

Guest Editorial to the special issue ‘Politics of environmental anticipation’

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More than half a century after the inception of environmentalism and futures studies in the early 1960's, renewed concerns in recent years with problematizing futures have triggered an array of social research concerned with how to account for matters of social-ecological uncertainty. As Noel Castree critically observed in his analyses of the future of environmentalism and the neoliberalisation of nature (Castree, 2006; 2008) the modern environmental movement went from having a thrilling infancy in the late 1960s to a rather successful 1970s adolescence, to failing to enjoy an early adulthood full of achievement in the 1980's and 1990's when the effects of nature's neoliberalisation became simultaneously evident and contested.

From the early 2000's, the resurfacing of a multiplicity of convergent postures and divergent perspectives from global change research, to the social sciences and the humanities, and ranging from an enduring assessment of the 'not yet' to the contested prefiguring of the 'what if', are perhaps indicative of what might be a reinvigorated 'futures turn'. But for whom do these futures actually turn for, remains a strong question with weak answers at most. At the very least, these novel and simultaneously convergent and divergent concerns with 'futuring' and 'futures' are symptomatic of a range of anticipatory modes of inquiry, ranging, for example, from critiques of how futures are predicted and projected by algorithms, modelling, and risk scenario planning, to how futures are envisioned, imagined or performed according to affective and sensory coordinates. More specifically, environmental futures today include perspectives of biodiversity loss, climate change, local and global tipping points and ecological emergencies (Oreskes & Conway, 2013), as well as new synthetic organisms, artificial biomes, renewable infrastructures and geo-, bio- and eco-engineering technologies aiming to secure the resilience of the biosphere. Anticipatory goals and concerns are incorporated within a growing number of fields and sectors of environmental conservation, knowledge, management and innovation, such as ecology, agronomy, biodiversity management, land use planning, oceanography and microbiology. Meanwhile, scientists, lay people, citizen scientists, artists and activists are engaging with enduring assessments of the 'not yet' in an attempt to understand and problematize non-human and human life in an age of manifold predicaments and multiple entangled crises.

In this special issue of *Futures* we concentrate on a particular figure: the politics of environmental anticipation. Through a stimulating collection of eight original articles we aim to provide a critical assessment of a range of sites where varied and conflicting politics of environmental anticipation are constituted and resisted. In doing so we are interested in illustrating the multiple ways through which the anticipation of environmental futures has come to the fore as a developing field of expertise and practice. More so, as a mode of thinking that is propelling new ways to engage with earth processes and economic organization.

Our aim as guest editors of this special issue of *Futures* is to connect new scholarship across 'epistemic trading zones' (Skrydstrup, 2013, p.225) bringing into dialogue a range of disciplines including STS, cultural geography, environmental humanities, futures studies, sociology, history, political science and anthropology. The articles build on empirical

investigations of a range of sites and infrastructures of environmental anticipation in order to examine the broad reconfiguration of research agendas, environmental governance and techno-industrial innovation pathways toward anticipatory and security purposes regarding biodiversity, ecosystems and the biosphere. They reveal insights into the complexities of anticipating the futures of entangled socio-technical-ecological dynamics whereby scientific research, government, industries, markets and civil society produce the future of nature and society in the same movement. They also reveal how, similarly to the 1960s and 1970s, environmental politics are at play today against the backdrop of sustained action from sceptic and anti-environmentalist lobby groups launching global anti-science campaigns.

The invitation we made to the contributors was to rethink or reflect on the heuristic and epistemic value of the notion of anticipation, and to respond to a number of framing questions including: How are futures brought into the present forms of social organization and praxis? Where does anticipation stop when “second-level” set of associated risks and questionable consequences are produced by anticipatory agendas and technologies themselves? How do technologies of anticipation re-shape environmental issues and politics? In response, the articles as a whole pay attention to the various, and partly competing, regimes of environmental anticipation enacted by a growing number of scientists, experts, community activists, industries and stake-holders aiming to conserve, restore, manage, secure, optimize and/or reengineer environments and societies.

Taken together, these eight contributions examine from a range of disciplinary perspectives the various assemblages of practices, forms of representation and material infrastructures enabling experts and lay people to anticipate, foster, and pre-empt the futures of biodiversity, ecosystems, landscapes and institutional practices. As they scrutinize the associated politics of anticipation tensions between constructivist readings of scientific knowledge production and the question of environmental science’s political consequences come to the fore throughout the articles of this special issue. This is explicit in the first article that leads and contextualizes the special issue: *The Politics of Anticipation: On Knowing and Governing Environmental Futures* where Céline Granjou, Jeremy Walker and Juan Francisco Salazar describe how the historical emergence and rise of future studies is intricately coupled to the emergence and development of environmental anticipation as discourse and practice. In looking at the likely contributions that the field of futures studies can make to reimagine collective agency and ways of being on Earth, the authors reflect critically upon its genealogical relations and co-optation by political conservatism and the strategic horizons mobilised by corporatism. In doing so the authors illustrate how the accumulation of environmental futures research not always leads to a progressive aversion of catastrophe. Knowing the future is one thing, but governing it is quite something else.

Irus Braverman’s article *Bleached! The Catastrophe Management of Corals* draws on participant-observation and interviews with coral scientists and marine park managers, to show how corals have emerged as both sign and measure of the imminent catastrophic future of life on Earth. Stark images of dying corals, bleached white by unprecedented ocean temperatures, shapes an analytic of catastrophe and closing future horizons where science communication and marine conservation management policies become entangled in an agonistic politics of anticipation. In her study of the “management” of coral reefs by scientists who anticipate their imminent global extinction through catastrophic bleaching events, Braverman reveals the significance of algorithmic models and elaborate temporal analyses in marine conservation biology for “knowing bleaching”. Braverman also poignantly uncovers the ways in which scientific knowledge can be ‘managed’, neutralized and prevented from

having appropriate political consequences. Neoliberal governments – in Australia, in this case – continue to forcefully brush aside obstacles to the expansion of the fossil fuel sector in the name of economic growth – the very process making the oceans an inhospitable environment to the Earth’s most diverse, productive and abundant ecosystems. Scientific labour is directed into further refining anticipatory methodologies, or diverted into imagining prosthetic methods of coral restoration which have little hope of success. Braverman’s account of an oceanic catastrophe to come, indeed one well underway, strikes as hard as the hell of Hobbes and Hegel: an advancing, immanent catastrophe almost certainly far beyond the scope of any precautionary policy or anticipatory action.

Next, in his article *Emptying the future: On the environmental politics of anticipation*, Christopher Groves examines anticipation as material-discursive practices. As a capacity or characteristic, he argues, anticipation not only manifests through representations, even if these representations of the ‘not yet’ are performative in nature, but also comprise material capacities, which are always simultaneously “technological, biophysical and affective in nature”. This is an interesting move as it pushes us – as Groves rightly observes - to extend our conceptual vocabularies to encompass the materiality of anticipation. In his attempt to theorize the entanglement of matter and meaning, Groves focuses on an analysis of the politics of anticipation of energy infrastructure planning in the UK, to illustrate how understanding anticipation as a capacity dependent on a heterogeneous set of human and more-than human capabilities enables comprehension of the deep sense in which environmental politics is always a politics of the future.

In his article *Anticipatory Policymaking in Global Venues: Policy Change, Adaptation, and the UNFCCC*, Rob DeLeo accounts for the anticipatory character of climate governance, building on a case study of the United Nations Framework Convention on Climate Change (UNFCCC). Far from the depiction of government as an inherently reactive entity which is often found in the literature, Rob DeLeo explores what happens to policymaking patterns when they become anticipative in order to tackle evolving future horizons, such as the complicated time horizons at stake with the partial shift from climate mitigation, which aims to reverse or at least minimise warming by reducing net greenhouse gas emissions, to climate adaptation, which strives to reduce social, economic, physical vulnerabilities in the face of an ever-warming planet. The article emphasizes the ways in which the governance of emerging hazards differs in some important ways from post-disaster policymaking, documenting how climate governance “is shaped by a combination of indicators, planning, institutions, and narratives describing constantly evolving temporal horizons”.

In their article *Earthly Graves for Environmental Futures: techno-burial practices*, Matthew Kearnes and Lauren Rickards emphasize how the intensification of mining and extractive processes relies on the development of promises of deep burial that require a re-imagining of the underground as a stable site shaped by technologies of material and social transparency. By documenting two techno-burial practices - the long-term disposal of industrial and toxic waste underground and the sequestration of carbon in soil and terrestrial sinks –Kearnes and Rickards explore how contemporary investments in the underground are over coded with an anticipation of hoped-for environmental and human futures. Evoking parallels with the funerary rituals deployed to achieve death as a final separation from the living, they draw attention to the ways in which contemporary subterranean politics sustains continuing hopes for an ecological modernity, one dependent on expectations that the remains of environmental pasts will be permanently interred. Strikingly, they highlight how the instability of the subsurface revealed by recent scientific research entails the continuing generation of “zombie waste”.

In their paper *MELiSSA the minimal biosphere: human life, waste and refuge in deep space*, Jeremy Walker and Céline Granjou develop a critical account of MELiSSA (Micro-Ecological Life Support System Alternative), a long-term European Space Agency program. This program aims to construct autonomous habitats in deep space, supplying astronauts with fresh air, water and food through continuous microbial recycling of human wastes. The article considers how anticipated futures of space travel and environmental survival are materialized in the project of engineering the minimal biosphere capable of reliably sustaining human life: a human/microbe association with the fewest possible species. This is a technical problematic that mirrors our situation here on Earth, as the unravelling of global ecosystem functions (eg. the cycling of carbon, nitrogen and phosphorus) is simultaneously a cause and effect of mass extinctions of species. MELiSSA's sewage-composting technology presents a formidable "bottle-neck" for the construction of the minimal biosphere, highlighting a dependence on irreducible complex microbial communities (here, those connecting the human gut to the composting processes of soil). MELiSSA is located within a wider genealogy of colonization bio-infrastructures and 'greenhouse geopolitics', now culminating in a range of space refugia projects imagined in the prospect that the Earth might cease to function as the only biosphere capable of supporting civilization.

In Martin Skrydstrup's article *Envisioning the Future by Predicting the Past: Proxies, Praxis and the Politics of Prognosis in Paleoclimatology* the attention shifts to the future of Greenland, where he develops an ethnography of Danish ice core research to account for how technologies of anticipation within paleoclimatology relate to contemporary modes of envisioning environmental futures. Examining research which seeks to improve characterisation of the past climatic era designated the Eemian (the warm interglacial period preceding the last ice age, which ended with the advent of the Holocene), Skrydstrup argues that ice core science gravitates towards what he terms "analogue anticipation" counter posing deep pasts with probable futures. Here ice core research works as a vantage point to discuss the political nature of climate science from the perspective of temporal proxies and prognosis.

In her paper, *Speculative promise as a driver in climate engineering research: The case of Paul Crutzen's back-of-the-envelope calculation on solar dimming with sulfate aerosols*, Mieke Van Hemert turns the attention to climate engineering to show how the ontological commitments underlying the desire to control climate futures stands in plain contrast to stances which do not see humans as masters of a calculable cosmos. The article focuses on Paul Crutzen's calculation of the cooling effect of the eruption of Mount Pinatubo (Crutzen 2006), scrutinizing the way it convinced atmospheric scientists and their funders to conduct and support research on stratospheric climate engineering with sulfate aerosols. Van Hemert shows how speculation continues to be a strong driver of climate engineering research and contends that climate scientists who have been contrarian to Crutzen's climate paradigm, through the constant invocation of complex feedbacks and hinting at irreducible unknowns, appear to be committed to what she terms "a rather more humiliating spectrum of stances".

Finally, in the last paper of the issue, "*Fixing*" *climate change through carbon capture and sequestration*: *Situating industrial risk cultures*, Declan Kuch addresses experimental projects of carbon dioxide (CO₂) capture and storage (CCS) promoted by coal, oil and gas industry experts and their allies as an integral part of climate change mitigation efforts, showing how public relations strategies persist despite the fact that the few attempts at scaling-up such solutions have stalled. Unpacking the ways CCS technologies have become conceived as a necessary solution to the coal industries uncertain future through the

influential prism of oil and gas industry expertise, he shows how industry experts claiming epistemic authority increasingly frame public skepticism about CCS as itself the critical risk to be 'managed'. While "such a mentality brings its own blind spots beyond the frequent spills, leakages and explosions in oil and gas projects", advocacy of the promise of CCS frames the problem of climate change "as merely one amenable to technical fix through ever more investment". Unpacking issues of procedural and epistemic (in)justice at stake in pre-packaged claims of CCS prospects for successful techno-burial, in particular their lack of consideration for the results of seismic science, he emphasizes the serious limits weighing on any future possibility of CCS being governed ethically.

By interrogating the different ways in which the politics of environmental anticipation "take place" in specific sites and across diverse knowledge practices, our aim is that this special issue might draw interest in a broader discussion of the category of anticipation in the context of a dire moment of political instability and ecological uncertainty. So, let us come back then to the set of key questions or challenges that frame this themed issue and that we set out to tackle together with the invited contributors in an exercise of thinking aloud together on how contemporary social-ecological research is made and unmade in relation to the contested expediency of futures as analytic category. That is: how are futures brought into the present forms of social organization and praxis? Where does anticipation stop when "second-level" set of associated risks and questionable consequences are produced by anticipatory agendas and technologies themselves? How do technologies of anticipation re-shape environmental issues and politics?

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Governing Environmental Mobilities. In a globalized world, we are facing a continuous growth of movements of people, goods, materials, and information. These movements, analytically termed mobilities, actively intersect with processes of environmental change. We coin the term environmental mobilities to refer to the movements of human and nonhuman entities and the environmental factors and impacts associated with these.Â Special Issue: "Generating Societal Value from Improved Weather, Water & Ice Forecasts in the Polar Regions", edited by Machiel Lamers (ENP) and Daniela Liggett (University of Canterbury, New Zealand).