a year-round resident.²

I had ventured to Longyearbyen in the depths of winter to participate in Island Dynamics' conference on –wait for it– "Darkness."³ For the past few years, I have been studying the history of light pollution and scientific research about this issue.⁴ What better place to think about artificial light at night than Longyearbyen –the northernmost town in the world– during real polar night.⁵ I traveled some 8,000 kilometers to present work in progress, meet scholars from diverse fields studying darkness, and experience light and dark in a dramatic landscape of both.

I also went to Longyearbyen for personal reasons. My father, a retired Arctic sea ice modeler, spent time in the polar north studying sea ice during the era of the Cold War and fossil fuels. Many scientists in the next generation of sea ice modelers now do so under the rubric of climate

² A hotel desk clerk told one conference participant that they thought winter and darkness were easier to adapt to than continuous light in summer. The clerk also shared that suicide rates are higher in summer. Their argument was that now "people" are used to working in artificially lit interior spaces, so it is therefore "easier" to adapt to winter conditions than to try to block out light during 24-hour days. This comment was especially interesting to me, given my work on artificial light at night. I wonder if people reliant on candle or whale oil (both past and present) would come to the same conclusions or if this is culturally, historically, and economically contingent.

³ "Darkness 2019," *Island Dynamics Conference*, Longyearbyen, Svalbard, 13-17 January 2019, <https://darkness-conference2019.wordpress.com/> (accessed 15 May 2019)

⁴ Sara B. Pritchard, "The Trouble with Darkness: NASA's Suomi Satellite Images of Earth at Night," *Environmental History*, vol. 22, n° 2, 2017; Sara B. Pritchard, "On (Not) Seeing Artificial Light at Night: Light Pollution or Lighting Poverty?," *Discard Studies: Social Studies of Waste, Pollution, & Externalities*, June 12, 2017, <https://discardstudies.com/2017/06/12/on-not-seeing-artificial-light-at...> (accessed 20 May 2019)

⁵ As Sophia Roosth writes, "The church, like most other things in Longyearbyen, boasts being 'northernmost': northernmost commercial airport, northernmost newspaper, northernmost sushi restaurant." See Sophia Roosth "Virus, Coal, and Seed: Subcutaneous Life in the Polar North," *LA Review of Books*, December 21, 2016, <https://lareviewofbooks.org/article/virus-coal-seed-subcutaneous-life-p...> (accessed 7 June 2019)



Figure 2: Topographic map of Svalbard. Longyearbyen is marked with a white star; it is located almost in the middle of Spitsbergen. Credit: Oona Räisänen. Permission is granted to copy this document under the terms of the GNU Free Documentation License. Source: Wikipedia, “Svalbard.”

change.⁶ Most of my father’s fieldwork took place in big tents on the ice over several weeks. He also went out on icebreakers –rugged ships departing from Longyearbyen or Tromsø that can bust through polar ice or, in his case, lodge themselves in Arctic ice for extended periods of time.⁷ Most of my father’s time “on the ice” was during the shoulder season when pack ice had built up and was close to seasonal highs, but didn’t entail the

additional challenge of doing fieldwork in the dark of polar night. We never talked much about the research he did or landscapes he saw, but for a variety of reasons, I wanted to see where my father had worked on and off over several decades. It is somewhat ironic, then, that I was in Longyearbyen during the prolonged period of darkness that is polar “night.” However, as we know from everyday language, seeing is both literal and metaphorical.

6 Certainly, the era of fossil fuels is not over in the Arctic or elsewhere. In fact, the melting Arctic has afforded new industries and possibilities, including those in the oil and gas industry.

7 Late-20th C. Arctic sea ice modeling fieldwork is indebted to ships and practices developed during polar exploration in the late 19th and early 20th C., especially Nansen’s “drift” over the Arctic Ocean between 1893 and 1896 in the polar ship “Fram.” For an accessible overview of this ship and its history, see the Fram Museum’s website, https://framuseum.no/polar_history/vessels/the_polar_ship_fram/ (accessed 20 May 2019)

I must admit that I was also drawn to Svalbard out of some sense of what I had started calling apocalyptic tourism⁸: the opportunity to see

8 Not surprisingly, there is scholarship on “apocalyptic” and “post-apocalyptic tourism.” Two useful starting points include Roger Norum and Mary Mostafanezhad, “A Chronopolitics of Tourism,” *Geoforum*, vol. 77, December 2016; Mary Mostafanezhad and Roger Norum, “The Anthropocentric Imaginary: Political Ecologies of Tourism in a Geological Epoch,” *Journal of Sustainable Tourism*, vol. 27, n° 4, 2019.

6

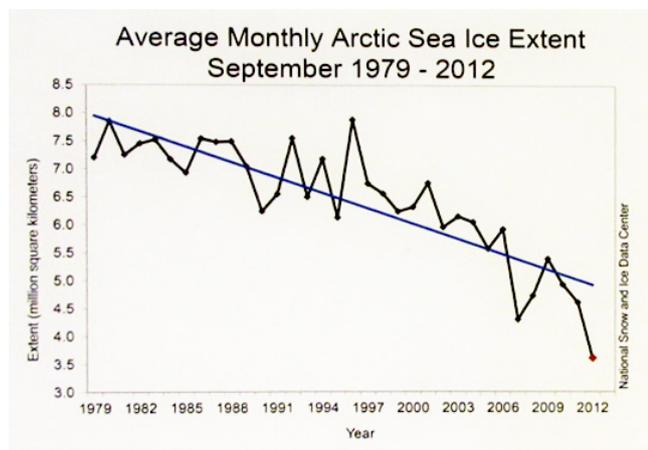


Figure 3: Graph of “Average Monthly Arctic Sea Ice Extent, September 1979–2012” on display at the Fram Museum in Oslo, Norway. Photo by the author.

some of the polar north before global climate change changes it further (fig. 3). The graph in Figure 3 has circulated in various media since 2012, but the descending line of Arctic sea ice averages feels more poignant and personal to me because these data map almost exactly onto my father’s career in the Arctic. Then I saw the graph again when I visited the Fram Museum in Oslo the day before I headed north to Svalbard for the conference. With graph in recent memory and feet on the ground in Longyearbyen, I began thinking about my trip –admittedly pessimistically– as traveling to the end of the world to see the end of the world.⁹ If the last living individual of a species is what Dolly Jørgensen calls an “endling,” I went to Longyearbyen, in part, to see an *endscape* –vestiges of a landscape (as people have known it for most of human history) that has been, and will continue to be, transformed by global warming, and will eventually disappear.¹⁰ Increasingly, “eventually” is, in fact,

⁹ The phrase, “it is easier to imagine an end to the world than an end to capitalism” (and versions thereof), has been attributed to Fredric Jameson. On the metaphor of “the end of the world” within the environmental humanities, see Anna Lowenhaupt Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruin* (Princeton, NJ: Princeton University Press, 2015); Stephen J. Pyne, “The End of the World,” *Environmental History*, vol. 12, n° 3, 2007.

¹⁰ Dolly Jørgensen, “Endling, the Power of the Last in an Extinction-Prone World,” *Environmental Philosophy*, vol. 14, n° 1, 2017. On “northscape,” see Dolly Jørgensen and Sverker Sörlin, (eds.), *Northscapes: History, Technology, and the*

soon, if not now. In other words, this January, I was a dark tourist in both senses of the term.¹¹

In this essay, I use my recent trip to Longyearbyen to reflect upon light, darkness, energy, and their entanglement in the endscape of the high Arctic during polar night.¹² I do so as a historian and scholar, but also as a privileged person navigating the hopes and fears of climate change in the early 21st C., as dire warnings mount and time-lines for action shrink. I’ve also been pushed to

Making of Northern Environments (Vancouver: UBC Press, 2013).

¹¹ For several overviews of dark tourism, see John Lennon and Malcolm Foley, *Dark Tourism: The Attraction of Death and Disaster* (London: Continuum, 2000); Philip Stone, “Dark Tourism Scholarship: A Critical Review,” *International Journal of Culture, Tourism and Hospitality Research*, vol. 7, n° 3, 2013; Glenn Hooper and John J. Lennon, *Dark Tourism: Practice and Interpretation* (New York: Routledge, 2016); Philip R. Stone, Rudi Hartmann, Tony Seaton, Richard Sharpley, and Leanne White, (eds.), *The Palgrave Handbook of Dark Tourism Studies* (London: Palgrave Macmillan, 2018). On forms of dark tourism in polar north specifically, see Harvey Lemelin, Jackie Dawson, Emma J. Stewart, Pat Maher, and Michael Lueck, “Last-Chance Tourism: The Boom, Doom, and Gloom of Visiting Vanishing Destinations,” *Current Issues in Tourism*, vol. 13, n° 5, 2010; Dieter K. Müller, Linda Lundmark, Raynald H. Lemelin, (eds.), *New Issues in Polar Tourism: Communities, Environments, Politics* (Dordrecht: Springer Netherlands, 2013). On the related “last chance tourism,” see Lemelin, et al., “Last-Chance Tourism”; Harvey Lemelin, Jackie Dawson, and Emma J. Stewart, *Last Chance Tourism: Adapting Tourism Opportunities in a Changing World* (New York: Routledge, 2012). For one example of climate-change tourism (also last-chance tourism), see Carol Farbotko, “‘The Global Warming Clock Is Ticking So See These Places while You Can’: Voyeuristic Tourism and Model Environmental Citizens on Tuvalu’s Disappearing Islands,” *Singapore Journal of Tropical Geography*, vol. 31, n° 2, 2010. For a non-academic discussion of species-loss tourism, see Douglas Adams and Mark Carwardine, *Last Chance to See* (New York: Ballantine Books, 1992). Although there appears to be a growing literature on climate-change tourism, my preliminary assessment indicates much of this work focuses on how the tourism industry should change in an era of climate change and fossil-fuel reduction. Much less work tackles the problem of tourism actually created or even increased by climate change, along the lines of what Lemelin et al. and Farbotko discuss. As climate crisis intensifies in coming years, I wonder if privileged tourists (like those of us at the “Darkness” conference) will actually expand the market for this particular kind of dark tourism.

¹² Although I could spill much ink about light pollution in Longyearbyen, I will address these concerns elsewhere.

wrestle with my own complicity in this process, including my trip to the end of the world.¹³

IN THE (LIGHT/DARK) FIELD

7 Most conference participants flew into Longyearbyen on the afternoon of Sunday, 13 January. I, like most participants with whom I spoke, initially struggled to adjust to the landscape of light/dark –or the lightscape and darkscape– of the high Arctic during our first hours there. In retrospect, the Svalbard airport felt normal and familiar enough –other than its small size and the taxidermy polar bear posed on top of the lone baggage carousel. Many of us were soon grumbling, however, about the dim hotel lobby and even darker rooms. Dark paint, wallboard, flooring, carpeting, and cabinetry didn't help. Even the chair in my small room was forest green. Many of us wanted to turn on more lights in our rooms, but there weren't any. Sparse contemporary furniture in classic Scandinavian neutrals –take your pick among light grey, dark grey, beige, and taupe (woo hoo!)– didn't appreciably brighten common spaces. Was this characteristic Scandinavian *hygge*? Sure, it was cozy, but some of us, especially those over age 40, just wanted to see.

8 The following Saturday, on my trans-Atlantic flight home, I reread that month's issue of *Scandinavian Traveler*, the in-flight magazine of Scandinavian Airlines. This time I paused – full stop– at a full-page ad touting “WarmDim” lighting. The phrase perfectly encapsulated the lightscape –or rather, darkscape– of most interior spaces I had just experienced. Ambient lighting was minimal and subdued. Task lighting strategically illuminated the hotel reception, bar, chairs, sofas, and bed. Many were single, clear, warm yellow bulbs hung low, nearly at eye level. In fact, I observed two conference attendees whack their heads –hard, I might add– on lights

as they got up from chairs and couches. Clearly, they did not expect the lights to be there.¹⁴

The exception to the darkscape of interior spaces was the bathroom. Here, ample recessed LED lights, also in warm yellow, brightened the small room like Las Vegas. Early in the conference, I confessed to another participant that I was strangely drawn to the bathroom –retreating to its intense lightscape and feeling like a lizard, desperate to soak up the bright light (and radiant floor heating). Perhaps I was unconsciously trying to reset my biological clock.¹⁵ On that plane ride home, I realized that I had simply flipped by the “WarmDim” ad on the flight out because it had no meaning to me then. Now it did.¹⁶

In contrast to restrained interior lighting, street lighting, restaurant and hotel signs, Christmas lights strung across the pedestrian corridor of “downtown” Longyearbyen, front porch lights, and interior illumination coming through unobstructed windows all brightened the supposed darkness of polar night that had attracted so many of us to the conference and place.¹⁷ As we walked to dinner downtown each evening (not that morning and nighttime walks looked any different), I couldn't help but notice the linear rows of street

¹⁴ One person was an American; I don't recall the national identity of the other individual. I wonder if Scandinavians (or those who spend a lot of time in Scandinavia in winter) are less apt to do so because they have been socialized to these geographies of light and lighting technologies in interior spaces.

¹⁵ In “The End of the World,” Pyne writes of Antarctic winters that “There is no way to reset one's biological clock” (650).

¹⁶ Danish “hygge” is now well known thanks to Meik Wiking's popular book, *The Little Book of Hygge: Danish Secrets to Happy Living* (New York: William Morrow, 2017). Nona Schulte-Römer discusses aspects of hygge in her contribution to this issue. Although I had spent time in Norway and Sweden before this trip, I had never been to Scandinavia during winter, which is probably why “WarmDim” lighting was so novel to me. By day four in Longyearbyen, I had also developed an additional hypothesis about the reason for interior darkscapes: dark(er) walls, floors, and furniture better absorb (ample) natural light during periods of “midnight sun.” Interior environments in the far north may be designed more around summer conditions.

¹⁷ Admittedly, many of us at the conference confessed to one another that the dog sled excursion was a huge draw. It didn't disappoint.

¹³ IPCC, “Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C Approved by Governments,” October 2018, <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special...> (accessed 15 May 2019)

lamps along the few streets in town that stopped at the pitch black of what I knew, from online maps, to be water's edge. From our hotel on the hill slightly above town, Longyearbyen's layout almost looked like an airport runway at night – except it looked the same whether it was “day” or “night.” More significantly, though, it wasn't that dark in town. It was easy navigating in polar night, thanks to all the artificial lighting.

- 11 Given my work with light-pollution scientists over the past four years, I found this lightscape of polar night both fascinating and disturbing. Furthermore, I observed first-hand how snow and ice reflected artificial light. They covered streets, sidewalks, and yards, making it almost impossible to see where one began and the other ended. On the third day of the conference, a gentle snowfall intensified existing reflectivity, further brightening the outdoors. I noticed a number of us looking out the window that afternoon. Perhaps it was jetlag and conference fatigue by that point, but it seemed as if our eyes had been drawn to the subtle but perceptibly different lightscape beyond the walls of the conference hotel. The cascade of fluffy snowflakes slowly descending through the air brought a new level of light to the polar “darkness” that was, in actuality, not that dark. Natural winter conditions in the high Arctic thus amplify any “artificial” light.¹⁸ Such magnification is even more dramatic during polar night, given that it is supposed to be dark for almost four consecutive months, and life forms have evolved in such environments. Put in the context of geologic time and evolutionary history, the transformation of the light/dark cycle in Longyearbyen

since the early 20th C. is especially dramatic and significant.¹⁹

These patterns were what surprised me most about my limited time in Longyearbyen. Interior spaces were much darker than I had anticipated and was used to, while the exterior environment was much brighter than I had expected. 12

As I wrestled with tensions between my expectations and actual experiences – darkscapes inside, lightsapes outside – I began thinking about light and dark in Svalbard in the past, and what it would have been like to visit, live, or work there in previous decades, if not centuries. What would it have been like to work by candle or whale oil, particularly during polar night? Moreover, how much energy did it take to survive in this extreme environment of cold temperatures, severe wind chill, and a third of the year without any sunlight? The Svalbard Museum in Longyearbyen displayed life-sized models of tiny cabins (shacks, really) in which early explorers and hunters lived. In most of these displays, a single lamp rested on a small table. Even with these displays right in front of me, it was hard to imagine these places – cabins, Svalbard – as lived experiences.²⁰ But what was most difficult for me to envision was the experience of light/dark in times past – a product, no doubt, of my multiple forms of privilege.²¹ 13

¹⁹ Edmund Russell, *Evolutionary History: Uniting History and Biology to Understand Life on Earth* (New York: Cambridge University Press, 2011).

²⁰ Christiane Ritter's hut can be toured virtually online. See “Ritter Hut,” <https://www.spitsbergen-svalbard.com/photos-panoramas-videos-and-webcam...> (accessed 11 July 2019)

²¹ As I wrote and revised this essay, I became more aware of the multiple forms of privilege I have in relationship to artificial light (at night) and light/dark cycles. For one, artificial light is now infrastructure in most of the developed world. Yet, for the homeless, “squatters,” and lower class people in the global North, electricity, including electric lighting, is not guaranteed. Some individuals and families are forced to choose, for instance, between food or medicine and electricity. My experience with artificial light and light/dark cycles is also conditioned by the fact that I grew up and live in the continental United States with temperate light/dark regimes. “Natural” light/dark cycles in Alaska, for instance, are closer to those in Svalbard. However, experiences with light/dark in the far north are far from monolithic

¹⁸ There are a number of papers that discuss the importance of reflectants – clouds, particulates, aerosols, snow, ice, even specific kinds of rocks – to shaping local manifestations of artificial light at night (ALAN). For snow specifically, see Andreas Jechow and Franz Hölker, “Snowglow – The Amplification of Skyglow by Snow and Clouds Can Exceed Full Moon Illuminance in Suburban Areas,” *Journal of Imaging*, vol. 5, n° 8, 2019. These findings suggest how ALAN is, in fact, an envirotechnical phenomenon. I plan to explore both ALAN and scientific research about ALAN as envirotechnical phenomena in future publications.

Our hotel rooms may have felt dark when compared to norms in industrialized countries in temperate or tropical regions during the early 21st C. Yet they were brightly lit when compared the possibilities afforded by candle, not to mention regions of the world with lighting poverty. Knowing the importance of the moon to contemporary light-pollution research, I wondered if lunar light during the full moon, especially given reflection on snow and ice, had been a valuable light source in the high Arctic. Did the full moon extend precious energy supplies, even if it was only for a few days each lunar cycle?²²

culturally and historically. For instance, indigenous communities in the low and high Arctic developed strategies to live with light/dark cycles there. At times, white settlers and polar explorers learned from, relied on, and benefited from this knowledge; at other times, they critiqued and even condemned indigenous norms. It is also important to note that there were (and are) not indigenous populations in Svalbard –unlike, say, northern Canada or Alaska. Imposition of industrialized light/dark cycles or expectations about “proper” lighting were not, therefore, part of Svalbard’s early history, unlike many northern places where settler colonialism occurred. Nonetheless, framing polar light/dark regimes as “extreme” normalizes and naturalizes conditions in temperate and/or tropical regions, thereby Other-ing the poles. My critique of “extreme” framing is influenced by conversations with Sarah Pickman, including her co-authored conference presentation: Sarah Pickman and Tess Lanzarotta, “Darkness Falls: Arctic Darkness and the Meanings of Normative Time,” presentation at “Darkness 2019,” Island Dynamics Conference, Longyearbyen, Svalbard, 13-17 January 2019. Despite my hesitation to use the term, for an overview of “extreme environments” in the field of environmental history, see the Introduction to the interdisciplinary forum on the topic, Steve Pyne, “Extreme Environments,” *Environmental History*, vol. 15, n° 3, 2010; for a number of examples, see the accompanying essays. On the deep ocean, see Helen Rozwadowski, *Fathoming the Ocean: The Discovery and Exploration of the Deep Sea* (Cambridge, MA: Harvard University Press, 2005). On space, see Valerie A. Olson, *Into the Extreme: U.S. Environmental Systems and Politics Beyond Earth* (Minneapolis: University of Minnesota Press, 2018); Lisa Ruth Rand, “Falling Cosmos: Nuclear Reentry and the Environmental History of Earth Orbit,” *Environmental History*, vol. 24, n° 1, 2019.

²² On hybrid systems of lighting that combined lunar and artificial light, see Stéphanie Le Gallic and Sara B. Pritchard, “Light(s) and Darkness(es): Looking Back, Looking Forward,” *Journal of Energy History / Revue d’histoire de l’énergie*, vol. 2, July 2019, consulted 01/07/2019, URL : energyhistory.eu/en/node/137

Indeed, on a tour of former coal mine 3 (now a tourist destination for groups like ours), our guide as well as several conference presenters, shared that few permanent settlements had been located on Svalbard before the early 20th C. For at least four centuries, whalers and hunters had mined rich Arctic natures, oriented primarily to sea and shore. Someone at the conference mentioned that several Russian orthodox monasteries had been built in Svalbard, even farther north than Longyearbyen. With the exception of the monks, I assume few people purposefully stayed through winter.²³ Moreover, until recently, Arctic sea ice froze solid around the archipelago during the full length of winter, making it nearly impossible to escape the entirety of polar night, if one did not leave in time. The darkscape of polar winter, both actual experience and unintentional possibility, must have been daunting for those from temperate and tropical regions unaccustomed to these kinds of light/dark cycles.

That began to change with polar exploration. Some expeditions accidentally overwintered. Others planned to do so in order to conduct research and take advantage of time in the field, rather than losing considerable time in transit between North American and European metropolises and polar regions.²⁴ Still, most explorers were transitory figures who intended to stay only for the duration of their expedition. They departed once resources were sampled,

²³ Again, Svalbard’s history is therefore distinct from places where white settler colonialism took place.

²⁴ On polar regions as a unit of analysis, see Adrian Howkins, *The Polar Regions: An Environmental History* (Malden, MA: Polity Press, 2016). Much could be said here about “heroic” white, male science-exploration, which was implicated in and constitutive of (settler) colonialism. For one overview of science and masculinity, see Erika Lorraine Milam and Robert A. Nye (eds.), “Scientific Masculinities,” *Osiris*, vol. 30, n° 1, 2015. In this respect, one might contrast the era of polar exploration in Svalbard with the era of the coal mine. However, the mine guide also shared that many (male) miners came from the mainland, worked for several years for high wages, and then returned to Norway. In this sense, many miners were transient, like earlier explorers. It is only more recently, especially with the decline of the coal industry and rise of science and tourism, that more families have established permanent homes in Longyearbyen.

data collected, and fieldwork completed, although many were serial polar explorer-scientists.²⁵ During the 1930s, Christiane Ritter, an Austrian painter, accompanied her naturalist husband to Svalbard and was the first woman to overwinter there. Apparently, one winter was plenty. In 1938, she published a book about her experience as “a woman in the polar night.”²⁶

16 The ability to overwinter and more easily experience the darkscape of polar night in Svalbard also changed with the discovery of coal and Munro’s founding of the mine in 1906. Between then and the late 20th C., Longyearbyen was a classic company town. However, I suspect that the landscape –and specifically the darkscape– of the high Arctic heightened the town’s dependency on the mine beyond standard arguments about a corporate near-monopoly on employment, ownership of housing and stores, and so on. Coal motivated year-round settlement. To maximize profits, mines needed to operate through winter –meaning, the dark season. Yet year-round living then required still more coal –for not only heat but also artificial light during the “days” of polar night. Coal thus altered Longyearbyen’s energy budget. As Stephen J. Pyne explains, “The energy budget [of the poles] is always negative; none during the dark season, reflected away during the light.”²⁷ Mining and using coal harnessed huge sums of energy in order to transcend these strict local constraints, making overwintering both feasible and easier.²⁸ Longyearbyen, by its very existence, suggests the fundamental link between artificial light and energy. However, by dramatizing this connection in an “extraordinary” landscape where it is dark for almost one-third

of the year, it reminds us of these seemingly banal links elsewhere –indeed, everywhere.²⁹

Coal was vital to Longyearbyen’s founding and past, but it is not relegated to history. In the early 21st C., the town still relies on fossil fuel and specifically the coal from its surrounding mountains. Our coal mine tour guide explained that only mine 7 remains open and operational. The rest, like mine 3, have been decommissioned. Twenty-five percent of the coal extracted from mine 7 is used by the town to produce electricity –for light, heat, and other uses. The remaining seventy-five percent is shipped to the town’s docks, transported, and sold (in island lingo) “on the mainland” (Norway). As we headed to and from the Svalbard airport, we passed the municipal electricity plant, as well as the harbor. Despite extensive artificial lighting around each large industrial facility, which would have made light-pollution scientists shudder, it was still hard to see the docks, ships, or coal.

Furthermore, fossil fuels, whether from Longyearbyen’s own mine or elsewhere, undergird many other artifacts and systems in the town, connecting this “remote” place to almost anywhere in the world and thereby making it far less remote than high latitudes and sheer distances imply. Unlike polar explorers a century or more ago, many local residents expect the same goods, services, and conveniences that those on the mainland enjoy. Another guide explained that three supply flights land in Longyearbyen every week, even in winter. They replenish the grocery store, tiny medical facility, and numerous tourist shops, as well as connect locals with family and friends on the mainland and beyond –for those who still use snail mail. The flights mean that residents can count on packages being delivered three days per

²⁵ These practices illustrate the idea of “centers of calculation.” The classic work here is Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Cambridge, MA: Harvard University Press, 1987).

²⁶ Christiane Ritter, *A Woman in the Polar Night* (New York: Dutton, 1954).

²⁷ Pyne, “The End of the World,” 649.

²⁸ My thinking here is influenced by Robert Marks’s concept of the “biological old regime.” See Robert Marks, *The Origins of the Modern World: A Global and Ecological Narrative From the Fifteenth to the Twenty-First Century* (New York: Rowman & Littlefield Publishers, 2002).

²⁹ On extraordinary as simply extra-ordinary, see Gabrielle Hecht, “Nuclear nomads: A look at the subcontracted heros,” *Bulletin of the Atomic Scientists*, January 9, 2012, <https://thebulletin.org/2012/01/nuclear-nomads-a-look-at-the-subcontrac...> (accessed 20 May 2019). At the same time, links between light and energy “everywhere” evade central questions about access, distribution, and (political) power, as well as some of the particularities of certain forms of energy and their affordances.

week. Locals may need to wait an extra day for, say, an Amazon package to arrive, but air travel, powered by fossil fuels, has annihilated time and space in the polar north, as elsewhere.³⁰ Moreover, unlike sea-based transit before the mid-1970s when the new, modernized airport became fully operational, travel is no longer seasonal, but year-round.³¹ Longyearbyen may have some unusual characteristics, but fossil fuels enable the town to exist and then connect it with seemingly distant locales, thereby making it less distinct.

19 Everyone in Longyearbyen, whether residents or tourists, is therefore complicit in carbon-based energy regimes and climate change in multiple ways. Furthermore, there is not really a way to opt out, although one resident has tried to do so. On the bus, our mine guide shared that one Longyearbyen resident was extremely proud of his new Tesla. Apparently, though, he forgot where the town's electricity actually comes from: coal.

20 Trying to pursue alternative energy in a landscape and livelihood defined and dominated by coal is admirable. Yet, as our mine guide noted, many alternative energy sources are not really feasible in the high Arctic. Solar panels would yield huge sums of electricity during endless summer days –“the land of the midnight sun.” However, the same panels would be useless during winter –“the land of the midday moon.” To get through the long, dark season, enormous batteries would somehow have to store four months of energy –and without cold temperatures reducing storage capacity or efficiency.³²

³⁰ I thank Sarah Pickman for sharing this story about supply flights from the town tour she took during the conference. A classic study of the annihilation of space and time, drawing on Karl Marx, is Wolfgang Schivelbusch, *The Railway Journey: The Industrialization of Time and Space in the Nineteenth Century* (Berkeley: University of California Press, 1986).

³¹ For a basic history of the Svalbard airport, see https://en.wikipedia.org/wiki/Svalbard_Airport_Longyear (accessed 11 July 2019). Of course, bad weather can cause air travel delays, but most flights still arrive and depart in winter.

³² The special challenges facing batteries in the polar north illustrate the premise of envirotech. For work that has applied an envirotechnical lens to batteries, see James Morton Turner, “Following the Pb: An Envirotechnical Approach to Lead-Acid Batteries in the United States,”

Instead, some countries with rugged coastlines have turned to wind power. Wind in northern latitudes, including Norway, can be fierce. Svalbard is no exception. Our coal-mine guide asked us to consider, though, what it would be like to maintain and repair turbines during polar night.³³ I know that I wouldn't volunteer for the job.

As conference participants, we could reduce our considerable carbon footprints by turning down thermostats, turning off lights, reusing hotel towels, and so forth, but refusing fossil fuels entirely once in Longyearbyen, particularly in the depths of winter, would carry some serious consequences. January temperatures average -13 to -20° C (8.6 to -4.0° F), not including wind chill. The surrounding sea does moderate Svalbard's winters. However, winds can increase dramatically when cold polar air meets milder oceanic air from the south.³⁴

22 Almost all food is imported. One greenhouse grows lettuce and other salad greens year-round, which the posh local restaurants tout. We could see the greenhouse bathed in red light, 24/7, downhill from the conference hotel. I have to admit it was novel, but I wondered about the comparative carbon footprint of importing salad by plane versus growing it during winter via coal-fueled electricity. I suspect that light-pollution scientists would vote for imported lettuce. Two conference dinners did offer more locally sourced food: Svalbard reindeer and whale. (In case you are wondering, the former was delicious; the latter was not.)

23 We also received repeated stern warnings from the conference organizers: “for your own safety,

Environmental History, vol. 20, n° 1, 2015. Alternatively, if Svalbard could connect to some sort of European-wide grid, it would be able to produce extensive electricity in summer, then tap reserves drawn from elsewhere during the winter. I thank Stéphanie Le Gallic for suggesting this point.

³³ For one work on maintenance and repair in the history of technology and science studies, see Andrew L. Russell and Lee Vinsel, “After Innovation, Turn to Maintenance,” *Technology and Culture*, vol. 59, n° 1, 2018.

³⁴ For an overview on Svalbard's weather and climate, see https://en.wikipedia.org/wiki/Climate_of_Svalbard (accessed 11 July 2019)



Figure 4: Gun storage locker and warning at the entrance of the supermarket in Longyearbyen. Photo by the author.

you should not go out for walks outside the inhabited areas if you are not accompanied by someone who can carry (and fire) a rifle.”³⁵ Reminders of polar bears were everywhere (fig. 4). Furthermore, during the first conference dinner, some of us learned that Svalbard’s polar bears do not leave the islands and head out onto the ice in winter. Even better, the archipelago’s polar bear population (3,000) actually outnumbers its permanent human population (2,200). Does the town’s extensive artificial lighting, powered by coal, attempt to segregate its large mammals –human and otherwise?

24 Current practices to conserve energy further show how dependent Longyearbyen is on coal. Many of us had hoped to visit the town’s Polar Expedition Museum. Like many conference attendees, I hadn’t planned ahead and failed to realize that the museum was normally closed in January. The museum did state it would open for special groups if at least 15 people committed to visiting. Our academic (read: nerdy) conference would have had no problem meeting this minimum. One participant actually

³⁵ For the “practical information” the conference organizers shared with participants, see <https://darkness-conference2019.wordpress.com/practical-information/> (accessed 11 July 2019)

contacted museum staff on Thursday, the day before we left, to see if they would be willing to open Friday morning before most of us flew out that afternoon. They apologized, but said they need three days’ notice in order to warm up the building for visitors.³⁶ In the heart of Longyearbyen’s dark season, it took that long for the building to heat up. The environment of the far north therefore requires modifications to customary architectural practices.³⁷ Although many of us were disappointed to miss the museum, we joked that we would have been perfectly happy touring it in our down parkas, ski pants, and wool hats. After all, most of us had spent a half-day outside on dog sleds in single-digit temperatures earlier that Thursday, but it was, alas, too late.

The museum’s policy suggests how power failures 25 are serious business in the high Arctic. Blackouts matter for heat, but they also matter for light, foremost during the dark season of polar night.³⁸ David E. Nye has noted that unexpected blackouts in the global North sometimes foster unexpected conviviality and community.³⁹ Planned brownouts in the global South can enable systems to continue operating; functioning thus depends on periodic dysfunction. Consequently, families and neighbors organize aspects of their lives around the temporary availability of electricity or water. But, unlike their peers in the developed world, many live with the expectation that energy will not always be available.⁴⁰ Based

³⁶ I thank Michaela Thompson for sharing this story.

³⁷ On envirotech and architecture, see Sophie Hochhäusl, “The Environment Is Social, Is Political: About Core Houses and Envirotechnical Regimes,” in “Field Notes: Architecture and the Environment,” (ed.) Sophie Hochhäusl and Torsten Lange, *Architectural Histories*, vol. 6, n° 1 (special issue), 2018., <http://doi.org/10.5334/ah.259>

³⁸ The field of disability studies offers considerable insights here in terms of the presumed ableism of light and sight. Blind and visually impaired people would have fewer challenges during blackouts, although other aspects of a blackout in the far north during winter would probably still present serious issues.

³⁹ David E. Nye, *When the Lights Went Out: A History of Blackouts in America* (Cambridge, MA: MIT Press, 2010).

⁴⁰ Brownouts are not, however, exclusive to the so-called developing world, thereby challenging such a tidy dichotomy and generalization. For instance, in May 2019, the huge

on my brief time in Longyearbyen, I wouldn't want to be there during a power failure, most of all in winter. Considering this exceptional possibility reinforces, then, the town's everyday reliance on coal.

26 As conference participants and tourists, we were complicit in coal extraction, fossil-fuel dependency, and the environmental consequences of Longyearbyen's energy regime far beyond the coal dust on our hands and faces from the mine tour. The carbon footprint of the coal industry here, as in other places, is overt and direct. It is easy to blame miners and corporate headquarters. As tourists, our substantial carbon footprints were mediated and obscured by many technologies and intermediate steps –from the computers we used to write our conference papers to the airplanes that brought us from Australia, North America, South Africa, and Europe. During the mine tour, I watched new friends and colleagues don miners' coveralls (*lompen*, fig. 5) and crawl awkwardly through the most generously sized tunnels (90 cm high) for a dozen meters, behind wagging in the air. That mining "experience" was nothing like the real thing, though: sometimes 30-centimeter-wide tunnels requiring miners to inch along on bellies, limited lighting, and a full day of hard labor underground, not to mention the constant threat of mine collapse.

27 I was both amused and uncomfortable as we played in what had been miners' hazardous workscape.⁴¹ It was surreal seeing scholarly concepts brought to life before my very eyes

California utility, Pacific Gas and Energy (PG&E), announced that it would require occasional brownouts during the summer of 2019 to reduce wildfire risks after a catastrophic fire season the previous year. For one story, see "PG&E Plan to Cut Power on Windy Days Could Leave Millions in the Dark," *Mercury News*, 14 May 2019, <https://www.mercury-news.com/2019/05/14/california-may-go-dark-this-summ...> (accessed 1 July 2019)

⁴¹ Richard White, "Are you an environmentalist or do you work for a living?" *Work and Nature*, in *Uncommon Ground: Rethinking the Human Place in Nature*, (ed.) William Cronon (New York: Norton, 1996); Thomas G. Andrews, *Killing for Coal: America's Deadliest Labor War* (Cambridge, MA: Harvard University Press, 2008); Thomas G. Andrews, "Made by Toile'? Tourism, Landscape, and Labor in Colorado, 1858-1917," *Journal of American History*, vol. 92, n° 3, 2005.



Figure 5: A miner's work suit (*lompen*) hanging near the entrance to mine 3. Note the reflective bars on the suit to facilitate seeing fellow miners in the depths (and darkness) of the mine. Photo by the author.

(fig. 6). To her credit, our mine guide did not entirely change risky histories of work into mere play. She told us how many miners had died since the first mine's founding in 1906; I am embarrassed to say that I no longer remember how many men have been lost. However, when I then asked her about miners' rates of injury and disease, she couldn't answer my question. My uneasiness, belied by the smile in this photograph during the mine tour, grew.

The final displays at the Svalbard Museum nar- 28
rate these recent changes in Longyearbyen, including shifting manifestations of coal from an exclusive landscape of labor to, increasingly, one of leisure. Since the 1990s, scientific research and tourism have expanded, diminishing the power of the coal company in town. Thirty thousand tourists now visit Svalbard each year –a significant number, given Longyearbyen's permanent population. Summer visitors play in the midnight sun. Winter tourists hope to see the northern lights and explore the darkscape of



Figure 6: The author in the “tool room” of former mine 3, now a tourist destination. This room includes many of the different kinds of tools Longyearbyen miners have used over the past century. All tour attendees were given hard hats with headlamps before we descended into the mine. Later, some attendees donned lompén. Photo by the author.

polar night beyond town by dog sled or snowmobile,⁴² although the skyglow of Longyearbyen reaches far beyond town borders.⁴³ The striking light/dark cycle of the high Arctic –when these “cycles” are in fact mutually exclusive seasons, each lasting for months at a time– is therefore central to both summer and winter tourism. While some tourist economies suffer during the off-season –for instance, ski resorts seeking to recruit summer hikers and mountain bikers– the attraction of Longyearbyen is less seasonal and

⁴² Many conference participants downloaded a northern lights app on their phones. At one restaurant, a large, high-quality LED screen constantly streamed the “night” sky so tourists could get real-time updates on the quality of the northern lights. Notably, imaging technologies amplify the green hue of the northern lights, making them greener (and supposedly “better”) than what appears to the naked eye.

⁴³ On the dogsled excursion, Longyearbyen’s skyglow was readily visible on much of the “return” portion of the loop course. Other artificial lights were present –from the headlamps all sled drivers were required to wear, to the headlights on snowmobiles on tracks farther up the hillsides. Nonetheless, being in the hinterlands of Longyearbyen under moonlight and stars –with snow and clouds reflecting both natural and artificial light– was a remarkable experience that is (still) hard to describe.

more stable. The town profits from light and dark tourism at their limits.

Yet coal still undergirds and enables the tourist industry, even if this reliance is largely hidden.⁴⁴ Tourism is not necessarily a more sustainable industry or future for Svalbard. To the contrary, if tourism continues to expand, it may actually increase coal consumption in a region already more vulnerable to the effects of climate change. This is especially true if Svalbard attracts tourists who come not to “rough it” in tents with rustic services, but to expect reliable energy and amenities of the global North: comfortable hotels with flush toilets, hot showers, crisp white sheets, and wifi; alcohol imported from the mainland (and, more likely, far beyond); fruit salad at lavish breakfast buffets; and so forth. Our “Darkness” conference? Guilty as charged.

Of course, ironies abound. Growing tourism to a remote location in the high Arctic worsens climate change that polar scientists at the University Centre in Svalbard (and elsewhere) study just a few hundred meters from shore. Given predictions of sea-level rise, will the University Centre need to move to higher ground in coming years? Even in the dimness of polar night, I could see new hotels and apartment buildings under construction. Meanwhile, old buildings are starting to heave out of the permafrost. Others are beginning to rot. Both processes threaten the town’s cultural heritage. Even relatively new homes have become undermined, and new construction therefore rises from steel –rather than traditional wood– beams.⁴⁵

Environmental and geologic destabilization associated with global climate change suggests how time is nonlinear, differentially distributed and

⁴⁴ White, “Are you an environmentalist?”

⁴⁵ I thank Catie Newell for sharing some of these stories from her town van tour. See also Thomas Nilsen, “Thawing Permafrost Makes Big Trouble for World’s Northernmost Town,” *Barents Observer*, 9 October 2018, <https://thebarentsobserver.com/en/arctic/2018/10/thawing-permafrost-tro...> (accessed 1 July 2019); Christine Karjord, “Climate Change Threatens Svalbard House,” *High North News*, 25 October 2018, <https://www.highnorthnews.com/en/climate-change-threatens-svalbard-hous...> (accessed 1 July 2019)

experienced. Time is speeding up in the polar north. In 2016, “meltwater seeped into the entrance tunnel of the Global Seed Vault,” on the hillside above Longyearbyen. Even in polar night, we could see the outline of the building because it was marked with lights and an illuminated Christmas tree. As one journalist wrote, “the breach made the world wonder: Will the Doomsday Vault last until doomsday?”⁴⁶ This timeframe is even more astonishing because the Global Seed Vault opened in early 2008, just eight years earlier. The built environment of Longyearbyen, constructed according to old codes and norms, is becoming rapidly obsolete as the pace of global warming quickens at the poles. Climate change is challenging and undermining existing envirotechnical systems, including –if not especially– those in the far north.⁴⁷ Even in the darkness of real polar night, I could sense the ways that Longyearbyen is an endscape, even as I, and other conference participants, contributed to its very making.

LIVED EXPERIENCES AND ENDSCAPES

32 Three months later, in April 2019, I ran into a fellow “Darkness” participant at another academic conference. (This time our carbon footprints were, thankfully, much smaller.) At an evening reception, we smiled and shook our heads at one another, still struggling to process our time in Longyearbyen. Both of us had written up field notes during and after our stay, but we agreed that they didn’t adequately capture our experience there. I’ve been humbled by my inability to articulate what it was like.

33 Time and distance have helped –somewhat– although it is increasingly difficult to recall all the subtle sensory experiences of being in those remarkable lightscapes and darkscapes. Spending time, however limited, in Longyearbyen drove home the potential of experiential, reflexive ways

of contending with light/dark.⁴⁸ Stéphanie and I co-wrote the Introduction to this special issue during the fall and early winter of 2018. A few weeks later, I was in Svalbard. Once there, some of the central themes of this issue –dynamic definitions of light and dark, porous borders, relationality, and multiplicity, among others⁴⁹– became more tangible, even visceral, to me as I experienced light/darkness in all of its complexity. In the process, many of these themes shifted from more abstract, scholarly concerns to felt, lived experiences –a pattern I’ve found elsewhere in my fieldwork with light-pollution scientists. At the same time, with this special issue in mind and confronted with the actual, physical experience of being in Longyearbyen, I began thinking about this place as a landscape of energy.⁵⁰ I also began reflecting on the inseparability of these processes and histories.

Svalbard’s “extreme” environment –specifically 34 its weather and polar light/dark cycle– has shaped the history of energy in Longyearbyen. In turn, artificial lighting, fueled by locally mined coal, not only contributes to climate change in a region already vulnerable to faster rates of environmental transformation, but also significantly alters the stunning darkscape of polar night.⁵¹ Such changes in light-dark cycles in many parts of the world are, arguably, unprecedented in planetary history.⁵² Trends elsewhere –patterns that are simultaneously local and global– are thus magnified at the poles. Longyearbyen may therefore be a generative case study for other endscares in the early 21st C.⁵³

⁴⁸ Adrian Howkins, “‘Have You Been There?’ Some Thoughts on (Not) Visiting Antarctica,” *Environmental History*, vol. 15, n° 3, 2010.

⁴⁹ Le Gallic and Pritchard, “Light(s) and Darkness(es).”

⁵⁰ Christopher F. Jones, “A Landscape of Energy Abundance: Anthracite Coal Canals and the Roots of American Fossil Fuel Dependence, 1820-1860,” *Environmental History*, vol. 15, n° 3, 2010.

⁵¹ As light-pollution scientists and activists are quick to point out, “natural darkness” is usually not that dark, due to celestial phenomena such as the moon, stars, Milky Way, airglow, and zodiacal light.

⁵² Sibylle Schroer, “STARS4ALL: Citizen Science to Save European Nightscapes,” presentation at *Artificial Light at Night Conference*, Snowbird, Utah, 12-14 November 2018.

⁵³ Many have been in the news –from Bangladesh and island nations like the Maldives to Venice, New Orleans, and New York City.

⁴⁶ Bridget Alex, “Arctic [sic] Meltdown: We’re Already Feeling the Consequences of Thawing Permafrost,” *Discover Magazine*, 3 January 2019, <http://discovermagazine.com/2018/jun/something-stirs> (accessed 1 July 2019)

⁴⁷ For one overview to envirotechnical systems, see Sara B. Pritchard, *Confluence: The Nature of Technology and the Remaking of the Rhône* (Cambridge, MA: Harvard University Press, 2011), especially the Introduction.

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