After the Permafrost: A Provisional Outline

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Abstract

Our emerging environmental predicament is one in which we cannot protect all the things that we value in the way that we would like to. Instead, we may have to accept courses of action (such as megaprojects and dam construction) that we would not ordinarily consider in order to adapt and compensate for changes in the cryosphere. One way of thinking about this predicament is to consider it as a case of tragic dilemma. This chapter will try to make sense of this way of looking at matters and will go on to outline how a concept of '*the integrity of place*' can help us to continue to value landscapes even under the impact of loss.

1. Preliminaries

As a provisional clarification, a situation of tragic dilemma is one where we have strong reasons for regret about our actions, no matter how we act. We might, alternatively, think of '*occasions when all significant duties cannot be simultaneously met*' or '*situations in which agents must act in ways which conflict with the agent's own understanding of good character*'. However formulated, such situations are often the product of prior ethical failures, rather than failures '*in the moment*' [1]. Past actions and inactions lead to unwelcome choices, and this is a good fit for our current environmental predicament. As a matter of convenience, I will use the first, and more broadly deontological formulation above, without assuming that it trumps rivals. The language of deontology happens to be particularly suitable for setting up some key ideas within geoethics.

A point which has been commented upon before, by Martínez-Frías, González and Pérez [2], Peppoloni and Di Capua [3], and in the '*Cape Town Statement on Geoethics*', which also addresses '*obligations*', alongside more virtue-like values and traits for geoscientists [4].

2. The Character of the Dilemma

Setting matters out in terms of duties, the first horn of our emerging dilemma is that we have a duty to respond to climate change in ways that minimize harm and environmental damage through '*adaptation* and *mitigation*'. Climate change is extensive and gathering pace. Our best sustained evidence indicates that the Greenland Ice Sheet is approaching or may even have passed a significant tipping point [5, 6]. Even if we could achieve optimal behaviour by humans, it would not reverse the disappearance of the Ice Sheet over the course of the present millennium or prevent a significant rise in sea levels over a much shorter period. Among other effects, such a rise in sea levels threatens low-lying islands and coastal communities in multiple ways. Kulp and Strauss [7] estimate that some 230 million people occupy land less than one metre above current high tide lines. Worst-case scenarios for Ice Sheet melt envisage much large rises in sea levels, affecting even larger numbers of people. Optimal behaviour by humans may alter the timescales and the extent of the damage (the difference between centimetres and metres is huge) but further calving from Greenland is expected. Yet this is only the largest individual contributor to rising sea levels, not the majority contributor. Most of the increase is still coming from ice cap melt in Alaska, the Canadian Arctic Archipelago, the Southern Andes, High Mountain Asia, the Russian Arctic, Iceland and Svalbard. Data drawn from the GRACE (2002–2017), and GRACE Follow On (2018–) satellite pairs indicates a contribution from these seven areas of 13 mm to sea-level rise between 2002 and 2019, increasing the overall annual rise to 0.9 mm per year [8]. This is worrying in terms of both contribution to sea-level rise and potential long-term impact upon agriculture and drinking water supplies, particularly in places like the Andes.

Permafrost loss is arguably the most alarming process of all. Scenarios involving optimal human behaviour still project around 30% loss of Arctic permafrost by 2100 [9]. More likely patterns of human behaviour are expected to yield up to 70% permafrost loss over the same time period [9]. Long before this, significant amounts of Arctic infrastructure will be compromised, with mitigating efforts then becoming more difficult [10]. Even meeting the 2015 Paris Agreement targets would still involve an aspirational rise limited to 1.5 °C and, at most, 'well below 2 °C above pre-industrial levels' [11]. Either would still yield massive change across the Arctic, given that its temperature rise is 2 times greater than the

global average. (I take the rate from the National Snow and Ice Data Center [12], but the figure is common across cryosphere research.) It is also far from clear that the Paris target is now within reach. Permafrost thaw was not fully accounted for in the initial projections.

We can reasonably anticipate continued global sea-level rise, driven initially by the melting of the Greenland Ice Sheet, and then accelerated at some point due to thermal expansion upon the release of Arctic carbon currently locked up in permafrost, primarily as CO_2/carbon dioxide and to a lesser extent as the significantly more potent greenhouse gas CH_4/methane. This applies even if we add all the relevant notes of caution about the uncertain role of CH_4 and take an optimistic view of its likely impact. It is very dramatic to see fires on water, but in terms of greenhouse gases most permafrost thaw is still leading to CO_2 release—which is good news, but this could change. Carbon release from subsea permafrost is a particular concern [13], and inland surface collapse and the formation of thermocarst (marshy hollows with water from permafrost thaw) as a source of CH_4 is already extensive. However, this particular balance has still not been tipped. CO_2 remains the more immediate problem.

Beyond a certain point in this entire process, effective forms of adaptation and mitigation will require more than behavioural change. If we have not yet reached this point, then we are moving rapidly towards it, with little prospect of avoiding it. The options for effective action '*in addition*' *to* behavioural change are, however, limited. Megaprojects such as dam construction, glacial engineering and geoengineering more generally, that is, engineering with a comparatively direct planetary level significance, are the most obvious options. On the plus side, the readiness of governments to fund megaprojects (for better or worse) has been reasonably well established. The Trans-Alaska Pipeline system ($33.8bn) and the Shinkansen between Tokyo and Nagoya ($38.5bn) are among the most expensive, but still nowhere near the $100–150bn cost of the International Space Station (a sum so large that there is no value neutral way to aggregate a final total). Even if the required funding is of a still higher order of magnitude (closer to ISS levels than Shinkansen levels), the expense may be a major political barrier, but may not be an insurmountable political barrier. We may also anticipate a continuing shift towards Chinese global hegemony over the coming century, which may produce problems of other sorts, but may favour ambitious megaprojects.

This is the second horn of the dilemma, because there is a great deal that can be said against the direct effects of megaprojects and geoengineering, and especially against giant dams. They involve harms which we (arguably) have a duty to avoid, and under normal circumstances we ought to minimize their role. There

has also been an ongoing discussion about whether appeals to geoengineering might carry problems of moral hazard [14], that is, agents may be less likely to change their behaviours if they believe that the difficulties facing humanity can be solved by technology. But even if we are sceptical about such indirect problems, we may still be worried about the direct impact and vulnerabilities to harms which go hand in hand with technological responses to socially generated problems. We may think of these in terms of the idea that technology comes with its own troubling rationales. It is not just something that we make, according to Heidegger [15]. Or, we may think in the more concrete terms of the eco-critiques of later twentieth-century megaprojects, with dams in particular targeted as a source of great ecological harm as well as conflict with indigenous communities [16, 17]. Edward Abbey's *The Monkey Wrench Gang* [18] is the iconic text of this tradition, with a plotline focusing upon an attempt to destroy the Glen Canyon Dam in Colorado. Dam building, however advantageous, is not the option of preferred choice. But it is the kind of duty- downgrading option that we might have to choose in a situation of tragic dilemma if no other option will actually meet our broader environmental duties to respond and to mitigate the impact of climate change.

This goes to the heart of why it makes sense to think of our '*emerging*' predicament in terms of tragic dilemma, in terms of a choice between duties irrespective of the path that we choose. But '*emerging*' is not quite be '*now*', and this may seem to provide hopes of an escape route. Yet the data does seem to suggest that we are close and perhaps on the wrong side of the relevant tipping points. If we take Greenland as the key indicator, because of its major role in climate change and largest individual contributor role in sea-level rise, matters do not look good. Mankoff et al. [6] using Sentinel-1 data, and King et al. [5] using three decades of data, agree that the rate of discharge from the Greenland Ice Sheet stabilized at a higher level after the surge of 2000–2005. It did not revert to earlier levels but settled into a new phase of dynamic loss. At least as a precautionary matter, it does seem that we now need to think seriously about how to respond if we do go beyond the relevant tipping points.

A different, but also curiously consoling, thought is that any effective forms of engineering may simply be beyond us. Engineering on a scale that is large enough to have an impact by, for example, stabilizing the Greenland Ice Sheet, is currently well beyond our capabilities. But this alone does not rule out the prospect. We know, from NASA's Oceans Melting Greenland project, that the problem is primarily focused upon glacier fronts, with a pattern of loss which is shaped by the land structures underneath the Ice Sheet, and particularly by fjord depth [19]. There is a difference between parts of the Ice Sheet sitting on areas that slope down to the sea and areas that act more like a Velcro strap. This may

offer pathways to future mitigation strategies, given the availability of the right glacial engineering technologies over the course of a century or so [20].

By comparison with ice sheet calving, thawing permafrost is more spread out and harder, even in principle to deal with at a technological level. It is difficult to even imagine where we might begin with technologies to stabilize subsea permafrost in warming Arctic waters. Extensive Arctic permafrost melt simply looks unavoidable, and with it the increased likelihood of an accelerated rise in sea levels. Water containment, '*keeping it out*' and '*keeping it in*', then begins to look like a practical necessity, the end of the problem that we can actually seize hold of. Inconveniently (from the standpoint of environmental duties to avoid harm) if we are hoping to be saved from having to make undesirable choices by the impracticalities of measures such as dam construction, the long-term data does suggest that while dams would be too small to solve problems on their own, they can be an effective contribution to larger systems of containment. There is a strong correlation between the dam projects of the 1950s–1970s and the slowing of a century long rise in global sea levels [21, 22], in spite of increasing temperature anomalies at the time [23]. Much as we might like to find a different set of causes for this slowdown, it does seem that dams and their impact upon patterns of water flow were an important part of the picture. (Not the whole picture, but part of it.) They remain among our most ambitious, realizable, mega engineering projects. And they are of a scale that does seem capable of making a difference. Notoriously, the controversial Three Gorges Dam on the Yangtse has a reservoir large enough to hold 40 cubic km of water, with a difference between '*empty*' and '*full*' that is enough to shift the North Pole by an estimated 2 centimetres [24].

On the downside, dam placement and distribution are often marked by injustice, as well as harms to indigenous peoples. Dams in areas of high biomass, such as the Amazon, also pose an ongoing threat of CH_4 release. The main drivers for dam construction are still, at this point, economic and political, not environmental. In the case of the mega-dams along the Yangtse, the aim was to establish an economic corridor, alleviate poverty and strengthen political integration. However, the Three Gorges Dam has been associated with both a worsening of the extensive 2020 drought conditions to the south and with extensive flooding in the highlands in the same year [25], the worst of both worlds. There is no doubt more to come—not to mention the local environmental harms of altering watercourses and further undermining of the cultural heritage connected to various national minorities dependent upon the Yangtse. (Here I shift terminology for a reason: Chinese law does not have a classification for indigenous minorities, only *Shǎoshù mínzú*/national minorities.) Given these points, it is important to add the qualification that a reluctant acceptance that we may need projects *of* '*this type*' and *on* '*this scale*', does not entail commitment

to any particular set of political modalities. Nor does it entail the shoring up of the many, dangerous and insensitively placed

dams whose removal or breaching has been a welcome development in recent decades. For example, the Condit Dam in 2011, following an agreement with the Yakama Nation. Similarly, with recent calls to remove three lower Columbia River dams which were built without First Nation permission [26]. A requirement for future dam construction '*somewhere and on considerable scale*' in order to help buy some time does, however, introduce vulnerabilities. Cracks through which further injustices are likely to seep. The viable candidate sites for mega-dams may be limited.

3. Integrity After Loss

If we cannot save everything that we value, how should we then think about places subject to loss that we do not prevent, or even deliberately bring about? Here, it may be better to think about this problem by using a concept of '*integrity*' rather than a concept of '*personhood*', for places. The latter is an option which has gained ground in recent years as a useful legal device for extending statutory protection to rivers and mountains [27]. My concern with such an approach is that it is overly anthropomorphic. And while anthropomorphism is not always misleading and has an appealing (but superficial) similarity to the complex animistic views of indigenous peoples on the front line of climate change, overly strong versions of anthropomorphism come with a temptation to rely upon analogies whose status *as* analogies can easily be overlooked. Geological history then starts to look like memory. Systemic change begins to look more like action than event. In the longer run, geoethics may be better served by prioritizing concepts which are less focused upon the model of the human. A qualification here is that integrity also has its anthropomorphic origins in descriptions of human virtue [28]. However, the anthropomorphic overtones are weaker.

As a further clarification, what is at stake is the kind of integrity appealed to in environmental ethics [29, 30, 31] rather than the kind appealed to in routine land management, where '*integrity*' is a measure of human impact [32]. Used in the environmental ethics sense, the concept satisfies a number of rudimentary conditions: (1) It performs '*distinctive*' work, enriching conceptual repertoires, such as that of geoethics; (2) it tracks structural features which contribute to diversity by virtue of the unique/near-unique history of place; (3) the concept is also '*normative*', and not only structure tracking, and so it can be used when giving reasons for protective action; and (4) the concept has a relational aspect.

Places are distinct, but also part of global planetary systems. This concept of the integrity of place is also a particularly good fit for the Anthropocene. There is, for example, no obvious integrity requirement for a comprehensive lack of human influence, or even for limited human influence. The former is something vanishingly rare since the end of the Holocene. The latter is something we already have a concept for, that is, '*wilderness*', in the sense familiar from the US Wilderness Act: areas where '*man himself is a visitor who does not remain*'.[1] Unlike wilderness, even on pluralistic understandings of the concept [33], integrity is not a concept of '*minimal*' impact. Places may undergo radical, even catastrophic changes such as permafrost melt, or large-scale infrastructure placement, and still have integrity, at least *to* '*an extent*'. They can still be places where appeals to cultural significance, history, geological structure and irreplaceability make sense. They may shape practices of valuing and protection.

An illustrative case may clarify the point. Consider the ongoing disputes about telescope placement on *Maunakea* in Hawaii. Against site protection, the claim is made that the site is already too far gone because it has many installations. Overall, the transformation or damage to the site is palpable, obvious to all. Protection now seems pointless [34]. However, indigenous responses [35] (Pu'uhonua o Pu'uhuluhulu 2020), point instead to the continuing standing of the site as cultural heritage, complete with burial sites (albeit not in the immediate vicinity of telescope construction). Both sides also value environmental and astronomical knowledge, but they differ about the ways of valuing a site when extensive transformative damage has occurred, and about how the site should be seen overall, beyond its individual component places. For the indigenous opponents of further construction, the site is still thought of in the light of its history and as possessing a continuing wholeness. It is still, overall, *Maunakea*. A concept of the integrity of place captures something of this sort, the thing that the indigenous protesters see but which becomes harder for their opponents to see as additional installations are added to what once seemed pristine, but has now clearly been transformed from an earlier state by human activity.

Applying the concept to the Greenland Ice Sheet and Arctic permafrost, how should we make sense of the integrity of such places if it is not ended by extensive anthropogenic change? Partly this will involve thinking about history on geological timescales and recognizing the ongoing shapeshifting of places over time [36]. But partly it will involve a grasp of how landscapes shapeshift over more human and generational timescales, and the fact that change has always been part of our human story [37]. Integrity is relational. It concerns landscapes and humans. After all, the whole point of the concept of integrity is that it is

[1] https://www.justice.gov/enrd/wilderness-act-1964; U.S. Congress, 1964, sec. 2(c).

normative, that is, it concerns reasons for action to which humans are responsive, and is a tool for tracking not just landscape change but ways that humans in the landscape are typically responsive to a sense of its value. It is not merely descriptive of such attitudes. Rather, our grasp of integrity is partly a matter of '*having a sense of what it might be like to be embedded within the landscape*' and to value it in various associated ways. Knowledge of this sort may not be identical to indigenous attitudes and or to the indigenous knowledge of opponents of telescope siting in Hawaii, or the knowledge of *Evenki* dealing with permafrost melt in Siberia, or that of indigenous groups on the front lines of climate change. But it is at least intuitively plausible to say that arriving at such knowledge about integrity stands in need of indigenous/minority input or co-production to help understand what it is that they see [38, 39].

Understanding integrity of place may also involve something else. A still more ambitious move is left open. An ontological move towards which I am sympathetic, but which is not entailed by the provisional outline above. A claim that indigenous/minority presence within landscapes can be partly constitutive of its historically formed integrity. As an exemplar, we might think again of the cryosphere, and permafrost regions, the Arctic and sub-Arctic, where human presence and activities such as reindeer herding have long shaped and been shaped by the landscape. While such groups remain embedded within landscapes, there remains a strong case for seeing the landscapes as transformed places. Changed in unwelcome ways, but not comprehensively devalued. They do not lack integrity, and the standing that we continue to accord to those places we value the most.

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