Responding to the Anthropocene

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RESPONDING TO THE ANTHROPOCENE

PERSPECTIVES FROM TWELVE ACADEMIC DISCIPLINES

SCANDINAVIAN ACADEMIC PRESS

Responding to the Anthropocene: Perspectives from twelve academic disciplines

Published with support from Oslo School of Environmental Humanities and the Department of Culture Studies and Oriental Languages, University of Oslo.

Cover design: Punktum forlagstjenester
Cover photo: Pierre Huyghe, *Variants* (2021–ongoing). Courtesy of the artist; Kistefos Museum; Hauser and Wirth, London. Photo: Ola Rindal
© Pierre Huyghe.
Book design: Punktum forlagstjenester
Typeset in: Garamond 11/14
Paper: Munken Print Cream 90 g
Print: AIT Grafisk
Printed in Norway

ISBN 978-82-304-0362 -4

Scandinavian Academic Press
C/O SPARTACUS FORLAG AS
P.B. 6673 St. Olavs plass, 0129 OSLO
www.scandinavianacademicpress.no

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In Gladstone, Queensland, even the sunset is sponsored by the fossil fuel industry. The chimneys belong to one of the state's largest power stations, powered by Australian coal. (Photo: © Thomas Hylland Eriksen)

Introduction

Responding to the Anthropocene

Thomas Hylland Eriksen,
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The mounting ecological challenges, accelerated environmental destruction and climatic change characterizing the early twenty-first century have created a need for new interdisciplinary thinking across the academic world, not least in the humanities and social sciences. In this volume, we have invited a variety of scholars at the University of Oslo (UiO), Norway, from different disciplinary backgrounds to respond to current circumstances. To a great extent, this book is an outcome of the lecture series 'Welcome to the Anthropocene'[1] that UiO's Oslo School of Environmental Humanities (OSEH) has been organizing since the spring of 2021. This ongoing lecture series – open to students, university staff and the general public – attempts to collectively build university curricula where students can develop what we call 'Anthropocene literacy' – insights and critical reflections on the current planetary transformation and climate crisis.

In keeping with the spirit of the lecture series, we have asked scholars from a broad range of disciplines at the University of Oslo – archaeology, biology, geology, cultural history, literature, art history, science and technology studies, anthropology, political ecology, geography and law – to draw on their own research to interrogate and respond to the epochal concept of the Anthropocene. The essays of this volume reflect a diversity of relationships to the planetary crisis and the ongoing, far-reaching, environmental and sociopolitical transformations that are currently reshaping human pasts, presents and futures.[2] Rather than calling for a dissolving of all disciplinary boundaries, we argue that the Anthropocene manifests and is evident in multiple forms, requires a multiplicity of approaches to be studied and a clear and deep understanding of the specific theories, methods and traditions that each discipline brings to the table. Through the lecture series and this joint publication, we aim to build a tool for collaboration across different faculties and disciplines and use the Anthropocene as a productive concept to think together and learn from each other. From our experience teaching and researching at our university, the Anthropocene provides a productive contact zone where disciplines and scholars meet, come into fruitful friction, and sharpen their profile to contribute to a trans- and interdisciplinary dialogue meaningfully.

The concept itself

The Anthropocene is still an unofficial but increasingly common designation for the current epoch in Earth's geological history: a time in which human activity has radically altered the planet's climate, atmosphere, biodiversity, chemistry, and geology. The term has achieved broad acceptance despite its relatively recent origin. Derived from the Greek words *anthropos,* for 'human,' and *cene* for 'new,' the term Anthropocene was originally coined by atmospheric chemist Paul J. Crutzen and limnologist Eugene F. Stoermer in 2000. These Earth scientists proposed the term Anthropocene to declare a new geological era that succeeded the Holocene, the 12,500-year period following the most recent Ice Age.

The Anthropocene marks a distinct epoch in our planet's four-and-a-half-billion-year history, in which *Anthropos* – the human species – has rapidly become a geological force. According to this view, the human species has now begun to change the very biogeochemistry of the Earth, bearing comparison to how asteroids, for example, have shaped life and Earth systems in the deep planetary past. Although the term Anthropocene has not yet been formally recognized by the Stratigraphic Commission (an international body primarily consisting of Earth scientists and geologists (Steffen et al. 2011)), it has had a significant impact on academic research, teaching and environmental activism worldwide, with calls for the need to overcome established distinctions of what belongs to the 'natural' world and the realm of human culture, a distinction that today can be difficult to uphold.

Officially, we are still in the Holocene, the period following the last Ice Age, which ended about 12,000 years ago. Though the Anthropocene Working Group of the International Union of Geological Sciences voted in 2016 to establish the period as an official epoch, this has not yet been ratified. Yet, despite internal disagreements about periodization and terminology, it is clear that even though anatomically modern humans have existed a mere 200,000 years, we have already left an enormous imprint on the planet. In many ways, we have been too 'successful' for our own good. Human disturbances have been of such a magnitude that geologists of the distant future will find human-made material in the layers of the Earth's crust that classify as 'technofossils.' Geologist Jan Zalasiewicz, the chair of the Anthropocene Working Group, coined this term to describe the material footprints humans will leave behind through their material goods, such as plastic, cement, new artificial mineral compounds, domesticated animals and e-waste. He suggests that technofossils will be humanity's equivalent of a dinosaur footprint and take the forms of infrastructure, cities, motorways, computers and plastic compounds (Zalasiewicz et al. 2014), visible to whoever explores the traces of human pasts in a distant future.

By now, the term Anthropocene is commonly used in a wide range of academic disciplines and public discourses, as the chapters in this book show. Yet, it is an ambiguous term. As such, it has sparked heated debate and a variety of responses: While some embrace the notion of the 'good Anthropocene' based on the belief in the ecological salvation of the Earth through technological innovation and human control over an unruly nature (e.g., Asafu-Adjaye et al. 2015; Blomquist et al. 2015; Haff 2014), others see its implications as raising fundamental criticisms of the contemporary world order based on capitalism and growth. Numerous scholars have questioned the very concept itself. Among many things, it has been criticized for being masculinist (e.g., Åsberg 2018; Gibson-Graham 2011; Walton 2020), natural science-centered (e.g., Castree 2014; Pálsson et al. 2013), colonial (e.g., de la Cadena 2015; Todd 2015), ahistorical (e.g., Rowan 2015) and anthropocentric (Haraway 2015; Tsing et al. 2021), and obscuring the unequal environmental impact and cause of capitalist destruction (Chakrabarty 2009; Crist 2013; Castree 2015).

Despite these correctives and critiques, we believe that the Anthropocene, seen as a regulative idea and a broad umbrella concept, is useful and productive for sparking debates about the rapid destruction of our planet and for understanding complex and alarming changes that cannot be addressed within the silos of established disciplines: from the climate crisis to the rapid disappearance of species and the environmental effects of wars destroying more-than-human life as we have known it on this planet. No matter how the concept of the Anthropocene is approached or understood, the term has already served as a catalyst of vibrant and necessary cross-disciplinary conversations about the multiple crises of our times, as well as the possible pathways toward more sustainable and livable futures (for two excellent overviews, see Lorimer 2017; Swanson et al. 2015).

The periodization of the Anthropocene has been debated among geologists and other scholars (see Zalasiewicz et al. 2014 and chapters by Nightingale and Côte, Svensen and Jordheim, this volume). Crutzen and Stoermer have linked the beginning of the Anthropocene with the onset of the industrial era marked by the large-scale exploitation of fossil fuels in tandem with the steam engine toward the end of the eighteenth century (Crutzen and Stoermer 2000; Crutzen 2002). Others have contested this starting date. The geographers Simon Lewis and Mark Maslin (2015) suggest that the human-dominated epoch of the Anthropocene began around 1610, indicated by a sharp drop in atmospheric carbon dioxide, evident in ice core samples. This date recognizes the impact and devastation caused by the European colonization of the Americas and the subsequent mass deaths of Indigenous people, when previously managed forests began to regrow. As cultural studies scholar Heather Davis and anthropologist Zoe Todd point out (2017), for Indigenous scholars, this starting point is central to decolonizing the Anthropocene, as it pays tribute to the loss of Indigenous ways of life brought about by European invasion. Yet others, such as environmental historians John McNeill and Peter Engelke (2016), argue that the beginning of the Anthropocene coincided with the start of 'the Great Acceleration,' a period beginning after the Second World War characterized by rapid growth in human activities worldwide.

In this period of accelerating growth, the loss of biodiversity, the global spread of plantation agriculture, the fast development of rapid and efficient communication and transportation technologies, urbanization and rapid increase of human population and energy consumption may suggest that a new epoch is indeed near. Moreover, anthropologist and co-editor of this volume Thomas Hylland Eriksen has argued that there has been an 'acceleration of acceleration' since around 1991 (Eriksen 2016), since when phenomena ranging from tourism and air travel to transport and global trade have grown exponentially, accelerating environmental transformations and anthropogenic climate change. Regardless of the dating, it is indisputable that human activity has radically transformed our planet's atmospheric conditions, climate, biodiversity and landscapes, leaving traces in the Earth's fossil layers. These changes demand to be taken seriously by scientists and scholars across the academic world and require new ways of collaborating across fields, faculties and disciplines in research and teaching.

While the Anthropocene Working Group is still searching for possible markers and periodizations of the new epoch, the notion of the Anthropocene has transcended far beyond the context of its first and original mobilization. Scholars from the humanities, social sciences and the arts have used the term in multiple and productive ways. In the emergence of the Anthropocene, many see the 'end of Nature' as the end of an imaginary that clearly separates the realm of humans (or culture) from that of a pristine nature untouched by human cultural activity.[3] Many of the ideas, critiques and concerns related to the 'Age of Men' (*sic*) have been discussed over several decades by scholars such as Donna Haraway (1991), Bruno Latour (1993) and activist leaders like Bill McKibben (1999), yet have gone mainstream today under the banner of the Anthropocene, as indicated by the explosion of publications, media debates, conferences and artistic interventions that grapple with the term and its implications (see Lorimer 2017; Swanson et al. 2015). While this is not the place to discuss these intellectual developments in detail (see Nightingale and Côte, this volume), for many, the term has proven productive precisely because of its ambiguity and controversial nature.

Alternative concepts such as the 'Plantationocene' (Haraway 2015; Wolford 2021) and the 'Capitalocene' (Haraway 2015; Moore 2014) have accordingly been proposed to describe our planetary situation more adequately. Another concept proposed by science writer Charles Mann, is the 'Homogenocene' (Mann 2012), emphasizing the reduction of biological diversity due to global exchange and the industrialization, standardization and upscaling of food production. The Homogenocene, according to Mann, is an era in which the simplifying, standardizing logic of the plantation and the factory predominate. Adding further complexity to these terminological debates, feminist science studies scholar Donna Haraway (2015), obliquely inspired by the horror writer H.P. Lovecraft's (1926) tentacled monster, suggests that our present times should best be called the 'Chthulucene,' referring not so much to Lovecraft's diabolic beast as to a humble spider, *Pimoa cthulhu*, which lives under stumps in the redwood forests of Sonoma and Mendocino Counties, near Haraway's neck of the woods in California. With its emphasis on the tentacular character of the spider's web, this term suggests that realities are messier and more complicated than the tidier term 'Anthropocene' indicates, consisting of 'myriad temporalities and spatialities and myriad intra-active entities-in-assemblages – including the more-than-human, nonhuman, inhuman, and human-as-humus' (Haraway 2015: 161).

Others have similarly tried to overcome the alleged anthropocentrism of the term by proposing alternatives that emphasize how human life depends on other life forms for survival, reflected by terms for this era, such as the 'Phytocene' (Myers 2016), indicating the importance of photosynthetic organisms for human survival, or the 'Symbiocene' (Albrecht 2020), highlighting the importance of symbiosis and symbiogenesis, the co-becoming for all life forms on this planet. The list of alternative terms to the current geological era is long. This may, in part, be read as a reflection of competing interests among academic communities. Yet, as Donna Haraway (2017) suggests, opening for a plurality of possible terms helps us grapple with the current moment and develop a more nuanced conceptual vocabulary to imagine how the world could otherwise be.

As we have shown, the term Anthropocene is contested and debated. Still, it remains a robust, established and useful designator insofar as humanity, or part of humanity, is responsible for the current critical condition of the bio- and geosphere. Perhaps more importantly, the term clarifies that the common distinction between the social and the natural is misleading and untenable. From climate change and biodiversity loss to accumulating toxins and emerging diseases, we increasingly face challenges that are simultaneously social, political, technological and ecological. The concept of the Anthropocene thus helps to interrogate established disciplinary boundaries and organizational structures that still imply a separation between the 'natural' and 'sociocultural' realms.

The challenge of redrawing disciplinary boundaries

What unites the otherwise very diverse contributors to this book is the argument that the inseparability of nature, culture and politics to which the Anthropocene points also demands a radical move for thinking across disciplinary boundaries, both within and beyond the university. The Anthropocene calls us to move toward knowledge regimes that enable and foster true multi-, trans- and interdisciplinarity among diverse scholars, practitioners and learners. Sharp divisions between academic disciplines, sometimes spoken of dismissively as 'academic silos,' have always been unsatisfactory and are now indefensible if the goal is to understand the current ecological and climatic crisis. Current disciplinary boundaries arose from a particular historical situation characterized by imperialism, urbanization and industrialization, and these conditions no longer apply as they did at the end of the nineteenth century.

In the 1990s, an interdisciplinary group led by the historian Immanuel Wallerstein proposed to 'open the social sciences' and rethink their boundaries and *raisons d'être* (Wallerstein et al. 1996). They did not mainly have environmental issues in mind, which suggests that the argument has a general relevance. Today, it is abundantly clear that a wide range of knowledge and expertise is needed to grasp the enormous challenges confronting humanity and the natural world in the Anthropocene. These issues call for collaboration with open minds and hearts rather than defending bits of turf, as academics have been prone to do. As authors of this volume, we argue that if the Anthropocene points towards the inseparability of nature, culture and politics, it will ultimately entail a radical move beyond disciplinary boundaries.

Yet, while the Anthropocene urges us to move quickly toward interdisciplinary knowledge regimes, it should not result in disrespect for the distinct contributions and identities of separate disciplines.

Interdisciplinarity strongly depends on and builds upon long-standing, in-depth and thorough disciplinary knowledge, methods and theory. While academic leaders and some politicians speak highly of the promises of interdisciplinarity, academic conservatism makes genuine interdisciplinarity difficult to achieve. Genuine interdisciplinary research and teaching in the future will require great effort as it will involve rethinking the apparatus of scientific research and teaching – transforming the pedagogical curricula at our universities: enabling collaborations between departments, institutions and faculties; restructuring the administration and management of universities; building teaching and research around complex environmental challenges; generating new incentives and support for inter- and multidisciplinary projects; enabling collaboration between citizens, activists and other practitioners of environmental knowledges; and creating spaces for dialogue between fields and generations and for topics that go beyond academia.

At this particular moment, the gravity and comprehensiveness of the threats, risks, and dangers facing humanity and indeed life on the planet as we know it may serve as a powerful stimulant toward experimenting with and generating inter- and multidisciplinary practices.

The Norwegian Anthropocene

It is not a coincidence that this book has emerged from the cross-disciplinary networks of the University of Oslo, with the Oslo School of Environmental Humanities (OSEH) as a hub. Ecological matters have featured prominently in Norwegian intellectual life for decades, which is unsurprising considering the country's history. As urban elites were forging Norwegian national identity in the mid-nineteenth century, glorification of the simple rural life and the majestic, pristine mountain landscapes characteristic of central southern Norway became important elements in this new national character, which sought to distinguish itself from those of its older, more powerful neighbors, Denmark and Sweden. When studying Anthropocene matters and effects, the Norwegian context is interesting in several respects.

First and perhaps most importantly, ecological thinking has been important in Norwegian debates on eco-philosophy and related fields. The founder of 'deep ecology' in philosophy, the late Arne Næss (1912–2009), might be the most internationally famous Norwegian ecophilosopher, but he is not alone. His contemporary Peter Wessel Zapffe (1899–1990) made significant contributions toward a fusion of existentialist phenomenology and biological philosophy in his major work *Om det tragiske* ('On the Tragic,' 1942), while Sigmund Kvaløy Setreng (1976) and Hartvig Sætra (1990) developed explicitly political ecological philosophies. It also bears mentioning that the Norwegian economist Jørgen Randers was a co-author of the seminal Club of Rome report *Limits to Growth* (Meadows et al. 1972), a hugely influential critique of the environmental insensitivity of capitalism and the state. In contemporary Norwegian philosophy, Arne Johan Vetlesen is a significant ecological thinker who has devoted most of his work in the present century to rethink philosophy in the context of climate emergency and environmental destruction (see, e.g., Vetlesen 2019).

Beyond contemporary ecological perspectives in philosophy, the past decade has seen the emergence of diverse disciplinary, multidisciplinary and interdisciplinary research initiatives at Norwegian universities devoted to the climate emergency and rapid environmental destruction.[4] Moreover, Norway is interesting as an exemplary case demonstrating the fundamental dilemmas of the Anthropocene. A major exporter of oil and gas, the country has simultaneously tried to position itself internationally as ecologically responsible – with varying success, it is safe to say. The leader of the UN Commission on Environment and Development, which produced the influential report *Our Common Future* in 1987, was Gro Harlem Brundtland, at the time Prime Minister of Norway. Introducing the term 'Sustainable Development,' the report was seen as prescient and progressive in its emphasis on ecological sustainability. However, Brundtland was simultaneously the leader of a government that made great advances in expanding Norwegian oil and gas production in the North Sea. Critics quickly pointed out that the term 'sustainable development' meant 'green growth,' which activists and ecological economists saw as a contradiction in terms. This duality or double bind (Bateson 1972) between fossil growth and ecological sustainability is characteristic of politics in the Anthropocene, but perhaps it is nowhere more visible than in Norway.

It also deserves mentioning that many of the issues concerning Anthropocene effects on society, culture and ecology were raised in Norway as early as the 1970s. The Alta controversy from the late 1970s to 1981, was a powerful expression of protest against environmentally insensitive growth capitalism and arrogant state power. The dam would cause damage to the vulnerable ecosystem of the tundra, affect salmon fisheries and interfere with traditional reindeer migration routes (Paine 1982). The protests, where several high-profile academics such as Arne Næss and the criminologist Nils Christie were engaged, raised issues that have only grown in significance subsequently. State power versus local autonomy was a key issue since the damming of the river in question had been decided in distant Oslo. Another issue concerned technocratic rule versus conservation, which is often expressed as profits versus nature in the contemporary world. Perhaps most significantly, the Alta conflict raised global awareness about indigenous rights. The Sámi were demanding the right to stewardship over their ancestral lands, but they also presented a line of argument – which has become increasingly important in recent years – stressing the fundamental difference between the modern view of nature as a 'resource' to be exploited by humanity, and the Indigenous Sámi view of nature and culture as one. They might say the land does not belong to us; we belong to the land.

Indigenous cosmologies, or ontologies, have later been explored with the climate crisis and other Anthropocene effects as a backdrop. A main objective in this body of research consists in demonstrating that Sámi ways of relating to the environment differ fundamentally from the instrumentalist, technocratic logic characterizing interventions from the state and capitalist market (Kramvig and Avango 2021; Valkonen et al. 2022; Eriksen, Valkonen and Valkonen 2019). Indigenous perspectives have influenced non-Indigenous scholarship in the region as well, such as Sverker Sörlin's contributions to environmental history (e.g., Sörlin 2017; Warde et al. 2021) and Vetlesen's work in ecological philosophy.

Several contributors to the present book are active participants in the interdisciplinary dialogue, both domestically and internationally, about humanity and the nonhuman, ecological challenges, Anthropocene effects and climate change. Their Nordic and Norwegian experience, with its complex history of engagement with nature, has contributed to shaping their interventions into the broader ecology of ideas in global networks of knowledge.

At the institutional level, following the 1987 UN report *Our Common Future*, also known as the Brundtland report, all Norwegian universities (there were just four at the time) were endowed with new, interdisciplinary centers for research on the development and the environment. SUM (The Centre for Development and the Environment) at the University of Oslo is still thriving, while the others were eventually closed. SUM remains an important academic hub for inter- and multidisciplinary research on these issues.

The University of Oslo is not alone in working toward a more powerful, genuinely multidisciplinary understanding of the Anthropocene. The current initiatives toward interdisciplinary explorations of the Anthropocene witnessed in many universities around the world, and of which this book is a tangible expression, signal a more profound shift in perspectives, epistemologies and thematic foci in academic research.

The contributions to this book

In this volume, scholars from across the University of Oslo have been invited to share how their personal academic trajectories and wider disciplinary communities have been affected by the challenges of the Anthropocene. They address questions such as how the ecological and climate crisis has shaped their research and teaching and what kinds of collaborations and interdisciplinary initiatives they have developed to deal with the ambiguities and complexities of the multiple crises we face today. As the stories suggest, there are many parallels. Many have been worried about the state of the natural world for many years, and all have registered a rapid shift of focus in academic research since the turn of the millennium. Their lives have been affected by Anthropocene effects, and so have their respective academic specializations.

The three opening chapters by Dag O. Hessen, Henrik Hovland Svensen and Beate Sjåfjell present three distinct interpretations of the debates surrounding the Anthropocene as a concept, spanning perspectives from the life sciences, geosciences and law. Biologist Dag O. Hessen (Chapter 1) eloquently addresses the problem of the Anthropocene through a biogeochemical systems perspective, using and clarifying scientific concepts such as 'feedback' and 'tipping points' to explain its dynamics. He argues that measurements and predictions from the natural sciences indeed do have an impact on societal and political awareness and have the potential to motivate action. To achieve the urgent societal, political and economic transformations necessary to limit CO_2 emissions, he highlights the need to interweave the natural sciences with the social sciences and humanities.

The geologist and intellectual historian Henrik Svensen (Chapter 2) offers a different yet complementary overview of the Anthropocene debates, arguing that regardless of whether the Anthropocene is formalized as an epoch of geological time, it is still a useful concept to comprehend the large-scale changes on planet Earth. He asks: What is required to terminate the Holocene and initiate the Anthropocene? When should the Anthropocene start and what should we use as a measure for the new time epoch?

In Chapter 3, law scholar Beate Sjåfjell discusses the interrelationship of law and sustainability during the Anthropocene. After a critical discussion of the term sustainability and the UN Sustainable Development Goals, Sjåfjell explores law's potential as a tool for moving toward more sustainable futures. She argues that it may seem as if law has failed to deal with the extent of the social, environmental and humanitarian crises of the Anthropocene, considering that law should be seen as one of society's most powerful tools to achieve sustainable ways of life. Yet, drawing on international law and policies, she argues that there is hope and possibilities for change and improvement if law succeeds in holistically identifying the social and environmental aspects inherent in the planetary crisis rather than in separate 'silos' of legal frameworks. Importantly, Sjåfjell points out that law is a social construction based on values and, thus, far from morally neutral and that even strict legal regulations have no effect unless followed up in practice.

The next set of chapters examines how anthropology, cultural history and geography have responded to the concept, complicating it and offering critical interventions to rethink the concept. Although the Anthropocene is defined and delineated temporally, its study requires a broader rethinking of the relationship between academic disciplines and knowledge regimes. Echoing this call for collaboration across disciplines, Thomas Hylland Eriksen (Chapter 4) traces the shifting landscapes of anthropological engagement with the present challenges of anthropogenic accelerated change. He argues that environmental anthropology existed throughout the twentieth century, but it was never a mainstream concern in the discipline. The human *Umwelt* – the ecological environment – usually entered anthropological research in the guise of material resources used in human society or as ritualistic or totemic symbols, not as a subject of study in its own right. Yet, in the past two decades, we have witnessed an explosion of ecologically informed research, consisting of attempts to expand the discipline to reconceptualize humanity as part and parcel of the biosphere.

Time, albeit on different scales and explored through a different conceptual vocabulary, is also at the core of Helge Jordheim's (Chapter 5) intervention. With a background in time studies and conceptual history, Jordheim proposes we understand the Anthropocene as a time-coordinating and synchronizing device. He argues that one decisive function of the concept of the Anthropocene is to coordinate and synchronize the multiple and diverse times at work during a climate emergency – and thus, to allow for social, cultural, and political engagement with anthropogenic changes in the environment. Jordheim maps out and analyzes this time-work performed by the concept of the Anthropocene by asking one of the historian's perennial questions: When is the Anthropocene?

In their contribution, geographers and feminist scholars Andrea J. Nightingale and Muriel Côte (Chapter 6) argue that the various critiques of the Anthropocene concept have been important in showing that local distinctiveness matters, which is to say that not all knowledge can be homogenized under a universal heading such as the Anthropocene. Universalist narratives that erase differences are not only problematic because of the way they tell history; they also conceal the dynamics which perpetuate exploitative human-environment relations into the future. Universal framings, Nightingale and Côte hold, struggle to challenge Enlightenment logics, which present human and social processes as somehow separate from environmental change – a separation that many see as foundational to the destructive dynamics and multiple crises of our times.

In the three ensuing chapters, scholars of archaeology, political ecology, and science and technology studies show some of the ways the Anthropocene shift has stimulated both new research, theory and critique. Archaeologists Felix Riede and Per Ditlef Fredriksen (Chapter 7) address how archaeology can enrich our understanding of the planetary and deep-time perspective of the Anthropocene. The evident role that the long-term influence of human actors on environments and climate had, they argue, demands careful attention to prehistory and how from early on, human civilizations have been deeply entangled with their material environments. Furthermore, they suggest that if we believe that traditional ecological knowledge and ways of life might offer genuinely useful insights into alternative ways of living on our damaged planet, then prehistory offers a vast repository of such perspectives, albeit distorted through the vagaries of time, fragmentation and degradation.

Also concerned with questions of the shifting interface between humans and the animals they live with and consume, human geographer Mariel Aguilar-Støen (Chapter 8) argues that if we are living in the Anthropocene, we are also increasingly living in a 'pandemic era' of increasing disease transmission between animals and humans – zoonoses – and between wild and domestic animals. She points to agricultural expansion and industrial meat production interlinked with global changes driving pandemics as a core problem. Drawing on the interdisciplinary field of political ecology, she suggests considering pandemics and epidemics not exclusively as public health problems but also as anthropogenic processes constituted by interlinked ecological, economic, political, social and technological processes.

In the following chapter, science and technology studies (STS) scholar Kristin Asdal asks how documents are key to understanding how the Anthropocene is becoming institutionally established in connection with issues raised in public administration regarding the environmental crisis (Chapter 9). If the goal is to understand these complex issues and the multiple meanings, definitions and categorizations they involve, Asdal argues, the necessary insight is frequently accessed through documents, texts and paperwork. Documents, she points out, are material artifacts that are part of and integral to society and the way humans perceive, understand and act upon the environment. Working with an STS framework, she asks what we may gain from paying attention to how the material agency of documents is mediating human-environment relationships in the Anthropocene.

Following anthropogenic traces in the landscapes of Norway is also a concern for social anthropologist Marianne Lien (Chapter 10), who builds an assemblage containing human and nonhuman worlds, including the relationship between lichen and reindeer. She argues for the importance of rethinking 'the stories we live by' and how we conceptualize our relationships to the living world beyond the human. Lien invites the reader to join her in the northeastern county of Finnmark, where she has conducted fieldwork over several decades. Following the lives of people in this region, often described as 'remote' or 'peripheral,' she pays attention to a changing Arctic landscape heavily impacted by rapid ecological, social and economic changes connected to the Anthropocene. Lien shows the conflicting and often ambiguous power relations at play when categories such as 'wild,' 'natural' or 'domestic' are employed to define the ever-changing relations of humans, animals, and the broader landscapes they inhabit.

From a different disciplinary viewpoint, art theorist Ina Blom (Chapter 11) highlights the historical and technological context in which art started to produce its own dynamic interconnections between nature, technology and the social. Addressing part of the story of how modern art's environmental turn emerged, she identifies many cases where art does not simply represent or reflect on some already defined, pre-existing environment but rather engages in the construction of what she calls 'unthought' environments, new realities at the crossroads of the living and the technological, exploring and exacerbating the increasing blurring of those categories.

Taking on a different kind of art, the following contribution (Chapter 12) considers fiction from an ecocritical perspective. Literary studies scholar Sissel Furuseth shows the value of analyzing works of fiction to understand and deal with anthropogenic climate and environmental change. Furuseth argues that the growing awareness about the urgency of the ecological crisis has challenged ecocritical discourse in new ways. Following developments in Norway in particular, she gives examples of how literary representations of human–environment interactions may reveal insights into how humanity has acquired geological agency. She also highlights the centrality of postcolonial and decolonial debates in ecocriticism that are relevant, for instance, in a Norwegian context where writing about the environment is closely entwined with questions of Indigeneity and Norwegian colonization of Indigenous lands.

Finally, the Epilogue, written by Mette Halskov Hansen, China studies scholar and the current Vice-Rector for Climate, the Environment and Interdisciplinarity at the University of Oslo, begins with a story from her field research in China around the turn of the millennium. An anthropologist by training, Halskov Hansen studied in a village with a disproportionately high cancer rate. The town was located near several coal mines. She shows it is not enough to master Chinese history and politics to understand the predicaments of the villagers. To get a full understanding, one must also study the situation on different scales

– from village to government – and mobilize several disciplines. Halskov Hansen further argues for the urgency and necessity of reshaping and rethinking university education to build the kind of knowledge necessary to respond to increasingly passionate calls for change. These demands for change are not only coming from concerned activists around the globe but reverberate from the center of the international community, including the UN Secretary-General, the IPCC and UNESCO. She ends by encouraging our universities to take responsibility and offer new spaces of collaboration and radical change.

This slim volume can only provide a glimpse into the exciting and innovative scholarly work using the Anthropocene as an inspiration to rethink the ways we do research today, face enormous environmental and social challenges and reach out to other disciplines for collaboration. There are bound to be omissions. Yet, we believe that the book provides a representative cross-section of an intellectual revolution that we have the privilege of witnessing from within the university. Notwithstanding their diverse specializations, the contributors offer a surprisingly consistent vision for the future in and outside of academia, where neither the splendid isolation of the ivory tower nor the cozy boundedness of the disciplinary silo are viable options.

It is our sincere hope, as editors, that this book will open a few doors that have hitherto remained closed, that it will open minds to greater respect and curiosity reaching across the faculties and study programs, and that ours is a modest contribution toward an enhanced integration of the knowledges that make up academia. Ironically, it may very well be that the current environmental destruction and climate change lead to tighter collaboration and increased mutual curiosity between disciplines that used to be indifferent to, or ignorant of, each other.

Notes

1. The title of the lecture series 'Welcome to the Anthropocene' was inspired by an exhibition with the same name at the Deutsche Museum Munich, curated by Nina Möllers and co-hosted by the Rachel Carson Center of Environment and Society (RCC) at LMU Munich. For a virtual version of the exhibition, see: https://www.environmentandsociety.org/exhibitions/welcome-anthropocene (accessed March 3, 2022).
2. The UiO Anthropocene Lecture Series is an integral part of UiO's Honours Certificate in Environmental Humanities and Science (EHS), created by the Oslo School of Environmental Humanities to offer students from all disciplines and faculties the possibility to acquire additional knowledge on the environmental and climate crisis. The lectures are accompanied by readings and after each lecture, speakers and students meet to deepen their discussion. All lectures are open to the public and are published online. See https://www.hf.uio.no/english/research/strategic-research-areas/oseh/news-and-events/events/lecture-series/welcome-to-the-anthropocene.html (accessed April 22, 2022).
3. See for instance Lorimer 2015 for how this idea has been foundational to modern environmentalism.
4. It may be noted that shortly after the publication of the Brundtland report (1987), a Centre for Development and the Environment (SUM) was established at the University of Oslo as a response to the challenges raised in *Our Common Future*. Initially encompassing both the sciences and the humanities, the Centre soon came to be dominated by the social sciences. SUM remains a vibrant and active research center, and it is naturally represented in this book.

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One of the expected effects of climate change is an elevated tree line which again may imply increased C-uptake, but also reduced albedo. (Photo: © Dag O. Hessen)

CHAPTER 1

Connecting Climate and Culture

Bad and Good Feedbacks in the Anthropocene

Dag O. Hessen

I grew up in a period when the most naïve type of techno-optimism was fading out as it became clear that there were, in fact, limits to growth, and the flipside of growth became more obvious: there were stories of pesticides and other toxins accumulating in food webs, with loss of habitats and species and alarming news of the fate of our fresh waters. All Scandinavians at that time (the 1970s and 1980s) were aware of acid deposition, i.e. sulfuric acids originating from coal-fired plants elsewhere in Europe that caused massive, local extinctions of fish and freshwater fauna in the acid-sensitive, northern watersheds. This was also the period I was growing up close to Norway's largest lake, Mjøsa, and followed closely the progressive eutrophication with increasing blooms of algae caused by nutrient deposits. There was a real concern that this large waterbody could hit a tipping point caused by oxygen depletion in the deep waters. This would cause a vicious feedback cycle of increasing algal nutrients being released from the sediments. Eventually, during the 1980s, the 'hole in the ozone layer' and somewhat later global warming also came on the agenda, and these local, regional and global threats brought this alarming feeling of urgency, that in fact we had already entered the human era, although the term Anthropocene had not yet been coined. As a youngster searching for a purpose in life, I realized that nothing could provide more meaning than working for nature. Later on I also came in contact with Arne Næss, and his fellow philosophers Sigmund Kvaløy (later Setereng) and Peter Wessel Zapffe, and became familiar with deep ecology.

At the same time I had this attraction to science, to knowing, and to facts that brought me into a scientific career in biology, working with genomes, fluxes of carbon and other elements (reductionism in its best sense), until I gradually pieced things together into a more holistic, biogeochemical approach centered around carbon cycling and climate change which ultimately materialized in the Centre for Biogeochemistry in the Anthropocene, which I have headed in recent years. It involves several disciplines of natural sciences, but I also realize that to tackle the multiple challenges we face in the Anthropocene we need to cooperate across all scientific disciplines as well as with political, business and civil society. And, although I am a hardcore scientist, I know that facts also need to be accompanied by feelings.

The state of affairs

So, where do we stand currently? With the current trajectories of greenhouse gas emissions and ecosystem degradation, the planet is at risk of encountering serious local or regional feedback points in the Earth systems. These are driven by escalating feedback processes, which may ultimately – although, fortunately, this is unlikely – converge on large-scale or even global tipping points towards a 'Hothouse Earth' (Steffen et al. 2018). A number of positive feedback loops and potential tipping points are accentuating the risks of global change as we proceed along the trajectories of *business as usual* in the global use of energy and goods (Hessen 2019). While this awareness has undoubtedly motivated political and societal action, it is still far too slow and inefficient to avoid an average global temperature increase that would cause unprecedented damage to nature and societies. With the current rate of greenhouse gas emissions, we will have exceeded the 1.5 °C limit within eight years and the 2 °C limit within 25 years. At least beyond 2 °C global average warming, there is a serious risk of local, regional or even global disasters and tipping points, and hence there is an urgent need to achieve rapid changes in technology, but also patterns of consumption, behavior and norms. We need reinforcing and moderating interactions among climate feedbacks in: 1) biogeochemical cycles through increased emission of greenhouse gases from natural carbon pools; 2) cultural feedbacks through changes in norms, practices, and paradigms in society; and 3) political feedbacks that promote greater commitments to local, regional, and international goals and agreements, such as incentives ranging from CO_2 taxation, to public investments, as well as in law. In particular, we must consider how reinforcing (i.e. positive) feedbacks in the climate and carbon cycling interacts with sociocultural and political feedbacks, and we must identify potential entry points for stabilizing positive climate feedbacks.

There is an overwhelming scientific consensus that humankind is changing the world's climate and that urgent action is required to combat global warming (IPCC 2021). Despite a growing recognition of this urgency, CO_2 emissions continue to rise at a rapid pace, reaching an unprecedented 2.7% increase in 2018, which means that within a decade the world could reach cumulative emissions causing a global average warming of 1.5 °C. The current, most likely projections for energy use point towards a temperature increase somewhere between 2.2 and 2.7 °C by 2100 (IPCC 2021), implying also catastrophic events and an unprecedented toll on nature and societies in the near future. Such warming has critical implications for Earth system processes, many of which remain poorly understood.

We face two interrelated questions: How can we deliberately work with multiple, interacting feedback loops to help stabilize the climate? And where are the critical points of convergence? Deliberate, integral, and adaptive steps forward undoubtedly require a convergence of understandings of the relationships between natural and social tipping points. Steffen et al. (2018) explore the question: 'Is there a planetary threshold in the trajectory of the Earth System that, if crossed, could prevent stabilization in a range of intermediate temperature rises?' They highlight the self-reinforcing feedbacks that could push the Earth system onto a 'Hothouse Earth' trajectory, and focus on biophysical feedbacks such as permafrost thawing, weakening of carbon sinks, Amazon and boreal forest dieback, and decreased carbon sequestration in the oceans. Their study suggests that a 'Hothouse Earth' scenario would lead to a mean temperature increase of more than 5 °C, a point from which it would be difficult to return to a ‘normal’ situation for millennia, even as human emissions of greenhouse gases are reduced. Between the ‘stabilized Earth’ and ‘Hothouse Earth’ scenarios, there are less dramatic, yet still very harmful scenarios.

Cai et al. (2015) explore causal interactions among tipping points and their implications for society, as measured by an economic indicator of the social cost of carbon. They find that the costs increase dramatically, sometimes quite abruptly. They further conclude that the possibility of multiple interacting tipping points causing irreversible economic damage should be provoking strong mitigation action. Similarly, Steffen et al. (2018) argue that avoiding dangerous feedbacks and climatic tipping points ‘requires that humans take deliberate, integral, and adaptive steps to reduce dangerous impacts on the Earth System, effectively monitoring and changing behavior to form feedback loops that stabilize this intermediate state.’ Along the same lines, Lenton et al. (2019) argue that ‘… the consideration of tipping points helps to define that we are in a climate emergency and strengthens this year’s chorus of calls for urgent climate action – from schoolchildren to scientists, cities and countries.’

Feedbacks

From a systems perspective, a feedback is an interaction whereby the results or outcomes of a process have an amplifying or modifying effect on the system (Scheffer 2009; Hessen 2019). Feedbacks can be either negative (i.e., moderating or self-correcting, actually ‘downward spiraling’) or positive (i.e., amplifying or reinforcing).

Importantly, one feedback can trigger another feedback that moderates and/or amplifies the original feedback. In climate history, warm periods are typically driven by a number of mutually enforcing mechanisms that promote warming, as cold periods have been self-reinforcing to a level where Earth has been almost completely frozen solid. Like a very coarse thermostat, there are however pushbacks that have prevented Earth from being locked in an uninhabitably cold or warm state. Feedbacks may however push systems towards tipping points and eventually new stable states (Steffen et al. 2018). Several negative and positive feedbacks have been identified between natural and social processes at different scales, from local to regional or even global, and often related to environmental change (Lenton et al. 2008; Eriksen 2016; McKay et al. 2022). Scientific understandings and the dissemination of dangerous positive climate feedbacks that may eventually result in tipping points (e.g. permafrost thaw, forest fires and glacier melting, cf. examples below) has the potential to raise awareness and interest that may lead to social and cultural feedbacks, including new norms and greater political mobilization. When responses reach a sufficient level, they may trigger societal and political change – such as stronger international commitments and more stringent climate policies, and faster changes in technology, economic incentives, social norms and legal regulations. These, in turn may stimulate negative feedbacks aimed at limiting the magnitude and impact of climatic change. As awareness of the risks of exceeding thresholds and tipping points grows, one might expect social and political feedbacks to kick in and trigger actions to reduce the risks. It is important to understand that positive and negative here are technical terms, not normative or related to their consequences. An accelerated warming caused by iterative feedbacks is a positive feedback, but the consequences may be utterly negative. Self-reinforcing

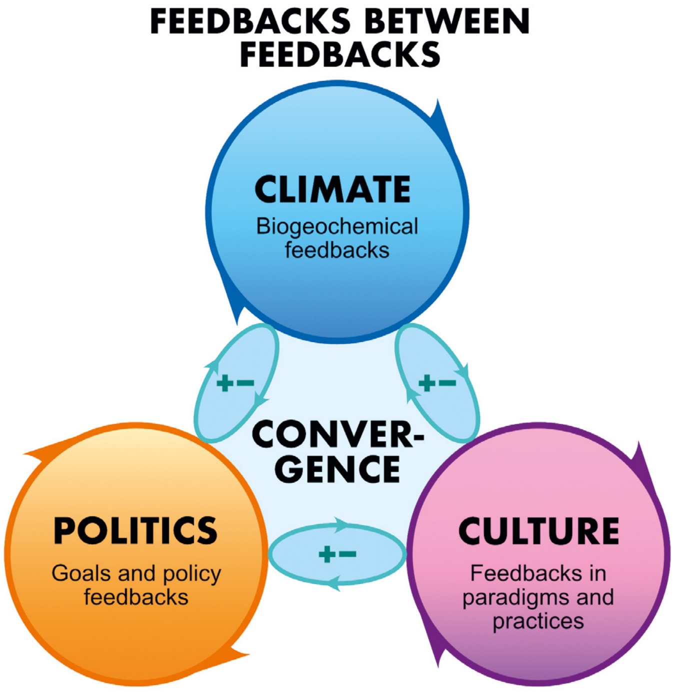

Figure 1. Conceptual iterative feedbacks within climate, sociocultural, and political realms. The arrows between the circles represent interactions among climate, society and culture, and politics, which again can constitute both positive and negative feedbacks. In the center of the figure is depicted an area of convergence where the different feedbacks interact.

changes in technology or social norms that counteract global warming are positive both in technical terms and with regard to consequences. Fig. 1. provides a conceptual outline of such iterative feedbacks within climate, sociocultural, and political realms.

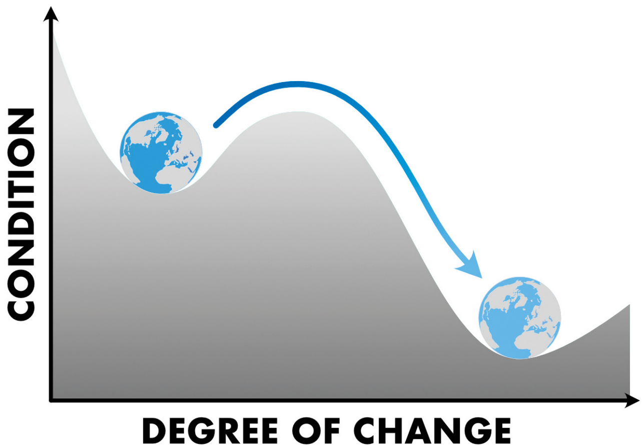

Figure 2. At sufficient perturbations, systems may flip over to a new stable state (right panel). Also tipping points are often characterized by hysteresis, i.e. a resistance against moving back to the original state. In principle, this phenomenon can occur in natural systems as well as in social and political systems. There is also a potential possibility of a global climate tipping point.

Tipping points or thresholds means that both climate systems and society will likely experience non-linear and abrupt changes, which again could be strengthened by 'feedbacks between feedbacks'. Like most positive feedbacks and tipping points in complex systems, there is an initial lack of responses due to the inherent stabilizing mechanisms (e.g. Scheffer 2009), before a threshold is reached (Fig. 2).

Despite early warnings since the mid-1960s, and growing public and political awareness and recognition of the problems since the mid-1980s (Weart 2008), progress in reducing greenhouse gas emissions has been slow, and carbon dioxide (CO_2) concentrations in the atmosphere have been rising steadily – and continue to do so. The 'information deficit' model, which holds that scientific knowledge about climate change should lead to concern and action, has been challenged in psychology research showing that both culture and emotions influence risk perception (Moser and Dilling 2011; Weber 2010; Kahan et al. 2012).

Feedbacks in biogeochemical systems

It is disputed whether the 1.5 °C or the 2 °C average increase really represent 'tipping point' temperatures, and the nature of the positive and negative feedbacks in the global carbon cycle is under regular scrutiny (Archer 2010; Hessen 2017). Nonetheless, throughout Earth's history, the mutual feedback between terrestrial systems and aquatic productivity has been essential for the evolution of the atmosphere and the global climate (Berling 2007; Lenton et al. 2008). If the current role of ecosystems as net sinks of C is reversed, it will result in a rapid increase of atmospheric CO_2, causing a vicious and dangerous feedback cycle.

There are several major positive feedbacks that could accelerate greenhouse gas (GHG) emissions and climate change. The boreal forests capture large amounts of CO_2, of which some is returned to the atmosphere, some is stored in aboveground vegetation, and some in roots, soils and wetlands. Increased warming affects these processes both in terrestrial and aquatic ecosystems in several ways:

1. Warming causes permafrost thaw that triggers decomposition of soil organic matter, releasing CO_2 and methane (CH_4), which speeds up warming (Rogeli et al. 2019).
2. Climate change results in warmer and potentially drier soils, especially in the boreal domain, mineralizing more soil organic carbon to CO_2, which again leads to increasing temperatures (Doetterl et al. 2015).
3. Less ice and snow due to warming results in reduced albedo (reduced reflectance of light), which again increases heat absorption on land and oceans, resulting in further global warming. Furthermore, increased vegetation cover reduces albedo both in the growing season and in the spring, when it triggers earlier than normal snowmelt. Vegetation also releases volatile organic compounds (VOC), affecting clouds, which trap more heat from below (Joutsenaari et al. 2015).
4. More runoff of organic carbon to aquatic systems reduces primary production (and thus uptake of CO_2), which promotes the release of CO_2 and CH_4 (Yang et al. 2015).
5. Drier forests will increase the incidence of fires, thus releasing carbon bound in forests and soils into the atmosphere, and thus leading to increased warming (Walker et al. 2019). For rainforests like the Amazon, fragmented and drying forest may in itself disrupt the internal hydrological cycle, which could potentially push the forest across a tipping point towards a savannah-like system (Lovejoy and Nobre 2018).
6. Increased concentrations of CO_2 in seawater causes marine acidification. A more acid (and warmer) ocean may sequester less C, reducing the ocean drawdown of CO_2 from the atmosphere (Doney et al. 2009).

So, what is at stake here? The boreal and Arctic biomes hold by far the largest terrestrial organic C-store, partly as woody mass, partly as belowground organic C. Vast amounts of organic C are estimated to be stored in the Arctic permafrost regions, corresponding to 50% of the terrestrially belowground C pools (Schuur et al. 2014). Current and predicted permafrost thaw will lead to biodegradation of the fossil carbon stores, causing emissions of CO_2, and also an increased risk of elevated release of CH_4 and N_2O (Turetsky et al. 2019). This will trigger climate feedback by increased warming and thus increased permafrost thaw. Moreover, a (highly uncertain) fraction of the peatlands is only partly degraded and enters the aquatic system as dissolved organic matter (DOM). This mobilization of DOM increases the export of organic C to lakes, rivers and subsequently coastal areas, thereby linking terrestrial processes to freshwater and marine areas. Increased warming will on the other hand induce a landscape greening, with vegetation expanding with latitude and altitude. This will sequester more CO_2, but also promote warming through reduced albedo, both in the growing season and in spring, when it triggers earlier snowmelt (Rydsaa et al. 2017).

Another such change is massive forest fires in the boreal zone. Recent studies in the Canadian boreal area have demonstrated how increased burning not only transfers C bound in forest into CO_2, but also C from underlying soils (Walker et al. 2019). Hence the gradual accumulation that these forests have represented may be reversed, turning these massive players in the global C balance from net sinks to sources of CO_2. The point here is that there are systemic connections leading to unanticipated consequences elsewhere in the system when one or a few parameters are changed. By nature, these abrupt changes are hard to predict with accuracy, begging for a precautionary attitude towards these risks. Moreover, since we are running out of time, the counteractive forces in terms of rapid societal changes in technology and new social norms in how we live, eat and consume is daunting.

Measurements and predictions from the natural sciences do indeed have an impact on societal and political awareness, and also motivate action, especially when supported by visual dramas. To achieve the kind of societal, political and economic feedbacks demanded for the shrinking CO_2 budget and brief timespan available, it is clear that natural sciences must be tightly interwoven with other disciplines with insights into the constraints and triggers of 'system' changes (Hessen 2019). To activate the types of cultural and political feedbacks needed to offset the positive feedbacks that could lead to climate tipping points, there is a need for an integrated approach that systemically and strategically brings together multiple disciplines and perspectives. While a number of environmental issues (e.g. freshwater acidification, ozone depletion, pesticides) have been successfully addressed through end-of-pipe solutions or by replacing harmful substances with environmentally friendly alternatives, responding to climate change and the challenges of sustainability will involve transformations across multiple, interacting spheres: the practical sphere (technologies, behavior, habits, consumption), the political sphere (norms, rules, incentives, institutions, and power relationships) and the persona sphere (beliefs, values, worldviews and paradigms) (O'Brien 2018). For such transformations to be successful, it is critical to understand the convergence of feedbacks, with particular attention to interactions among climate, cultural, and political feedbacks.

Loss of nature

The main global warming challenge is the Earth's growing thirst for energy, as 87% of the energy we consume is generated by the burning of fossil fuels. As we have seen above, nature itself is a key regulator of the global CO_2 balance by sequestering more than 50% of our emissions. This greatest of all 'ecosystem services' has ensured that we are not yet in the hothouse, but with continued degradation, forest fires, drought and heat stress, we cannot take this service for granted, unless we also protect nature. While the climate crisis is increasingly on the policy agenda, the parallel and equally disastrous global crisis is still largely going under the policy radar: the striking decline in wilderness, forests, natural ecosystems, animal populations and even global plant and animal biomass. In fact, many of the currently proposed policies aimed at 'saving the climate' may directly conflict with saving nature, often because these two issues are treated as separate challenges (cf. Bastin et al. 2019; Hessen and Vandvik 2022). The decline in wildlife populations since the onset of agriculture some ten thousand years ago is estimated at 83%, 80%, 50% and 15% for terrestrial mammals, marine mammals, plants and fish, respectively. The estimated biomass ratio of terrestrial mammals is 36% humans, 60% domestic animals and 4% wild mammals (Bar-On et al. 2018). More broadly, the abundance of naturally occurring species (across all organismal groups) has declined by 23%, natural ecosystems have declined by 47%, and as a consequence, one million species are now under threat of extinction (IPBES 2019). Among the most vulnerable systems in this respect are forests, bogs and wetlands, ecosystem components that are not only important storage pools of organic carbon, but are also essential for the terrestrial – atmospheric – aquatic water balance, both by absorbing excess water and by storing this in dry periods, which is a strong argument for explicitly incorporating and accounting for ecosystem components in climate mitigations (Scarano 2017).

Land-use change is the major driver of the loss of nature and biodiversity, and these changes are of staggering magnitude: more than 75% of terrestrial areas have now been significantly transformed by human activities, including a large fraction of the Earth's most fertile areas suited for agriculture, according to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2019). The report estimates that 83% of the global wetlands have been drained or otherwise lost since preindustrial times, and the area of global rainforests has been reduced by 50%. A consequence of these massive human landscape transformations is that 42% of the annual terrestrial photosynthetic productivity is sequestered by humans and our crops and stocks (Krausmann et al. 2013). The protection and restoration of natural ecosystems is critical for climate adaptation and mitigation, due to their capacity to sequester and store water and CO_2. Nature too has its thresholds where irreversible tipping points may be reached, both for ecosystems (like the Amazon rainforest) and for animal or plant populations. Once passed, there is a point of no return for extended periods. Should the Amazon enter a new savannah-like stable state, the tolls in terms of atmospheric outputs of CO_2, lost biodiversity and loss of Indigenous people will have global impacts for the foreseeable future, and make Earth a poorer place.

Climate, nature and human behavior

Climate and nature are intimately linked, and many Earth processes are self-sustaining and characterized by stabilizing mechanisms. Many of Earth's limits are about to be exceeded, and for some parameters we are already far above the sustainability level. The notion that we humans are on a kind of steady upward path spurs us to get up in the morning and do our bit. It quite simply makes *sense*. This is the way modern humans have resolved the yearning for a purposeful existence: life is not just about eating, surviving and reproducing, but also about constantly acquiring new insights and breaking new ground in knowledge and technology. Optimism about the future and technology were boundless in the 1950s and 1960s. Many still refuse to abandon the idea of continued growth in prosperity, because if we must abandon this, what is to fill the resulting vacuum? Who wants to reconcile themselves to retreat and regression? Well, in spite of the fact that this may run counter to continued expectations of growth and prosperity, we have to face the fact that the linear growth model that has served us well since the dawn of the industrial era is no longer morally or ecologically sustainable.

There are two sides to every coin, and all advances that imply an increased need for resources have long-term consequences that can be difficult to foresee. This is, of course, a killjoy conclusion, but that's just the way it is: if we add up our collective footprint on the planet today, we have already far exceeded the globe's carrying capacity. The question is what the future path will be. Will we be able to find measures that give us an acceptable glide path back to a stable situation that respects carrying capacity – possibly continued growth that is cautious enough to ensure that any technological advances we make will be capable of absorbing our excesses and closing the gap that has arisen? Or will we see a future growth curve where we constantly exceed carrying capacity to an even greater extent – until reality reins us in with a thoroughly brutal fall? Nobody can give a definite answer to this, but there is one thing we can say for sure: the combination of an increased population with increased demand for resources means that we will be living on expensive consumer credit in the future. The longer we hesitate to take action, the steeper and deeper the fall. We have already overdrawn our account and are now financing the party by taking on a constant stream of new consumer loans to service our growing debt.

A new awareness of this is in the air. Reports of floods, fires, droughts, heat waves and melting ice pour in weekly, supported by a steady stream of new, expert reports that underscore the seriousness of the situation. A new green wave is now rising, headed by Greta Thunberg and the young climate strikers. And while it is true that most such waves crash against the cliffs, or run out in the sand – some do leave a legacy of lasting change.

I have always seen my father's lifetime as an era in which the curve of both technology and consumption took its sharpest upward turn. My father was born into a society that had more in common with the Middle Ages than the digital society from which he eventually departed. He grew up in an island community in western Norway that was based on subsistence farming, where existence was not so very different from life in the Middle Ages or Viking times. The cultural context to which he belonged was the traditional coastal culture, where fishing and a few animals in the stables sufficed even for a large family. It was a society based on manual labor, horse-drawn ploughs and the absence of fossil fuel; it was a life built on drudgery – a daily battle to put bread on the table – and from that point of view, it is not to be viewed with nostalgia. Yet at the same time, this was also a meaningful existence precisely because its goal was to work one's way out of drudgery and poverty. Paraffin lamps were replaced with electricity, and my grandfather acquired the island's first telephone and motorboat. Society was on its way toward something better; most people also experienced tangible improvements in their lifetime, and there were no dark clouds on the horizon. The sea was endless, the heavens likewise, and it was unthinkable that we could have a negative impact on the planet. Development and modernity were perceived not just as indisputable benefits but also as a meaningful project for this generation. My father thus belonged to the first generation to share in Norway's new modern life, with all its promise. He was the country student who moved to the city, acquiring a student loan and an education, a car and housing. In his later years, he even absorbed the whole new, globalized world through the internet.

The idea – indeed the ideology – of continued growth and prosperity is difficult to relinquish for precisely these sorts of reasons. In addition to the psychological appeal of the thought of constant progress, we have also acquired an economic system that *demands* eternal growth. This makes it doubly difficult to picture an alternative. At the same time, the arguments for reining in growth are hampered by negative terms like *stagnation*, *recession*, *decline* – words that have an unattractive ring in the late capitalist culture, even for those of us on the margins of the financial world (cf. Hessen 2019).

This is one of the dilemmas of the environmental movement. And this, at any rate, is where the old movement for moderation often ended up in a bind. It doesn't much matter if your organization is called The Future in Our Hands when the prophets of growth have ownership rights on the description of reality, and moderation becomes synonymous with overly prudent rationing and regression. Part of the problem is that the people arguing against growth as the ultimate purpose of humanity have painted themselves into a rhetorical and ideological corner. 'No to ...'

has often ended up as the standard response. If the alternative to growth appears not only to be a *no to* anything that is fun, but also seems like a return to the 1960s, or worse yet the tough 1930s, few are likely to feel inclined to join in.

I do not long for a return to my father's sustainable but exhausting youth on a steep hillside farm in western Norway either, or for an existence where we eat cold porridge in the pale beam of a stinking oil lamp clad in woolen sweaters with indoor temperatures of 12 degrees Celsius. If this caricature of an existence appears to be the sole alternative to continued growth, it is hardly surprising that most people politely decline. That is why the message about reining in growth must not be presented as a *no to* but must express, to a much greater extent, what it is a *yes to*. It is a yes to more of what most of us place at the top of the list when it comes to a good life: friends, love, family, nature, time to feel that we are alive, but also reflection, long trains of thought – in fact, more quality and less quantity.

I genuinely believe that the situation *is* pretty dark, even though it is not the case that the world will 'collapse'. At the same time, I don't think there's anything wrong with being a bit terrified by the situation we are facing. A degree of anxiety can spur people to action. The fact that we suffer some pangs of conscience and, moreover, acknowledge our own personal responsibility is all to the good. It's true that this kind of thing varies from person to person, but unless we engage the emotions, half-heartedness and indifference will probably win the day. Current developments – in terms of climate, natural diversity and society's insufficient response to these challenges – give grounds for concern but not for panic, and definitely not for resignation. The acknowledgement that it *may* get very bad indeed is more like a prerequisite for the type of action we now need.

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From rocks to gravel: The face of the Earth is rapidly changing. This process is among the characteristics of the Anthropocene.
(Photo: © Henrik H. Svensen)

CHAPTER 2

Anthropocene Encounters in Deep Time

Henrik H. Svensen

A few years ago, I walked along a beach in Denmark together with a group of geologists. Limfjorden was calm, with a gentle but cool breeze. The island of Fur was quiet as the summer holiday was still a few weeks ahead. We had the beach to ourselves and walked a kilometer along the shore before arriving at the target: a steep cliffside where the sea constantly eroded the island's plateau, gradually destroying the land. The cliff is made up of sediments formerly deposited on the floor of the North Sea some 55–56 million years ago and later lifted above sea level by the forces of thick glaciers during the last ice age. The whole island, and most of Denmark, is made of former seafloor sand and mud. We study these sediments and try to reconstruct everything from ocean temperature in deep time to the erosion and even rainfall from the surrounding land masses of the past, now representing Norway, Sweden, the UK and Germany.

We were doing fieldwork on Fur primarily because the sediments contain hundreds of volcanic ash layers formed by violent volcanic eruptions that happened further northwest and in Greenland. These eruptions began 56 million years ago, precisely at the same time as the Earth went through one of the most significant known climatic changes. In just a few thousand years, the climate warmed by up to 10°c due to increased atmospheric carbon dioxide (CO_2) and methane (CH4) concentrations. The greenhouse temperatures lasted over 200,000 years and are known as the Paleocene-Eocene thermal maximum (PETM). This event is arguably the most relevant case from the geological past that we can use to understand current climate change.

We had a few ideas about what could have triggered the warming based on what we had been working on earlier. My favored hypothesis is that the carbon was released from the Earth's crust when magma rising from the mantle got stuck in sediments near the surface and heated the organic matter, oil and gas stored in the subsurface. This process is the closest we can get to the rapid, anthropogenic release of carbon from the very same crustal reservoirs: sedimentary rocks containing organic matter, oil and gas. Carbon was, and still is, transferred from rocks to the atmosphere and ocean. In the Anthropocene, we are doing the transfer ourselves.

We dug trenches along the cliffs in Denmark to get at the samples we were looking for. In one trench, a change in the color of the mud, from light grey to dark grey, showed that we had hit the target. That dark mud was deposited on the seafloor at the time the temperature of the Earth started to rise. In the same sample, it was easy to see layers of volcanic ash.

It felt both strange and sensational to hold a sample that formed at the start of the warmest period of the past 70 million years. At the same time, it represents the material remains of what is believed to be the closest deep-time analog to the Anthropocene. During the past decade, samples like this, and deep-time climates in general, have gained new importance and relevance. How did that happen, and what can the samples from Fur island and elsewhere tell us?

I first grasped the importance of the concept of the Anthropocene in 2011 when reading about the work of the Anthropocene Working Group (AWG). Since then, I have been following the discussions and developments of the concept. I soon realized that the Anthropocene sparked an interest and curiosity for geology among humanistic and social scientists. Perhaps my own interest in the Anthropocene and the PETM is mirrored by the emerging international scientific focus. My paleoclimate research developed a growing and necessary orientation toward current climate research and how we can use Earth's history to understand the future better. Looking back, it all makes sense to me. I have collected rocks since I was a kid, somehow using them to orient myself in the world.

What is the Anthropocene?

The concept of the Anthropocene was born from the emerging understanding of how the Earth system is changing by our presence and activities. Conquering nature has been a major driving force in the industrialized world for over two hundred years, including taming wildlife and extracting minerals and fuels from the Earth's crust. Industrial farming has changed the surface of the Earth, including ecosystems, and the biomass of wild mammals is only four percent of the total mass of mammals.

The recent interest in the Anthropocene was sparked following scientific discussions at a conference in Mexico in February 2000. Paul Crutzen recalled that he 'just made up the word in the spur of the moment' when thinking about how different our times are compared to the rest of the Holocene (Lewis and Maslin 2018: 21). The 'accidental Anthropocene' story is seductive, as stressed by Lewis and Maslin, because people 'love stories' and scientists feel needed when called upon to help understand what's going on: 'Like planetary environmental doctors, today's scientists can be saviors of the world' (Lewis and Maslin 2018: 25). Since the initial Anthropocene paper by Crutzen and Stoermer (2000), the Anthropocene concept has produced a complex and multifaceted field of research. Importantly, the roots of the idea can be traced centuries back in time (e.g., Davis and Oldroyd 2011; Steffen et al. 2011), showing that scientists and natural historians have been concerned about the human influence on wildlife, pollution and land-use changes long before now.

The Anthropocene is proposed to be defined as the latest epoch of geological time due to pervasive anthropogenic changes to the Earth system. At the same time, the Anthropocene represents an idea, a concept, a metaphor and a worldview (e.g., Rickards 2015; Lewis and Maslin 2018). Moreover, the Anthropocene merges deep time, historical time and even the future. My aim with this chapter is to present and discuss some key earth science aspects of the Anthropocene. Why is geology suddenly considered important for the Anthropocene? What can we learn from deep time, and how can something that occurred 56 million years ago be relevant for understanding the future?

The Earth as a system

The Anthropocene is not primarily about how we have changed the climate or modified the surface of the Earth. Cities, roads and infrastructure are constantly modifying or replacing original landforms, as is mining. However, there is more to the Anthropocene if we explore the natural science aspects. A key point is that anthropogenic changes have affected the entire Earth system and have become integral parts of Earth system science (e.g., Steffen et al. 2020). In fact, Steffen et al. (2020) describe the Anthropocene as one of several concepts born from Earth system science.

Earth system science is a holistic way to think about the Earth as composed of interacting spheres. Initial models were made during the late 1980s as a set of equations describing the transfer of mass and energy between reservoirs (e.g., Steffen et al. 2020). The Earth is accordingly divided into rocks (the lithosphere), water and ice (the hydrosphere), living organisms (the biosphere) and air (the atmosphere). This is, of course, a simplified approach, but it enables us to understand and quantify both natural and anthropogenic changes, for instance, the temperature consequences of increased CO_2 levels in the atmosphere – or how weathering of rocks may reduce the atmospheric CO_2 and cool the Earth on longer timescales. When atmospheric CO_2 dissolves in surface water, the resulting acidic water will lead to a slightly higher rate of chemical weathering of rocks. When rocks weather, dissolved elements such as calcium may end up in the oceans, where microorganisms take up both calcium and CO_2 as carbonate. These organisms eventually die and may end up on the seafloor, with the important consequence that the carbonate is removed from the fast part of the carbon cycle. This process is called silicate weathering.

The Anthropocene is based on the idea that we have changed the Earth system in such a fundamental way that we need to use deep-time examples to find something comparable. Deep time is a useful metaphor since millions and billions of years are difficult to comprehend meaningfully. Often, the mass extinctions evident in the geological record represent examples of the consequences of significant and rapid changes to the Earth system. We do not know the consequences of these ongoing changes but fear that the current configuration may become unstable and lead to mass extinction and tipping points such as thawing permafrost, changing ocean currents and collapsing ecosystems (see Lenton et al. 2019).

The challenges of introducing a new epoch of time

Discussions about the Anthropocene have long centered around the need and desire to define a new geological period. The current formalized geological epoch is called the Holocene, defined as the last 11,700 years, i.e., from when the last ice age ended. The Holocene Epoch has a very specific starting point but no end. Formally, we are still in the Holocene. What is required to terminate the Holocene and initiate the Anthropocene? If we adopt the term, when should the Anthropocene begin, and what should we use as a measure for the new time epoch? Regardless of whether we formalize the Anthropocene as an epoch of geological time, it is still a very useful concept, as stressed by the AWG:

> The currently informal term 'Anthropocene' has already proven highly useful to the global change and Earth System science research communities and thus will continue to be used. Its value as a formal geological time term to other communities continues to be discussed.

The responsibility to resolve the question about ending the Holocene was given to the Anthropocene Working Group, formed in 2009 by the International Commission on Stratigraphy. The AWG is part of the Subcommission on Quaternary Stratigraphy, which works on the timescale and systematics of sediments deposited during the past 2.6 million years. Today, the AWG has 38 members and has published several scientific papers in favor of formalizing the Anthropocene as an epoch. However, this requires resolving two main issues: How and where can we measure the Anthropocene? Based on these evaluations, when did the new time epoch start? From what appeared to be a simple task of defining the Holocene as terminated, we see the contours of a complex problem.

What does it mean to measure the Anthropocene? This is critical for the geological community, as there must be a practical way of finding out if sediments from lakes or the ocean floor were deposited in the Holocene or the Anthropocene. Is there a fossil that can be used as an indicator (i.e., a proxy) for the Anthropocene? Perhaps we can use the concentration of a particular metal associated with industrial pollution?

When a useful proxy is established, the next step is to find out exactly when the proxy started to increase above the background Holocene level. If there is no convenient and robust proxy to gauge the Anthropocene, the geological community will likely recommend keeping the Holocene for now.

One of the initial ideas was to use the industrial revolution to mark the start of the Anthropocene. Industrialization and the associated energy extraction from coal greatly impacted land use and led to significant CO_2 emissions. This was also Paul Crutzen's suggestion in 2002:

> The Anthropocene could be said to have started in the latter part of the eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane. This date also happens to coincide with James Watt's design of the steam engine in 1784 (Crutzen 2002).

However, using the industrial revolution as a starting point is not ideal for defining an epoch of time. Industrialization cannot be *measured* meaningfully globally and did not begin simultaneously worldwide. This means that industrialization is not a synchronous event and thus cannot be used to define a global epoch. Even the increase in atmospheric CO_2 from the mid-1900s is problematic since CO_2 concentration is difficult to reconstruct based on proxies, and the atmospheric increase was, after all, rather gradual. In theory, we could define the Anthropocene starting from the year the atmospheric CO_2 rose above a certain level, e.g., 350 ppm, but how would you measure this if you take samples from, for instance, seafloor sediments? Past CO_2 concentrations are difficult to quantify, and the available proxies are simply not precise enough for such a purpose. See Paleo-co2.org (2023) for an overview of accepted proxies and the results of CO_2 reconstruction for the past 70 million years.

During a conference in Cape Town in 2016, the AWG members formally voted on what they regarded as the best proxy to use for the Anthropocene. The result showed a clear preference for 'the artificial radionuclides spread worldwide by the thermonuclear bomb tests from the early 1950s' (Anthropocene Working Group (2023)). The alternative proxies included plastics and aluminum. This means that we can use sediments and ice cores to define the onset of the Anthropocene in localities worldwide by measuring certain radioactive elements. The next step for the AWG is to find the best locality to use when defining the transition from the Holocene to the Anthropocene. That locality will then be used as a gold standard by the community.

Let's take a closer look at the geological archive to better understand how changes in the Earth system are recorded and how time periods are defined.

A hierarchy of geological time

Sedimentary rocks represent our natural archive when we reconstruct deep-time environments and climates. We also use this archive when defining time, either by characteristic fossils, changes in sediment types or the content of certain elements and their isotopes. The onset of the PETM is, for instance, defined as an anomaly in the isotopes of carbon preserved in the organic matter in sediments or carbonate minerals in limestone. Other periods are defined by rapid changes in the number of species worldwide. When the number of species is reduced by 75 percent, we define this as a mass extinction if the reduction occurs within a limited period, typically one million years or less.

Mass extinctions represent fundamental perturbations of the Earth system and are often accompanied by marked changes in the colors or types of sedimentary strata. The content of fossils shows the presence of distinctly different faunas before and after extinctions. For these reasons, mass extinctions often define boundaries between time units. Eons, eras, periods and epochs are the main elements in the hierarchy of geological time (Murphy et al. 2023). Eons are the most fundamental, and the eon we live in, the Phanerozoic, began 541 million years ago with the appearance of complex life forms in the oceans. The most dramatic events on Earth affect this hierarchy at the second upper level, the era level. The boundaries between the three most recent eras (Paleozoic, Mesozoic, Cenozoic) are defined by two mass extinctions: the Permian and the Triassic ('P-T boundary,' 251.9 million years ago) and the Cretaceous and Paleogene ('K-Pg boundary,' 66 million years ago).

The most recent time period is the Quaternary, which started 2.58 million years ago with the glaciations in the northern hemisphere. The Quaternary is subdivided into two epochs: the Pleistocene and the Holocene. The AWG has suggested that the Anthropocene belongs at the epoch level in the geological time system, although earlier discussions did not exclude the possibility of the Anthropocene belonging to the level of periods or even eras.

Mass extinctions and climate change

The P-T boundary was the most severe known mass extinction and is used to define a change from the Paleozoic to the Mesozoic Era. The extinction resulted in a 96 percent loss of species and ten million years of environmental crises characterized by extreme temperatures, acidic oceans and a severe loss of vegetation on the continents. The extinction likely began with the massive release of CO_2 from the Earth's crust, triggered by volcanic activity in East Siberia 251.9 million years ago (e.g., Svensen et al. 2009). The era change at the Cretaceous-Paleogene (K-Pg) boundary was initiated by the vast meteorite impact 66 million years ago. The impact occurred in Mexico and the Gulf of Mexico and left the 180-kilometer-wide Chicxulub crater.

Both these crises occurred on short timescales ranging from hours and days to millennia, even though they represent entirely different scenarios. The development of these crises is well known from detailed studies of coevally deposited sedimentary layers. Studying localities worldwide is crucial to understand global changes. This is equivalent to the science being done to understand how the Earth is changing today. We need measurements and observations from as many places as possible. One example is the global temperature increase of recent decades, which is based on measurements from thousands of meteorological stations across the world. We can never study or know the earlier Earth in equivalent detail for a given time period. For some important events, like the well-studied K-Pg boundary, we have data from more than 350 localities worldwide, of which at least 105 represent terrestrial localities, the rest being oceanic (c.f. Vajda and Bercovici 2014). When going further back in time, reconstructions of Earth are based on fewer localities, and the uncertainties increase. Today we measure Earth system changes on a timescale of hours and days. In deep time, we are lucky if the geological archive has a resolution of one thousand years per sample. Still, we study rocks with all possible methods to reconstruct the deep past.

One example is a project about the P-T boundary on Svalbard that involved analyzing every millimeter of preserved mudstones, identifying fossils and measuring the concentrations of certain elements (Zuchuat et al. 2020). The concentrations of isotopes of carbon are particularly useful for understanding changes in greenhouse gases. Metals such as aluminum, titanium, lithium, chromium, uranium and mercury are used to reconstruct everything from how much erosion took place on the continents, to the oxygen level in the ocean, to the extent of explosive volcanic eruption. The decline in the number of fossil species and genera tells us about the severity of the extinctions. All in all, the mass extinctions represent complex events where all the spheres underwent significant and long-lasting changes.

Whereas the mass extinctions mentioned above have been known for about 150 years, climate change during the Paleocene-Eocene Thermal Maximum (PETM) is a quite recent discovery. The PETM is defined at the same hierarchic level as the Anthropocene – i.e., an epoch – and took place 56 million years ago. It is also the best example of greenhouse gas-driven climate change from the past 180 million years.

What is the PETM?

The PETM was initially discovered as an extinction event that mainly affected a single-celled marine organism called foraminifera. This extinction was discovered in the 1980s (e.g., Thomas 1989) and was believed to have lasted less than 20,000 years, likely caused by oxygen-poor ocean waters. The 1980s was an exciting decade for geoscience, kick-started on June 6, 1980, with a paper in the journal *Science* about the K-Pg boundary mass extinction and the link to a meteorite impact (Alvarez et al. 1980). One of the lasting legacies of that work is that catastrophic changes on a global scale can happen on a timescale of minutes and days. Previously, millions of years were believed to be required for substantial changes to happen. The initial PETM work of Thomas (1989) showed that even processes in the ocean leading to extinction can happen fast. Deep time got shallower and closer to understandable timescales, even approaching historical time. Today we take this insight for granted, but it is important to remember that the discovery of rapid changes to the Earth system represents a fundamentally new way of thinking about the Earth.

Kennett and Stott published the first detailed PETM study in 1991, and they suggested that the event was not restricted to the oceans but could have involved surface global warming (Kennett and Stott 1991). During the 1990s, numerous studies showed that the carbon cycle was indeed disturbed by adding a lot of carbon to the atmosphere. The proxy used to draw this conclusion is the isotopes of carbon in sedimentary rocks worldwide (see Sluijs et al. 2007). For the past 30 years, the PETM has developed as an important research topic within the Earth sciences. Part of its importance is the triggering of greenhouse gases released from the Earth's crust. Much of the carbon must have come from the organic matter and oil and gas reservoirs stored in sedimentary basins. Some of the carbon was likely sourced from volcanic eruptions – the same eruptions that gave rise to the volcanic ash layers on Fur in Denmark. The full magnitude of the carbon release was about tenfold that of the past century's total anthropogenic emissions, but the annual carbon release was only one-tenth of the anthropogenic emissions, i.e., around one billion tons of carbon per year. To summarize, the PETM resulted in a 10°C warmer hothouse that lasted for 200,000 years but was triggered by a significantly smaller carbon release than today.

Figure 1. A rock from the Eocene sedimentary strata at Fur, Denmark. The black layers represent volcanic ash sourced from hundreds of kilometers away. The ash fell from the atmosphere 56 million years ago and was deposited on the seafloor of the North Sea. (Photo: © Henrik H. Svensen)

Lessons from deep time

There are marked differences between the current and deep-time Earth. The continents were located in different positions, including the positions of mountain ranges, but several continents have been located more or less at the same latitude for the past 100 million years. The ocean currents and seaways did not flow as they do today. The connection between the Atlantic and Arctic oceans is fairly recent (during the past 50 million years). The CO_2 level in the atmosphere, hence the temperature, has varied a lot. Before the PETM started 56 million years ago, the background CO_2 level was about twice as high as today. The current CO_2 emissions are, however, tenfold those of the PETM, leading some scientists to suggest that we are heading toward a 'no-analog state' (Zeebe et al. 2016), i.e., that we cannot use deep-time examples to understand what might happen if anthropogenic emissions continue to rise. In deep time when the world got warmer, the biosphere could adjust by moving habitats, only hindered by natural barriers like mountains or oceans. The sixth mass extinction is not yet a mass extinction compared to deep-time examples, but it still represents increased species rarity and loss. The sixth mass extinction represents a projection of the current species loss into the future (one million years), which is then compared to the fossil record (Barnosky et al. 2011).

As a geologist, I study deep time with the present in mind. It is, however, not obvious how we can use knowledge and findings from the deep past. For instance, can the Anthropocene be compared to the K-Pg boundary and an extinction by impact? Or is the extreme climate change during the PETM a better comparison? And in case we can somehow use information from the past, how should we use the deep-time events? Should we use them as case studies, direct comparisons, analogs, or examples to learn from? On top of this, deep-time events may become political due to the Anthropocene, as noted by Sluijs et al. in 2007:

> Given the probable ties between releases of near-modern levels of carbon-based greenhouse gases and PETM climatic and biotic change, the PETM has developed as a provocative geological case study in global change, and many of the event's characteristics and mechanisms are under intensive study (Sluijs et al. 2007).

A possible way to further understand how we may use past events is to analyze how scientists describe them. I have been part of a cross-disciplinary project studying several key papers about the PETM (Svensen et al. 2019). We have explored how the PETM is framed and used as an example of 'extreme climatic warming' in four cases across different scientific genres. These genres represent different knowledge platforms, including an IPCC scientific consensus report (Jansen et al. 2007), a popular science book (Hansen 2009), a scientific paper (Zeebe et al. 2016) and a commentary article in the journal *Science* (Alley 2016).

Zeebe et al. (2016) use climate modeling to better constrain how much carbon was released during the PETM and compare the estimates with the anthropogenic emissions. The overall conclusion is that the current carbon release rate is 'unprecedented during the past 66 million years.' Consequently, Zeebe et al. use the term 'no-analog state' for the anthropogenic carbon emission scenario, resulting in 'a fundamental challenge in constraining future climate projections.'

The IPCC considers the scientific knowledge about the PETM too uncertain to draw conclusions from. The main reason is the way IPCC evaluates past climates and their search for robust figures on how many degrees of warming a doubling of the atmospheric CO_2 level will lead to (i.e., the climate sensitivity). This represents a very practical and perhaps narrow use of paleoclimate studies. Our analysis shows that the PETM may still contribute to the scientific understanding of ongoing climate change by being presented as an example. For Alley (2016), the PETM is regarded as a 'heated mirror for future climate.' Although the PETM is regarded as too uncertain to guide present-day climate change modeling, we found that it is still considered morally significant and can influence public opinion and policymaking (Svensen et al. 2019).

Anthropocene perspectives on the Earth

The Anthropocene discussions of the past decade have resulted in new concepts intimately tied to Earth system changes and how we understand our times. These new concepts include the technosphere, tipping points, the sixth mass extinction, the Great Acceleration (since around 1950) and planetary boundaries (e.g., Zalasiewicz et al. 2017; McNeill and Engelke 2014; Rockström et al. 2009). A discussion of these concepts is beyond the scope of this chapter, but a brief mention is still useful.

As stressed by Steffen et al. (2020), planetary boundaries link 'biophysical understanding of the Earth (states, fluxes, nonlinearities, tipping elements) to the policy and governance communities at the global level.' Several suggested boundaries are also important for understanding deep-time events, like the average temperature, acidity and level of ocean nutrients and atmospheric ozone concentration. Several of the planetary boundaries are connected to how we have changed the surface of the Earth through agriculture and the construction of infrastructure. One of the surprising turns recently is that the material parts of the Anthropocene are suggested to represent a new sphere in the Earth system: the Technosphere (Zalasiewicz et al. 2017).

The Great Acceleration is a term used for the combined increase in socioeconomic and natural trends following the Second World War (McNeill and Engelke 2014). The Great Acceleration is just another way of approaching the Anthropocene and is, in fact, part of the definition for the onset of the Anthropocene (Syvitski et al. 2020). These trends resemble, in several ways, the escalating changes that characterize past crises like the P-T boundary and the PETM.

The understanding of the present and the past are intimately linked. When thinking about all the complexities and research possibilities following the introduction of one new word – the Anthropocene – my mind wanders back to the beach on Fur. I'm exploring rocks that are somehow part of both deep-time climate change and the grand narrative about how one species has changed the Earth. The former mud from the floor of the North Sea, now sedimentary rocks exposed along a cliff (Jones et al. 2019; Stokke et al. 2020), are charged with a meaning it would have been impossible to understand when I started studying geology in the 1990s.

Together with colleagues, I will be part of a new project about the PETM in Denmark, hoping to learn more about its relevance to the Anthropocene. At the same time, the research into the Anthropocene and the current changes that are taking place will likely also change my perception of deep-time climate change.

Acknowledgments

I would like to thank the Norwegian Research Council for support of two projects with grant numbers 223272 (a Centre of Excellence grant to CEED) and 324690 (the project Gardening the Globe).

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CHAPTER 3

Sustainability and Law in the Anthropocene

Beate Sjåfjell*

When I started working on my doctoral thesis in law in 2003, I had chosen a topic relevant to business because my subsequent plan was to work in one of the major law firms in Oslo. Starting my research on the highly specific theme of the regulation of uninvited takeovers of control of companies listed on stock exchanges, I brought to this work a conviction that in any area of law, a scholar should check whether people or the environment are affected in any way and if so, investigate whether they are given appropriate consideration. My conviction was based on an intuitive recognition that the environment is the basis for all life and a deep affinity for all living beings.

My expectation was that I would check this out and move on, concentrating on the nitty-gritty of takeover rules. Instead, it became the start of an academic career that has at its core the role of business law in ensuring the transition to sustainability. Through extensive collaboration in the SMART Project (2016–2020) and beyond, I have come to understand sustainability as securing social foundations for people everywhere now and for the future, while mitigating pressures on the environmental limits of this planet (Leach et al. 2013; Raworth 2012; Rockström et al. 2009; Steffen et al. 2011; see also Meadows et al. 1972).[1]

Talking about people and the environment in a business law context was frowned upon in 2003. Indeed, it was suggested that I was in the wrong field – if that was my interest, I ought to be doing research on human rights law or environmental law. Now, especially after the adoption of the United Nations Sustainable Development Goals (SDGs) in 2015 (United Nations 2015), there is much sustainability talk in all areas of business and related to business. However, it is often unclear what the underlying concept of sustainability is or, indeed, if there is any underlying concept at all. There is much 'sustainability washing' (using references to sustainability to cover over continued unsustainable business) and 'sustainability wishing'[2] (for example, business goals related to sustainability without clear plans on how to achieve them). It is therefore crucial to begin any discussion of sustainability by clarifying how the concept itself is used. Despite the great impetus the SDGs have given to the debate, they will not be my analytical starting point. I will start by introducing the research-based concept that I will apply in this chapter and explaining its relationship to the SDGs.

Working on my doctoral thesis, I discovered two things at an early stage: Law recognizes sustainability on an overarching level, yet in many practically important areas, law has not managed to implement that recognition. It has become increasingly clear to me that law is of crucial importance to securing sustainability, while at the same time, law has failed us. And yet, there is hope.

Law is essential for achieving all large-scale societal and structural changes. Some key questions are: Why does law have such significance in the context of sustainability? How has law failed us? And what, if any, are still law's possibilities for contributing to sustainability? Throughout this chapter, I will use examples from my area of research on business, law and sustainability and the European legal context.

Sustainability: a research-based concept

The United Nations Secretary-General António Guterres stated upon releasing the Intergovernmental Panel on Climate Change's 2021 report that climate change is a 'code red' for humanity. Understandably, sustainability is often conflated with climate change. And indeed, climate change is one of the grand challenges of our time. But climate is not the only code red – we have a whole range of code reds for humanity, as the planetary boundaries research amply demonstrates.

The planetary boundaries framework was first developed under the leadership of Johan Rockström, then director of Stockholm Resilience Centre. Rockström brought together an international team of natural scientists to try to identify what is intuitively obvious to most of us if we think about it: there must be biophysical limits to what we can do on this Earth. There must be limits to how much we can extract from and dump back into nature – in the ground, freshwater, oceans and air – and still expect this one planet to continue being a relatively safe space for humanity as it has been for around 12,000 years (Waters et al. 2016).

The first article (Rockström et al. 2009) identified nine planetary boundaries, in other words, nine Earth system processes that together make up the conditions for what we today refer to as the Holocene. It also showed that human activity had caused the transgression of three of the hitherto identified nine boundaries. The planetary boundaries framework has been criticized, interrogated, contributed to and strengthened by the work of scholars from around the world. In 2015, Will Steffen et al. concluded that four planetary boundaries had been transgressed (Steffen et al. 2015), while work under the leadership of Linn Persson et al. in 2022 demonstrates that the previously not quantified boundary of 'novel entities' (microplastics, nanomaterials and various other forms of chemical pollution) has also clearly been transgressed (Persson et al. 2022). Further, in 2020 Tom Gleeson et al. argued that the water boundary has already been transgressed (Gleeson et al. 2020).

All this shows that it is about more than climate, that there are actual limits that cannot be erased by referencing political, economic or business realities, and that despite all the talk of sustainability, we are still on a very certain path towards a very uncertain future.

As the introduction to this book will have spelled out, the alarming situation of planetary boundaries being transgressed is the reason why the geological epoch we are in now is increasingly being referred to as the Anthropocene – an era shaped by human activity.

And yet, any mention of 'human activity' as the cause of the current disruptions of Earth system processes is a gross simplification of the causes and consequences of the Anthropocene and ignores the inequalities and injustices perpetrated against much of humanity in the name of economic development (Hickel 2017; Cornell 2022). Sustainability is therefore also very much about social justice.[3]

Kate Raworth has contributed greatly to developing an integrated concept of sustainability by positioning the social foundations for humanity within the figure illustrating planetary boundaries, and asserting that it is not just about a *safe* space for humanity, it is about a safe *and just* space (Raworth 2012). Together with Rockström and Raworth, Melissa Leach introduced the vital idea of pathways toward such a safe and just space (Leach et al. 2013). The safe and just space for humanity has since become a reference point for sustainability-oriented scholars, civil society and increasingly also policymakers.

Raworth's work is based on the political consensus in the UN deliberations and adoption of the SDGs. As she emphasizes, the minimum requirement intrinsic to securing social foundations for humanity now and in the future is ensuring basic human rights are realized (Raworth 2012). In a similar way as the scientific basis for the planetary boundaries framework must continuously evolve in light of new understanding of what is 'safe', attempts at defining and pursuing the social foundations must be rigorously interrogated in light of what is 'just'. This cannot be exhaustively defined by the SDGs or by a minimalistic approach to human rights. We should therefore look beyond human rights when defining the social foundations; this is also about 'questions of justice and inequality relating to global patterns of consumption and production, resource allocation, benefit distribution, and so on' (Kotzé and Kim 2019).

What does all this mean for the SDGs? The 'sustainable development' of the SDGs is a policy-focused concept. The SDGs should outline the process of getting to a state that is 'sustainable' for all living beings on this planet; in other words, 'sustainability' describes conditions of a system that can sustain itself far into the future. Taken at face value, the SDGs are internally inconsistent and in conflict with each other, notably with the aim of infinite economic growth for all countries at all times and without any recognition of ecological limits. Also, crucial aspects of sustainability, notably Indigenous peoples' interests, are not well enough included (DeLuca 2017).

For the SDGs to serve as guidance for fruitful ways forward, therefore, they should be interpreted within a research-based concept that recognizes that we live on one finite planet (Sjåfjell et al. 2020). Efforts to resolve any aspects of sustainability, including climate change, must always be positioned within an understanding of the integrated, dynamic, interconnected and complex nature of the aim of sustainability as a safe and just space for humanity (Daly 1991; Ekins et al. 2003; Roome 2011, Leach, Raworth and Rockström 2013). I take the complexity and interconnectedness of this research-based concept of sustainability with me as I turn to the significance of law.

The significance of law and how law has failed us

The significance of law

Law is one of society's most powerful tools for achieving societal goals. Societal goals can be, and to some extent are, formulated in law as overarching objectives, by which all public sector initiatives and actions should be measured. We can see this, for example, in national constitutions and in the Treaty goals of the European Union. Such overarching legislative objectives can shape how laws, policies and concrete actions are implemented and the parameters by which the actions are assessed. Law is not only relevant to the public sector. Law sets out the rights and duties for public and private individuals – in other words, for states, regions, municipalities and individual people, companies and pension funds, to mention some examples. The rights and duties established by law and how they are enforced – or not – contributes to shaping the societies in which we live and how we perceive our own role and that of others. Law has a constitutive role. For example, what is often referred to as free markets depend on the rights and duties set out in law. A market without rules is not one where the law of the market prevails but that of the jungle (Rajan and Zingales 2004). Without some form of legal rights and duties, nothing could be safely bought or sold, no contracts could be entered into, and no property could be developed – or kept safe from development.

Law contributes to our conceptualization of what is right and what is unacceptable. This includes the relationship between nature, on the one hand, and societies, individuals and businesses, ranging from the local corner store to multinational corporate groups, on the other. Is nature a free for all unless protected by property rights? Can states and individuals, companies and investors, take and exploit what they want from nature and dump what they don't want back into it – in the oceans, rivers, air or ground? Is nature a source of 'eco-system services' for which we must try to find good prices so that it is not overused, or does nature have its own intrinsic rights? Do trees have rights (Stone 2010)? Can rivers have rights (O'Donnell 2018)? Are (nonhuman) animals legal subjects or only objects ('things') (Shyam 2015)? These are all questions where law conceptualizes and contributes to how we see the world around us.

Law also shapes how we deem what is fair and just in relation to other people. An obvious historical example is the abolition of slavery (Reuters staff 2007). That slavery still exists today in some forms is one aspect of the failure of law that I will return to below. Law sets out fundamental criteria for when and to what extent people can decide over their own lives and whether people of different genders and different origins should be regarded as fully equal. Law determines how to secure the basic welfare conditions of each individual and sets into place systems of distribution through taxation and public services. Law also determines some basic conditions for the employment of people in the public sector and in businesses and whether and how people can create their own jobs. Law can also contribute strongly to conceptualizing how a society should respond to people in other societies, including what is perceived as fair treatment of immigrants or refugees and to what extent one society should concern itself with the treatment of people in other societies, for example through the global value chains of businesses.

Law does not act in a vacuum. Putting into place rules that are in conflict with dominant social norms may not have the intended effect. But law can also change social norms (Elster 2015). If legislators decide that deeply ingrained habits in society must change, mandatory rules that are followed up and enforced, sanctioning those who don't comply, can achieve changes quite quickly. The ban on smoking in public places illustrates this, both in the sense of how it has changed social norms and how the result varies depending on how strong the pro-smoking social norms were and how effective (or not) public enforcement of the laws was (Origo and Lucifora 2013). Social norms can also contribute to changing laws; one example being civil society activism leading to a recognition of animals as sentient beings in the Treaty of European Union (D'Silva 2020).

Law's failure

Considering the significance of law as one of society's most powerful tools alongside the extreme unsustainabilities of our time lends itself to the conclusion that law has failed us. And that, unfortunately, is a correct conclusion.

Law has conceptualized and encouraged the use of the company, a main legal form for organizing business. The company is an innovative invention – as important for economic development as the contract was in Roman law. It allows entrepreneurs with innovative ideas to use the company form to be able to follow up on the business idea without risking everything personally if the business fails and allows for the influx of capital from a range of investors with the same protection. We call these investors shareholders. It is the company that owns the business and is responsible for the obligations and debts of the business. Law has allowed also for companies to become shareholders in companies, thereby creating the basis for enormous multinational corporate groups, with the company controlling the group – which we call the parent company – reaping the benefits if the corporate group goes well. As a starting point the parent company is without liability if something goes wrong somewhere in the corporate group. This is further exacerbated through the use of the legal device of the contract, allowing for the establishment of long supply chains often spanning the globe – referred to as global value chains. I use this as an example of law's failure because it is such an extreme one. Through these corporate groups and global value chains, we see an outsourcing not only of the production of goods but also of the responsibility, accountability and liability for harm resulting from that production. And these are not exceptions to a rule of a well-functioning system. On the contrary, you can expect that when you buy a product in a shop in Europe, more often than not, the product will have come to that shop through a process based on exploitation of people, destruction of the environment and the undermining of the economic bases for well-functioning societies (Sjåfjell 2020). How could this happen?

This failure of law is partly a result of silo-thinking, or compartmentalization, in law. By this I mean that there are different areas of law for various aspects, such as environmental law for the protection of the environment, labour law for employee-related issues, human rights law for human rights, tax law for taxation issues – and company law setting out the regulatory infrastructure for companies. Ideally, these areas of law should work together and aim to support each other's purposes. But instead, we see that the mere existence of environmental law and human rights law, to take two examples, has been seen as reasons not to discuss environmental and human rights issues in company law (remember my experience when starting on my doctoral thesis?). Company law, which for historical reasons (being a new invention) needed to set out the rules regulating the relationship between the company and especially its shareholders, has allowed certain ideas to develop. One such influential idea is that the shareholders' interests are the most important interest to be considered in and by companies.

Combined with the tension between companies, being creatures of national law, and business (employing companies as elements of their structures as explained above) being globalized, this has left vital elements of sustainability relatively unprotected. We can see this as a compartmentalization also between the laws of various nation states and between the various layers of law (notably international and national law). Indeed, there is an inverted relationship between the competence of law and the need for regulation. Sustainability is a global problem, albeit one with localized causes and effects. Business, as a significant driver of unsustainability and with the power to be a part of the solution, is globalized, while the strongest competence to regulate still lies with national legislators and regulators, who often hesitate to regulate, fearing regulatory competition (business relocating to other jurisdictions).

While company law is an extreme and therefore also very apt example, what I have described here with company law is also a general failure of law. Economic efficiency theories have underpinned much of legal regulation, leading to environmental law that attempts some pollution control but is not a law of environmental sustainability. Environmental law very rarely sets standards of environmental protection that are high enough to prevent the continuous degradation of nature, nor does it require the level of regeneration of nature that is urgently needed. We have seen some, albeit insufficient, success in Europe in protecting nature but very little in ensuring that our economic development is not based on destruction of nature in other parts of the world. While gender equality, labour standards and (other) human rights do have some success stories to share, we see the continuation of slavery in modern forms across global value chains of European companies. Also in Europe, law has not managed to protect rights of Indigenous peoples, and across global value chains of European companies, their lands are exploited, and invisible workers without decent working conditions produce the goods we buy.

Capra and Mattei provide an interesting analysis to understand the background to law's failure, comparing the development of natural science from a mechanistic approach to a systems-based understanding of the ecology of our Earth, while law has continued on its mechanistic path (Capra and Mattei 2015). Capra and Mattei also identify a fundamental flaw in much of the public debate on how to secure vital societal interests.

These debates often take opposite starting points – arguing for a greater role for the public sector or the private sector, for state intervention or for leaving it to the market. However, these are often really two sides of the same coin, both about property and power – while what we need is community and collaboration around our commons (Capra and Mattei 2015; Ostrom 1990).

In addition to silo thinking, law can be rigid and static in a rapidly changing society and tends to reflect values and interests of those with power. Law is never value-neutral. Law is always the result of struggle. Law must be continuously interrogated on the values on which it is based. Suggestions for changes to law should be seen as valid as suggestions to maintain the status quo. If not, we risk continuous path-dependent perpetuations of inequality. European countries have left their colonial histories more or less behind. Yet, with law's strongly compartmentalized approach, law has allowed what Jason Hickel describes as a new form of colonization through business, with illicit financial flows (the shifting of money from where the value is created, to or through tax havens, to the pockets of investors) undermining the bases for well-functioning welfare systems in previously colonized states (Hickel 2017).

Is there no hope, then, in the existing legal systems? I believe there is. In the next section, I will take you through some of the possibilities while also continuing to reflect on the shortcomings of law.

Law's possibilities

To give some indication of law's possibilities, I will draw on international laws and policies, European Union law, as well as mention examples from European nation states. I mentioned earlier that law does not exist in a vacuum, highlighting the interaction between law and social norms (which is not in itself a clear-cut distinction, but that is a topic for another discussion). I will return to this here, as developments in sustainability-oriented social norms and the way these are slowly being integrated into law are amongst the aspects that give hope. At the same time, we see a continuing tension with economic efficiency theories and social norms based on these, which serve to narrow the possibilities law gives various actors, including businesses, investors, public procurers and consumers, to make sustainability-oriented decisions (Sjåfjell and Mähönen 2022; Sjåfjell and Taylor 2019). Across all levels of law, the international trend of lawsuits against companies and states by civil society, investors and the public sector, also contribute to giving hope, with courts showing their ability to be guardians of overarching sustainability goals (European Coalition for Corporate Justice 2021).

Law's recognition of planetary boundaries

The international community has created a vast body of international environmental law that promotes various environmental aspects of sustainability. The recognition of the ecological limits of our planet (planetary boundaries) is reflected to varying degrees in the body of environmental law. The most prominent of international environmental regimes is the ongoing legal process to tackle climate change. The climate change regime was created by concluding the 1992 United Nations Framework Convention on Climate Change. This was followed by the conclusion of the Kyoto Protocol in 1998 and the Paris Agreement in 2015. However, these international environmental regimes, including the Paris Agreement, are insufficient to ensure that we stay within planetary boundaries (Häyhä et al. 2018). A possible exception is stratospheric ozone depletion. This was a severe threat in the late twentieth century but now appears to be coming under control following the successful implementation of the Montreal Protocol, which phases out the production of the atmospherically active substances responsible for ozone loss.

A smart regulatory mix on several levels is necessary to ensure sufficient environmental protection to mitigate the increasing risk involved in transgression of other planetary boundaries, including climate change and biodiversity. On the EU level, environmental protection is recognized as an overarching objective of EU law, highlighted by the Courts, set out in the EU Treaties, and including a horizontal duty (a duty applicable across all areas of EU law), to integrate environmental protection requirements in all areas and activities of the EU with the aim of a sustainable development (Sjåfjell 2019). Increasingly, national constitutions are also setting out overarching environmental goals, and yet, environmental law remains characterized by weak enforcement and a striking lack of compliance (UNEP 2019). The Rights of Nature movement (Putzer et al. 2022) together with the international trend of lawsuits against businesses and states (European Coalition of Corporate Justice 2021), illustrate the creativity, determination and desperation in using law to attempt to mitigate the failures of law.

Law's protection of social foundations

Human rights, as set out already in the 1948 Universal Declaration of Human Rights, include the right to life (and thereby to sufficient water, food and medicine); the right not to be held in slavery or servitude; the right to equality and not to be discriminated against; and the right to work and to 'just and favorable conditions' of work, including remuneration that ensures workers and their families 'an existence worthy of human dignity' (Universal Declaration of Human Rights 1948).

While a European perspective on human rights may have tended to focus on civil and political rights, in a global perspective, fundamental human rights are inextricably connected to a viable environment: the right, not only to life, but to the basics needed to be able to live: water, food and health. This is increasingly recognized also on the EU level. The EU Treaties set out the importance of the social aspects of sustainable development for EU policies and activities, both within Europe and globally. The aim of the European Union is to 'promote peace, its values and the well-being of its peoples,' Article 3(1) of the Treaty of the European Union (TEU), with the values set out in Article 2 TEU: 'respect for human dignity, freedom, democracy, equality, the rule of law and respect for human rights, including the rights of persons belonging to minorities.'

Discussing human rights in the context of sustainability, of securing social foundations of humanity, gives rise to the question of whether protecting human rights – including socioeconomic rights – is sufficient (Moyn 2018). Indeed, the 'safe and just operating space' framework may be seen as a criticism, indicating that the human rights movement has not done enough (Kotzé 2019).

In the context of business, the UN Guiding Principles on Business and Human Rights (UNGPs 2011) set out that 'internationally recognised human rights' are recognized as the 'benchmarks against which other social actors assess the human rights impacts of business enterprises' (UNGPs, Principle 12, commentary), as a minimum those rights expressed in the International Bill of Human Rights. Additional standards include the human rights of 'specific groups or populations that require particular attention', elaborated on in United Nations instruments regarding the 'rights of indigenous peoples; women; national or ethnic, religious and linguistic minorities; children; persons with disabilities; and migrant workers and their families.' The elimination of discrimination in respect of employment and occupation, whether on the basis of gender, race, age, disability or migrant status, is crucial (Novitz 2020).

On international and European level, we have elaborate laws in place that can be viewed in the context of securing the economic bases for domestic welfare states, including international instruments (core OECD instruments) against corruption and regarding taxation. These are crucial governance issues and are included in OECD Guidelines for Multinational Enterprises.

Law for sustainability?

Sustainability is a general principle of international law, and as I indicated above, a range of international conventions aim to secure various aspects of sustainability. Yet, generally international law tends to consist of compromise texts, strong on objectives and weak on implementation, relying heavily on the individual nation states to follow up. Despite their weaknesses, the SDGs are an important expression of internationally accepted social norms of sustainability. They have given impetus to debates on how to achieve sustainability. In the area of business, the OECD Guidelines for Multinational Enterprises (OECD 1976) have, through several rounds of revisions and with their innovative mechanism of national contact points, contributed to a gradual shift in social norms regarding expectations to and within businesses.

Although highly influential, the UNGPs and the OECD Guidelines have not together been sufficient to change the way business operates, and we therefore see that the social norms these two sets of norms express are increasingly being integrated into legislation. This is happening in countries such as France, Germany, the Netherlands and Norway (e.g., Krajewski et al. 2021) and several key areas of EU legislation, notably within the EU's Sustainable Finance initiative and in its recently published proposal under its Sustainable Corporate Governance initiative (Sjåfjell and Mähönen 2022).

The European Union is a potentially very powerful driver for sustainability within Europe and as a global actor. The EU has stronger legislative powers than the international community and a strong basis in its Treaties for working to achieve sustainability. While words on paper – legal words included – do not lead to change if they are not followed up, the time we are in now is characterized by sustainability being firmly placed on the EU agenda, also as a follow-up to its commitment to the SDGs. We see sustainability aims expressed in the fields of sustainable public procurement, sustainable finance, sustainable corporate governance and actions on the circular economy. Yet, in practice, the EU's sustainability work is very much focused on mitigating climate change, and its brave Treaty commitment to contributing to the sustainable development of the Earth has tended to be translated into Europe-focused action.

Sustainability is (still) possible

Based on many years of experience as an increasingly interdisciplinary and firmly sustainability-oriented legal scholar, I remain optimistic that it is possible to achieve sustainability. It will not happen on its own – it will take a whole jigsaw puzzle of concentrated efforts. Law is one element of this, a necessary but not sufficient condition for achieving sustainability. For law to be a driver of sustainability, it needs to take sustainability more seriously. Any references to sustainability, or aspects thereof, should always be interpreted within a research-based concept of sustainability, encompassing the whole complex interconnectedness of environmental, social and governance aspects within planetary boundaries. And sustainability should always be the overarching objective and the standard against which any rule or decision is measured.

The future depends on all of us. In concluding this chapter, I encourage you as reader to question the values that form the basis of the laws that regulate us. Ask the policymakers that set the rules for your country, your municipality, your workplace and your place of study: What concept of sustainability are you aiming for? And what are you doing to achieve it?

Notes

* My warmest thanks to Ursula Münster for setting up the interdisciplinary lecture series upon which this book is based, and to the editors as a team for their input to an early draft of this chapter. I could not have arrived at the interdisciplinary understanding of law and sustainability that I present here without a wonderful network of amazing colleagues. I am so grateful to all of them, and especially in the context of this piece, Sarah Cornell, Stockholm Resilience Centre, who also gave me insightful comments to a draft of this chapter, and Jukka Mähönen, University of Oslo and University of Helsinki.

1. In the SMART Project, we used the formulation '*within* planetary boundaries'. Now in 2022, in recognition of the reality of the continuing vast environmental destruction that has led to

ever grimmer reports about the extent to which the planetary boundaries are being transgressed, I am using the terminology of '*mitigating pressures on* planetary boundaries'. Thank you to Sarah Cornell, who identified the need for this change in terminology and with whom I developed the new formulation.

2. My thanks go again to Sarah Cornell for coining this apt phrase.
3. This chapter concentrates on the concept of sustainability and not on the Anthropocene, the latter being a concept that is not recognized to the same extent – or at all – in the law, although it is debated in contexts beyond Earth sciences (see e.g., Ahlström et al. 2021).

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A monument to industrial optimism off the Gladstone – Calliope road, Queensland. (Photo: © Thomas Hylland Eriksen)

CHAPTER 4

What Is It about the Anthropocene that Anthropologists Should Be Mindful Of?

Thomas Hylland Eriksen

It is far from self-evident that social anthropologists should be engaged in research on Anthropocene effects. After all, the very term *anthropology* signals a focus on *anthropos*, the human being. It forms part of the *social sciences*, the study of human social life, social organization and institutions, and it also dips its feet every so often into the fertile waters of the *humanities*. It is therefore interesting that there has been a massive growth in anthropological research dealing with the interface between humanity and the rest of nature since the turn of the millennium. The concept of the Anthropocene shares its etymology with anthropology but signals a broader perspective by holding out an implicit promise of an alternative view.

This also entails that the new anthropology of the Anthropocene is interdisciplinary. In fact, there is broad agreement that interdisciplinarity must be part and parcel of an anthropology of climate change since climate change is a physical process, dealt with through political processes at the national and supranational levels, yet responded to at the level of local communities. Let's begin with a few examples. Working on sustainability issues on the German North Sea coast, Werner Krauss (2015) has shown the need for understanding various disciplines in his collaborative work with fishermen and conservationists. Krauss also works with natural scientists who search for a balance between objectivity and engagement and enters into dialogue with the political authorities by arguing the need to move beyond natural science and involve the human dimension when producing climate change policy. Noah Walker-Crawford (2021) has followed a Peruvian activist to Germany in a litigation case against an energy company, engaging with political theory, legal scholarship and NGO activism in his anthropological explorations. David Rojas's and Noor Johnson's (2013) work on climate summit meetings draws on knowledge from various academic disciplines, ranging from international law to climatology. This enables them to show why climate policy needs to move up and down different scales and not assume that signed international agreements will necessarily lead to the desired changes in the physical world.

Becoming an environmental anthropologist

My personal trajectory exemplifies the shift. I was a long-haired teenager in the late 1970s and a strongly engaged, dogmatic and extreme environmentalist. A member of two green youth organizations, I held the heterodox view that humanity ought to return to a Paleolithic – Stone Age – way of life for the sake of our common future. Blissfully ignorant of Rousseau's intimations along similar lines two centuries earlier, I had come to understand that humanity's fall from grace began with the agricultural revolution. Returning to the Stone Age seemed the only way to avoid catastrophe.

The apocalyptic literature about environmental destruction that has spread like wildfire in this century had its precursors in the sixties and seventies, and this is where I found ammunition for my countercultural campaign. Gordon Rattray Taylor's *The Doomsday Book* (Taylor 1970) described in graphic detail how uninhabitable the Earth would be before the end of the twentieth century. Georg Borgström published a string of books about population growth and resource shortages, including *The Food and People Dilemma* (Borgström 1973), whereas Paul Ehrlich's *The Population Bomb* (Ehrlich 1968) painted a similarly grim picture of an overpopulated world slowly running out of food. The competition was tough, but the most depressing account may have been the Finnish author Nalle Valtiala's book, *Mennesket – et skadedyr* ('Man – a vermin') in Norwegian translation (Valtiala 1970). Things were looking bleak indeed, and the pessimism had received palpable support from respectable quarters when, in 1972, the philanthropic think tank called The Club of Rome published its highly influential report *Limits to Growth* (Meadows et al. 1972). Back then, I was still unacquainted with Malthus's theory of population from 1798, suggesting food production growth would be unable to keep up with population growth, leading to famine and misery unless people abstained from excessive sex (Malthus was a priest – a profession famous for its complicated relationship to this kind of activity). All the aforementioned publications have a neo-Malthusian flavor. In the mid-nineteenth century, Marx and Engels criticized Malthus viciously, even infamously describing him (and with a speciesist slur) as 'a baboon,' arguing correctly that the means of production (technology) would ensure a rapid increase in productivity. So far, they have largely been proved right. However, the Australian physicist Graham Turner (2014) has checked the predictions made in *Limits to Growth* with four decades of hindsight, finding that they were surprisingly accurate. The Malthusian trap has not been overcome once and for all.

Against the backdrop of personal convictions resulting from a hippie sensibility and avid perusal of neo-Malthusian literature, I was surprised when I moved into a bedsit to study at university in August 1981, to discover that I rather enjoyed living in a society capable of making a good cup of cappuccino, progressive rock and fast disk drives. In spite of this setback, I never quite abandoned green anarchism and did produce a handful of glowing articles about Theodore Roszak, Murray Bookchin and Gregory Bateson in the anarchist monthly, of which I was an editor (we were all editors, this being an anarchist collective). I joined the green student organization Grønt Gras ('Green Grass') and seriously considered writing a dissertation in philosophy about deep ecology before turning to the juicier pastures of anthropology. Yet, environmental concerns were by now tempered by a passion for the spoils of modernity and a recognition of the fundamental contradictions in which we live. The lives we cherish are undermining their own conditions since we ruin the planet by enjoying comfortable lives. Yet, it is difficult to imagine a materially secure and ecologically sustainable future for the multitudes, most of whom are still struggling to make ends meet. As the 1980s came to an end, doomsday still seemed some way off, which reinforced the conviction that inequality was the more urgent challenge.

Some of the critical environmentalist literature also turned out to be ethically problematic. Some of the most consistent defenders of nature were purists, reactionaries, anti-humanists and Romantics who hated the filth and degeneration of city life, rejected modernity and yearned for a fictional state of pristine bliss. Some were also card-carrying white supremacists, like Garret Hardin, who formulated the influential theory of the tragedy of the commons. There was more than a whiff of anti-Semitism in this particular anti-modern movement. Going back to the early history of environmentalism, I discovered that the venerated John Muir (1838–1914), a founder of American environmental thinking, saw the national parks in Yellowstone and Yosemite as pristine and empty, oblivious or indifferent to the fact that Indigenous peoples had lived there, in and with their ecological surroundings, for millennia. The pioneering ethologist (specialist in animal behavior) Konrad Lorenz became a Nazi. More recently, the late biologist E. O. Wilson proposed that half of the planet be set aside as wilderness while humans might live on the other half. He saw no reason to comment on the destinies of the people living on that half of the planet he would designate as pure wilderness for the sake of biodiversity and planetary health. Meanwhile, in the Sundarbans, at the mouths of the mightiest rivers of the Indian subcontinent, people are complaining that white do-gooders care more about the Bengal tigers than humans.

The existence of this conservative strain in environmentalism, which so easily lapses into racism, anti-humanism and authoritarian yearnings for order, can make it difficult not to have an ambivalent attitude toward green thinking, even for the most devoted worrier.

As the 1990s came and went, my intellectual interests and research continued to drift away from environmental issues. A student of comparative modernity, I studied and published on the politics of identity, globalization, creolization and migration for many years, also investing a great deal of energy in defending minority rights. As an anti-racist activist, I served on the board of the Anti-Racist Centre in Oslo for many years. However, the awareness of the fundamentally destructive and inequitable effects of global capitalism, imbibed at a tender age, never quite left me. When I got the chance, in the early 2010s, to carry out a larger research project called *Overheating: The Three Crises of Globalisation*, one of the crises – arguably the most fundamental one – was designated as being that of climate and the environment.

A seismic event in anthropology

To some extent, the personal trajectory I have sketched mirrors trends in anthropology and social theory generally. Environmental anthropology existed throughout the twentieth century, but it was never a central mainstream concern in the discipline. The human *Umwelt* – the ecological environment as it is perceived by people – usually entered anthropological research in the guise of material resources utilized in human society or as ritual or totemic symbols, not as a subject of study in its own right. This stands to reason insofar as anthropologists are trained to study humans, not insects or lichen. At the same time, a major intellectual challenge in the discipline in the present century, reflected in the current explosion of ecologically informed anthropological research, consists of attempts to expand the discipline in order to reconceptualize humanity as part and parcel of the biosphere.

The reason for this shift is easy to discern. Anthropology has always been informed and inspired by events and current concerns – recent examples are the COVID-19 pandemic (from 2020) and the Syrian refugee crisis (from 2015), which immediately led to research endeavors and a flurry of publications. The considerable interest in ethnicity and nationalism toward the end of the last century was similarly a result of the perceptible shift from class politics to identity politics across the world (Eriksen 1993). A decade or two earlier, feminism produced a heightened awareness of gender (Rosaldo and Lamphere 1974), and historical processes such as the marginalization of Indigenous groups and the aftermath of the Second World War, leading to decolonization, the civil rights movement and the Cold War, stimulated important work among anthropologists keen to understand not only what it entails to be human but also how the individual life-world is shaped by large-scale events in the outside world (Wolf 1982), often ultimately motivated by a desire to use knowledge to make the world safe for human differences, to quote Ruth Benedict – less unequal and saner for humanity, and now including the biosphere too.

In this century, the towering concerns are caused by accelerated acceleration, global neoliberalism, climate change and environmental threats. The concept of the Anthropocene is suddenly ubiquitous. The term was originally coined by the atmospheric chemist Paul Crutzen and, independently, the late biologist Eugene Stoermer. Crutzen is also the co-author of a much-cited article, co-written with his colleague Will Steffen and the historian John McNeill (Steffen, Crutzen and McNeill 2007), on social aspects of climate change. The current popularity of the concept does not merely signal an increased engagement with climate and the environment but also a view of human life as being planetary in its entanglements and seamlessly integrated with that of other species. In this shift lies a radical potential for rethinking what anthropologists and other social scientists do, whether we mainly try to understand the world or the human condition. Many of us, whether or not we find the term Anthropocene useful (see Nightingale and Côte's chapter for a critical view), grapple with this shift, trying to reshape anthropology in order to come to terms with what some speak of as a more-than-human world inhabited mainly by nonhumans. Perhaps post-humanism is an appropriate label.

Although the prophets of doom in the latter half of the twentieth century were proven wrong, environmental challenges are now affecting human lives worldwide in such momentous ways that they can no longer be ignored. Changes now take place so fast that researchers and even journalists find it difficult to keep pace. In my own work, I have proposed the term *overheating* to describe the increased rhythm of change since around 1991 (Eriksen 2016). In an eponymous book, John McNeill and Peter Engelke (2016) speak of 'the great acceleration' since the Second World War, but it would also make sense to talk about an *acceleration of acceleration* since the end of the Cold War around 1991. In the overheating years of the last three decades, world trade has tripled, tourism has quadrupled and the amount of plastic in the ocean has grown fivefold – to give some examples. Environmental destruction has exploded, along with massive growth in consumption and mobility, with anthropogenic climate change as the paradoxical crowning achievement of the present era. The availability of abundant and powerful energy thanks to fossil fuels, a blessing for humanity since the early nineteenth century, has now become its ruin and its self-inflicted recipe for catastrophe.

Since the early nineteenth century, we have been able to exploit enormous amounts of energy; at first just in the form of abundant near-surface coal deposits, subsequently through the harnessing of oil and gas for the betterment of humanity. The fossil fuel revolution enabled us to support a very high and rapidly growing global population with a seemingly insatiable desire for consumption. Yet the cost of extracting fossil fuels grows as the low-hanging fruit has been used up. At the same time, production relying on fossil fuels is inherently destructive (Hornborg 2019) in a dual sense since we are simultaneously eating up capital that has taken the planet millions of years to produce *and* are undermining our own civilization by altering the climate and ruining the environment on which we rely. The short and the long term mirror each other, as do the large and the small scale, and there is no easy way out. The lesson from cultural history may nevertheless be that lean societies, decentralized and flexible, with less bureaucracy than farming, fewer PR people than fishermen, are the most sustainable in the long term. As the archaeologist Joseph Tainter remarks toward the end of his magisterial survey of civilizational collapse: 'Complex societies … are recent in human history. Collapse then is not a fall to some primordial chaos, but a return to the normal human condition of lower complexity' (Tainter 1988: 198). The current form of human adaptation is anything but sustainable, no matter how you view it.

Although the study of anthropogenic climate change is as recent in anthropology as it is in other disciplines, its history has important precursors.

Ecological perspectives in anthropology

Whereas mainstream British and French social anthropology in the mid-twentieth century was mainly preoccupied with research on social organization, politics and ritual, American cultural anthropology tended to emphasize the study of symbolic meaning.

However, in the United States, there was also a tradition, going back to the nineteenth century, of studying material culture, technology and ecological adaptation. In fact, its founding father, Franz Boas, had himself an expressed interest in the ways Arctic peoples survived under extreme climatic conditions. After the Second World War, Julian Steward (1955) championed human ecology, studying social and political systems from a materialist perspective that encompassed both technology and ecology. His contemporary Leslie White (1949) studied technology and energy use from a social evolutionist perspective, arguing that cultural evolution could be measured as the amount of energy a given society was capable of using. These approaches ceased to wield influence in the discipline by the early 1980s, and especially White was criticized for not paying enough attention to power discrepancies and internal societal dynamics. In any case, the emphasis on energy and ecology remains relevant, if sometimes neglected, for anthropological research on Anthropocene effects.

A different approach to ecology was represented in Gregory Bateson's work, which remains seminal and influential (Bateson 1972). Although he was trained as an anthropologist, Gregory Bateson intended to become a biologist like his famous father William Bateson, who named his son after the discoverer of genetics, Gregor Mendel. In fact, he was converted to anthropology in the smoking compartment of a train to Cambridge in the company of Alfred Cort Haddon, another renegade natural scientist who had jumped ship to become an anthropologist. Bateson, born in 1904, did not quite fit into 1930s British social anthropology, which at the time was dominated by the towering figures of Radcliffe-Brown and Malinowski, separated by their opposing views on structure and the individual but united in their concern with social integration and relative indifference to ecology.

Bateson was different, given his consistent interest in relationships, processes and the logic of living systems. A restless mind, he would soon move from rituals in Melanesia and affect in Bali to cybernetics – of which he was among the founders – psychiatry and general systems theory. Among his most powerful concepts are those of schismogenesis (self-reinforcing, usually destructive relationships), flexibility (uncommitted potential for change) and double-bind (irresolvable dilemmas resulting from errors in communication). Drawing on the philosopher Bertrand Russell's theory of logical types, which states that a class cannot be a member of itself since it exists at another logical level, he wrote about twisted thought but also about meta-communication among both humans and animals. A dog playing with another dog, or with a human for that matter, may display the same kind of aggressive behavior as a dog intent on attacking and inflicting injury, but by wagging its tail and only pretending to bite, it sends off the meta-message that it is just pretending. In later work on dolphin communication, Bateson similarly looked, ultimately unsuccessfully, for logical types and different registers of communication. He rejected the dualism separating humans from other creatures, seeing the entire chain of being as one, that is, one brimming with signs, communication and meaning.

To give an example of Bateson's thinking, his article 'Cybernetics of the Self,' ostensibly about alcoholism but really about thinking and being in the world, shows that if an alcoholic relies on willpower as a means to stop drinking, he will necessarily fail since his problem is relational and systemic. The alcoholic, thus, must give up his erroneous epistemology, according to which he is the captain of his soul and accept that he is a part of something larger than himself, dependent and entangled.

Riffing on the fundamental difference between an individualist and a systemic view of agency, Bateson offers the example of a man chopping down a tree:

> Consider a man felling a tree with an axe. Each stroke of the axe is modified or corrected according to the shape of the cut face of the tree left by the previous stroke. This self-corrective (i.e., mental) process is brought about by a total system, tree–eyes–brain–muscles–axe–stroke–tree; and it is this total system that has the characteristics of immanent mind.
>
> More correctly, we should spell the matter out as: (differences in tree) – (differences in retina) – (differences in brain) – (differences in muscles) – (differences in movement of axe) – (differences in tree), etc. What is transmitted around the circuit is transforms of differences. And, as noted above, a difference that makes a difference is an idea or unit of information.
>
> But this is not how the average Occidental sees the event-sequence of tree-felling. He says, 'I cut down the tree' and he even believes that there is a delimited agent, the 'self,' which performed a delimited 'purposive' action upon a delimited object (Bateson 1972: 444–45).

By shifting the gaze like this, Bateson shows the limitations of the conventional view of the acting person as an entity that somehow begins and ends with the barrier of the skin. What matters are differences that make a difference.

In a short article from 1970, Bateson identified three 'root causes' of what he described as *the* ecological crisis. The first was the destructive side-effects of technological progress in the shape of ecological destruction and pollution; the second was population increase leading to resource depletion; and thirdly, he spoke about a set of entrenched Western cultural values and mental templates that place humanity in an unhealthy relation to the environment, owing to a flawed epistemology based on Cartesian dualism and individualism. Like many anthropologists after him, Bateson criticized the ideal according to which humans should strive to control the environment fully rather than seeing themselves as part of a larger ecological system, along with the strong focus on the individual, the belief in endless economic growth, which is logically impossible; the assumption that we live within an infinitely expanding frontier and the conviction that technology will solve all problems we face. What Bateson calls a healthy ecology consists of 'a single system of environment combined with high human civilization in which the flexibility of the civilization shall match that of the environment to create an ongoing complex system, open-ended for slow change of even basic (hard-programmed) characteristics' (Bateson 1972: 502). In this lies a quest for an equilibrium where humanity does not undermine the conditions for its own thriving.

Whereas Bateson identified ecological crisis as a central contradiction of contemporary civilization early on, he did not address climate change explicitly. His ex-wife Margaret Mead may in fact have been the first anthropologist to do so (Kellogg and Mead 1980), as she convened a conference about the atmosphere as early as 1975. Climate change was not yet on the agenda – in fact, many scientists at the time believed that we were heading toward a new Ice Age rather than an overheated world – but the conference took on smoke, smog and other forms of anthropogenic atmospheric disturbances as global challenges that needed to be dealt with in politics and research.

Anthropology and the Anthropocene mess (or mesh)

The contemporary world of climate change, the Anthropocene and global transformation have provided research grants, jobs and publishing contracts for many academics. In their contributions to this book, Dag O. Hessen and Henrik Hovland Svensen, in particular, present some of the basic, recent and emergent insights from the natural sciences. However, as they both point out, without understanding culture and society, no change will occur, regardless of the amount of objective scientific knowledge about ecosystems and atmospheric processes at our disposal. This is where the social sciences and humanities are needed.

Much has been said about the public understanding (or lack thereof) of science, but what may be needed today is an improved *scientific understanding of the public*. One of the hallmarks of anthropological research is its emphasis on ethnographic fieldwork. It is slow and often cumbersome, it teaches the researcher a lot about a few rather than a little about many, and it makes it possible to describe and translate local life-worlds on their own terms. It is through the treasure trove, or perhaps goldmine, consisting of thousands of detailed studies of local life that anthropologists can show that Anthropocene effects not only affect different societies and places differently but are also interpreted and acted upon in ways that are sometimes similar but which frequently also fundamentally differ. Neither economic statistics, nor climatology, nor quantitative social science can perform this task, and since humans live in social worlds that are culturally shaped in complex ways, understanding a lifeworld is time-intensive. Unless climate change mitigation is going to follow the same logic as corporations and centralized government, neglecting local priorities and overrunning communities with exogenous change by telling them what to do without listening first, this knowledge is essential in order to come to terms with the Anthropocene.

The anthropology of the Anthropocene showcases not only the human world in all its diversity but may also indicate ways out of the dead end of industrial modernity, the double-bind of contemporary global civilization forcing us to contradict ourselves just by living normal lives, since we crave exactly those forms of security, the rights and the creature comforts that undermine the conditions for their continuation.

One approach consists in engaging in a sustained dialogue with thinkers from small-scale stateless societies that have proven to be ecologically sustainable over the centuries or even millennia; the 'cold' societies in Claude Lévi-Strauss's terms (1962), exploring their worlds and entering into equitable dialogue with them. A contribution to this school of thought in anthropology is Joy Hendry's *Science and Sustainability* (Hendry 2014), which explores Indigenous alternatives to the expansive, boisterous capitalist growth economy. In philosophy, Arne Johan Vetlesen's *Cosmologies of the Anthropocene* (Vetlesen 2019) raises many similar questions, drawing on academic philosophy as well as Indigenous cosmologies. A book that brings the dialogue between Indigenous and non-Indigenous perspectives beyond the level of programmatic statements is *The Sámi World* (Valkonen et al. 2022; see also Eriksen, Valkonen and Valkonen 2019). It should be added that although some intentional communities in the affluent world, such as ecovillages, emulate traditional societies and even aspects of their culture, it is unrealistic that the majority of the world's population should revert to the lo-tech life of small-scale societies. There are eight billion of us at the time of this writing, and most of us live in urban areas and depend on others to satisfy our basic needs. However, since anthropology can offer holistic descriptions of thousands of sociocultural configurations, it shows that many recipes for fulfilling lives are available, not just one. The comparative study of values, and indeed value, points in this direction. The good life in many non-consumerist societies is not a hedonistically satisfying life but a virtuous one, as it is in Aristotle's social philosophy. In South America, the *buen vivir* movement, informed largely by Indigenous cosmologies and in part by anthropological thought and research (Escobar 2008; Gudynas 2021), is an attempt to move beyond the emptiness, inequality and destructive tendencies of capitalism, recovering older ideas of how to live instead. Nonmodern societies were not always ecologically sustainable, and they often transformed local ecologies to their own benefit, but they did not undermine the conditions for human life in ways even remotely resembling the scale and velocity witnessed today. People whose lives are not dominated by state and market forces even today represent alternatives to the ideologies and practices of global capitalism (Scott 2009; Escobar 2020).

Another family of insights that anthropology can offer concerns the primacy of the local. Most of the time, we humans don't live in countries but in places. This is the case just as much for the Chinese (pop. 1.3 billion) as for the Seychellois (pop. 90,000). Methodological nationalism, unthinkingly seeing the country as a natural unit, was never part of the anthropological toolbox. In practice, this would entail that policies usually must be tailor-made. If they are to be efficient and not just foment resistance and resentment, they have to take their point of departure in the resources people already possess.

Thirdly, anthropology is in a privileged position to address one of the chief sources of the democratic deficit experienced in many parts of the contemporary world, namely the growing scalar gap between decision-making and those who are decided upon. A main cause of the rise of populism, ethnonationalism and politicized religion, the powerlessness resulting from a feeling of not being taken seriously yet not knowing who to blame, who to trust and what to do, is a result of opaqueness, aloofness and the impenetrability of increasingly distant powers.

Fourthly, anthropology continuously and tirelessly shows that one size does not fit all (Hoffman et al. 2021). What works in a small town in Queensland might not work in lower Manhattan; what works in the local communities of western Oslo might not work in Sogndal in the western part of the country. Each place is interwoven with every other place, but each place also remains distinctive and unique.

As should be clear, the communities I have in mind here are not Indian peasant villages or family-based Amazonian societies but those of the affluent world. If anthropology is going to make a practical difference when it comes to confronting the double bind of the global system and the effects of the Anthropocene, a main empirical priority must consist in studying people living in those societies that created this situation in the first place. What are the values guiding urban Norwegian academics when they fly several times a year to give twenty-minute presentations at conferences, even if they are perfectly aware of the carbon footprint associated with frequent flying? How can we explain that Britons throw away a third of the food they buy? How can the practices of Americans who associate driving with the inalienable right called freedom be shifted without violating their fundamental beliefs? And how can Australians be weaned off their dependency on air-conditioning in a way which is compatible with what is recognized as an Australian way of life? These are questions that anthropologists are capable of answering, combining the virtues of slow, basic research with the urgency of applied research in projects that look, in Kirsten Hastrup's evocative terms, at the 'drying lands, the rising seas and the melting ice' (Hastrup and Hastrup 2015). A political economy approach, informed by anthropological reflexivity, is provided, inter alia, in works by Hal Wilhite (2016) and Alf Hornborg (2019). Local responses to climate change are explored in several edited volumes (Crate and Nuttall 2016; Stensrud and Eriksen 2019; Hoffman et al. 2021), and anthropologists have also contributed some significant ethnographic monographs on climate issues, ranging from Jessica Barnes's research on water in the Nile delta (2014) to Linda Connor's work on mining in Australia (2016). Herta Nöbauer (2018), carrying out research in Austrian ski resorts, studies how artificial ski slopes are being built in anticipation of snowless winters. She highlights how the Austrian winter tourism industry anticipates mild winters and invests in new infrastructure to mitigate the effects of the melting snow. Harold Wilhite and Cecilia Salinas (2019) have shown how forest peoples, many of them indigenous, are victims both to resource extraction on their territory and global climate change. Climate change threatens their livelihood through changes in precipitation and temperature, and the problem is compounded by logging, further marginalizing people on the peripheries of global modernity. What these and many other studies have in common is the recognition of global-local linkages, where local lives and communities cannot be understood independently of the large-scale processes producing changed circumstances for future options and constraints. Climate anthropology is inherently multi-scalar, moving from the locality via government and corporations to supranational politics.

As pointed out at the outset of this chapter, the new anthropology of the overheated Anthropocene must be interdisciplinary, and it cannot afford to ignore the contributions of natural science to an understanding not only of Anthropocene effects but of human lives. While the critique of reductionist science – the failure to take human subjectivities and integrated wholes into account – is pertinent, it is not always relevant. The ability of scientists to understand people in all their diversity, including those from other parts of academia, should not be underestimated, but the toolbox enabling such an understanding must contain the slow, long-term, qualitative, interpretive methodologies of ethnography. Finally, the new anthropology must take pains to retain the classic virtues of anthropology although the world and the study object have changed: It must be based on fieldwork, even if drawing on other kinds of knowledge as well. It must be holistic in a new sense, now taking account not only of the full richness of human life-worlds and their contexts but of the extended *Umwelt*. It also must be comparative, since it is often through comparison that new theoretical insights are generated.

Without a discipline, it is impossible to be interdisciplinary; instead, one just ends up being undisciplined. On the other hand, without interdisciplinarity, any attempts to speak about the Anthropocene will inevitably result in the sound of one hand clapping. Ironically, it seems as if a deep global crisis is what was needed for the interdisciplinary dreams of visionary and ambitious intellectuals to come to fruition. This journey has only just begun.

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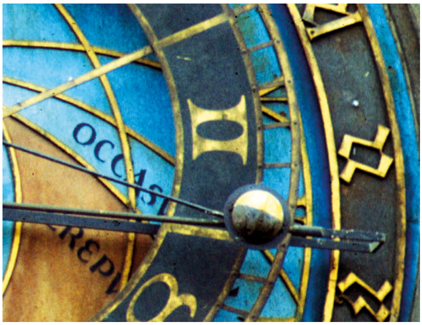


Prague astronomical clock. (Photo: Wikimedia Commons)

CHAPTER 5

When is the Anthropocene?

A Historian's Perspective

Helge Jordheim

Like most others, I live my life aided by various time management tools, primarily clocks and calendars, but also weather forecasts and grant application deadlines. That is not to say that I am especially punctual. My friends would say otherwise. I am merely describing a cultural condition I share with most people around the world, although with important exceptions for groups more attuned to other rhythms, of nature, of the body or of transcendent beings (Rifkin 2017). Furthermore, I ply my trade as a historian of sorts, perhaps not a card-carrying one, but a historian of culture, ideas, knowledge and texts. As a historian, I habitually use time as my main tool for navigating the choppy ocean of events, beings and things that we refer to simply as 'the past.' More often than not, the past expands into the present and the future. In my historical work, I look for ways of ordering these events according to a system of years and dates termed 'chronology' or by slotting them into cause-effect paradigms or narratives of change and even progress. Recently, however, my time management tools have started appearing less useful and effective and less reliable than they used to be. This includes tried and tested periodizations, like 'the modern age' and 'the post-war' and my own internal seasonal clock telling my body when to expect the harsh temperatures of winter and the mild winds of spring.

One reason time seems to be out of sync and why it appears ever less manageable is the spatiotemporal reality that we have become used to calling 'climate change,' 'climate emergency' or 'climate crisis.' To put it simply: This is the most pressing concern of our time, but none of our traditional ways of experiencing, conceptualizing and managing time seem to apply. As Michelle Bastian points out in her essay aptly named 'Fatally Confused,' our attempts to coordinate ourselves with the pressing ecological changes currently taking place by using conventional time-telling tools are failing. She quotes environmentalist Bill McKibben, who states that we are in the grips of a 'fatal confusion about the nature of time and space' (Bastian 2012: 23). In other words, I and others around me struggle to find ways of reckoning and managing the times of anthropogenic planetary change, extreme weather, climate science predictions and possible apocalyptic futures.

However, it is not for want of trying. We mobilize all our best-rehearsed and effective time management practices on social and political levels to deal with this new and threatening situation. In clock time, we are invited to estimate how close we are to the apocalypse by means of the Doomsday Clock, set by the *Bulletin of the Atomic Scientist*, or practice long-term thinking by means of the 10,000-Year Clock by the Long Now Foundation. In calendar time, we plan climate summits, election campaigns, demonstrations and acts of civil disobedience and introduce climate legislation and regulation. In historical time, we set deadlines for the reduction of CO_2 emissions by 2020 or 2030 and the shift from fossil to green energy. While these are all viable practices, they have so far failed to bring about the kind of temporal coordination of political, social and intellectual forces necessary to battle climate change effectively.

In general, the power of societies at a local, national and global level to act decisively to achieve their goals depends on their ability to agree on common timeframes, within which they can self-organize and synchronize, step by step, toward a common goal (Palonen 2006; Jordheim and Ytreberg 2021). In the absence of such collective timeframes, however, consumer habits, election cycles and our inability to negotiate the conflict between long-term and short-term interests prevent collective action that is needed to avert global warming and climate emergency. In addition, other times keep emerging, which are induced but not suffered primarily by humans: species extinction, loss of biodiversity, soil and water pollution. So far, human societies have not managed to coordinate with these anthropogenic environmental times and act in synchronization with other species and life forms to combat the crisis of nature.[1]

This is where the Anthropocene comes in, as a time-coordinating and synchronizing device. In an important and indeed striking sense, one decisive function of the concept of the Anthropocene is to coordinate and synchronize the multiple and diverse times at work in our climate emergency – and thus to allow for social, cultural and political engagement with anthropogenic changes in the environment. There is an ongoing discussion about whether or not the Anthropocene is a successful, effective or even a good concept for achieving this goal. Recently, Julia Nordblad has pointed out how the concept carries an apocalyptic imaginary that closes off the future to present intentions and actions (Nordblad 2021). Others have claimed that the Anthropocene is a red herring that displaces real and unpleasant political questions into geological time and, thus, beyond human grasp (Demos 2017).

In the following, I will be less interested in these normative questions and rather try to understand how the concept actually operates at the crossroads between human and natural sciences, as well as between science and politics. I will argue that the Anthropocene can be seen as what the sociologist Niklas Luhmann has called a 'supersynchronizer,' which operates above and beyond the work of synchronization taking place within various disciplines and fields of society, taking over for other metaphysical concepts like 'destiny' and 'progress' (Luhman 1990). The success of the concept of the Anthropocene, I would argue, is due not to its ability to offer one-word answers but its striking power to assemble and coordinate different times, both human and natural, geological and political. In this way, it responds to the need to navigate the many present temporal conflicts.

In this essay, I will take a closer look at some of the environmental times assembled in the concept of the Anthropocene, how the concept has gained its synchronizing power and the implicit and explicit consequences that follow from it.[2] In short, I am going to map out and analyze the time-work performed by the concept of the Anthropocene by asking one of the historian's perennial questions: When is it? When is the Anthropocene? In the latter part of the chapter, I will offer two answers to this question, taking account of the long-term and the short-term Anthropocene, respectively. First, however, I will discuss some of the origins of Anthropocenic temporalities at the crossroads between geology and history.

Anthropocene between the disciplines

If we were to respect disciplinary borders, the 'when' of the Anthropocene is not a historical – let alone a historian's – question. Both the term Anthropocene, coined only a couple of decades ago, and its content, primarily a temporal interval, originate in the discipline of geology. In the order of modern scientific disciplines, geology has found its place in the sciences, one of C. P. Snow's 'two cultures,' history in the other, the humanities, mostly due to the objects they study (Snow 1993). Geologists study rocks and minerals to define their composition and location in the earth; historians study all kinds of texts to uncover what kind of information they contain about past humans and their lives.

Although they part ways in almost all practical matters, geologists and historians share their most basic object of study, the past – more precisely, the past as it has survived into the present – and make claims on the future. In his magisterial work about the eighteenth- and nineteenth-century beginnings of geology, the historian Martin Rudwick coins the term 'geohistory' (Rudwick 2005), partly to avoid anachronistic inferences to the modern discipline of geology, partly to insist that what mineralogists and other natural historians were discovering was history: the history of *ge*, the Greek term for Earth. Even today, biology and geology should be counted among the historical natural sciences as their fundamental theories, evolution and stratigraphy, decisively are theories of the past.

The need for closer dialogue between history and geology has recently been discussed in two influential essays by the historian Dipesh Chakrabarty, 'The Climate of History' (2008) and 'Anthropocene Time' (2018). In the first, Chakrabarty points out the need for historians to discuss climate change as part of their work (Chakrabarty 2009); in the second, he discusses why it is so difficult. Fundamentally, he contends, the problem is time. Questions that involve geological timescales, encompassing millions and billions of years, keep falling 'out of view and the time of human world history comes to predominate' (Chakrabarty 2018: 6). For this reason, he goes on, 'we do not take into account Earth-history processes that outscale our very human sense of time,' and 'do not quite see the depth of the predicament that confronts humans today' (ibid.). Chakrabarty goes on to offer several examples of how ongoing debates about climate change and geological periodization fail to reconnect 'human-centered and planet-centered time,' as he puts it, paraphrasing Jan Zalasiewicz (ibid.). This is hardly a surprising insight anymore, but it emphasizes the need to raise the question of the Anthropocene in a way that keeps disciplines together rather than divides them.

Periodization and stratigraphy

It should be clear by now that the question guiding this essay – 'When is the Anthropocene?' – is not historical or historiographical in any modern disciplinary sense. Rather, the question is both older and more recent than the discipline of history centered on human lives and events, which took shape in Western Europe from the late eighteenth century onward. Instead, it invokes a comprehensive natural history that up until the eighteenth century, was a knowledge project in its own right but then split up into disciplines like biology, geology, chemistry, meteorology and today, even Earth system science.[3] Although they belong to the natural, nomothetic, experimental sciences, all these disciplines produce histories, and the Anthropocene has a place in all of them. At the same time, however, human history branched off from the other natural histories and became a knowledge project and eventually a discipline in its own right (Jordheim 2022). Faced with a climate emergency and nature crisis, the challenge is to reconnect these fields of knowledge and practice. The concept of the Anthropocene, already branching out across most, if not all, disciplines, offers a chance to do just that. That means, however, that we need to think through the time-work, the practices of synchronization and periodization taking place in both of Snow's cultures.

For something to be real, both as a scientific fact and as an object of political action, it needs a time and place. According to a historiographical trope harking back to Antiquity, chronology is one of 'the two eyes of history,' the other being geography (Grafton 2003: 79). What chronology or geography cannot see does not exist, at least not as a historical fact. Similarly, in our everyday lives, everything we experience or do links to places and times. Historians pride themselves on specifying the concrete point in time – whether discrete or extended – when something occurred. Rather than an end, this represents a place to start for historical analysis, interpretation and narration. When you know when – the date and the year – something took place, you can fit it into explanatory patterns and narratives. Time might mean a singular date or a longer or shorter temporal interval. In our current discussions about climate change, the same rule applies: for it to be real, to be accepted as real and acted upon as real, processes like global warming and the ruination of nature need a time and a place, a set of chronological and geographical coordinates.

Other contributions to this volume discuss what we might refer to as the site or indeed the geography of the Anthropocene, exploring the tension between the Earth and the Earth system as the home of all humanity, and the world, a capitalist and imperialist system of states and economies where there is a huge gap in wealth and power between the Global North and the Global South. I will in this contribution seek to open the other eye of history more widely, as it were, by shifting the attention from geography to chronology and to the most politically salient feature of all time-reckoning acts, periodization – dividing history into meaningful or practical temporal intervals.

Periodization is one of the fundamental activities of any historiography, either human or natural (Lorenz 2017; Jordheim 2012). Practices of periodization are as ancient as historiography itself and involve identifying the beginnings and endings of historical processes, delimiting sets of historical events and giving them coherence or a common denominator. In a second step, resulting from a successful act of periodization, the period becomes a historical framework, a synchronic, more or less homogenous context for understanding or explaining events and lives. Periods are simplifications, and they are tools of synchronization. With the aid of a period, lives, events and other historical particulars can be assembled into a container and treated as if they belong to the same system of meaning or the same cause-and-effect chains. If we live in the Anthropocene, everything that surrounds us also belongs to the Anthropocene.

At the most basic level, the Anthropocene is the name for a unit or an interval of time, more specifically, that particular form of time we call history and that is counted in years, as opposed to minutes, seconds and hours. Exactly when the Anthropocene began remains an open question, at least for now. What all scientists agree on, however, is that if something like the Anthropocene exists as a meaningful and useful periodization, it must refer to something that is ongoing, moving from the past through the present into the future. Before we can discuss the question of beginnings, which remains a contentious issue for the scientific community, as well as what it means for a historical periodization to include the present, we need to pay attention to the methods used by geologists to periodize Earth's history. According to the International Commission of Stratigraphy, their work adheres to the following definition of stratigraphy:

> Stratigraphy, from Latin stratum + Greek graphia, is the description of all rock bodies forming the Earth's crust and their organization into distinctive, useful, mappable units based on their inherent properties or attributes in order to establish their distribution and relationship in space and their succession in time, and to interpret geologic history (International Commission on Stratigraphy 1994).

Both eyes of history make themselves known in this definition, as 'relationship in space' and 'succession in time' respectively; the same goes for periods as 'distinctive, useful, mappable units' as well as the larger framework 'history,' more specifically 'geologic history.' To what extent 'stratigraphy' refers not only to a technical exercise reserved for card-carrying geologists but to an approach to history more generally becomes clear when we start by looking at the word. As pointed out above, 'stratigraphy' is a combination of one Latin and one Greek word: *stratum*, 'layer,' in plural *strata*, 'layers,' and *graphein*, 'to write.' 'Stratigraphy' literally means 'layers writing.' The word enters English as well as German and French around the middle of the nineteenth century, which is also the time for the breakthrough of geology in the works of James Hutton, Charles Lyell and others (Oxford English Dictionary n.d; Gould 1988).

In itself, the word is surprising since almost all other words with the suffix *-graphy* are in one way or another related to writing, either the physical process, like 'calligraphy,' or the work of the sciences, like 'geography.' By contrast, 'stratigraphy' seems to rely on a usage that is either pre-modern or metaphorical or both, comparing the surface of the Earth to a book – similar to the Christian 'Book of Nature' – which is inscribed and can be read by those who know how to read the signs. If earthly nature is a book, then the strata are the pages covered in writing. This fits with the dating of the origin of stratigraphy to the work of the Danish priest, anatomist and mineralogist Nicolaus Steno and his book on how solids end up within other solids, *solido intra solidum*, mostly referred to as the *Prodromus*, published in 1669 (Steno 1916). According to scholars of geology, this book contains the first draft of what will become the framework of modern geology, the theory of rock layers or strata and their position relative to each other, known today as stratigraphy, including the law of superposition, the principle of original horizontality, as well as the principle of lateral continuity (Rudwick 2005). However, the term 'stratigraphy' appears to be a later coinage linked to the beginning of geology as a science in the early nineteenth century in the works of Georges Cuvier, James Hutton, Charles Lyell, Johann Gottlob Lehmann and William Smith. Almost two hundred years after Steno, layers of sediments deposited in laterally extensive, horizontal layers and accumulated into formations, presented geologists with a form of writing that they read and interpret to define and delimit the intervals of Earth's history: periods, epochs, ages and eons.

In present terminology, stratigraphy is often preceded by the prefix 'chrono-,' which in Greek means time. Chronostratigraphy refers to how the reading of rock layers is used to define and delimit geological periods, such as the Holocene and the Anthropocene. Returning to the International Commission of Chronostratigraphy, they describe the commission's task as the following:

> Its primary objective is to define precisely global units (systems, series and stages) of the International Chronostratigraphic Chart that, in turn, are the basis for the units (periods, epochs and age) of the International Geological Time Scale; thus setting global standards for the fundamental scale for expressing the history of the Earth.

This, of course, is no small thing: time units that are both valid all over the globe and fundamental to history as such. It is hard to imagine a more ambitious periodization.

To understand more about what periodization achieves, we return to human history, where periods have traditionally been more contested than in geology, that is, before the Anthropocene. Periodizations come with their own politics, mostly a politics of delimitation, ruptures and new beginnings. They bring about a break with the past, which is turned into a closed, clearly defined unit of time to be handled and manipulated at will. A paradigmatic example is the Middle Ages, coined by Renaissance scholars to frame themselves as the heralds of a new era while at the same time reconnecting with the golden age of Greek and Roman Antiquity. To achieve this, however, they had to bracket the thousand years that had passed in between, periodize them and excise them from history. In this way, Renaissance scholars could break free from structures and systems in their own time that they opposed – Christianity, feudalism, superstition – and replace them with rationality, absolutism and science. Another paradigmatic example is the Enlightenment, which came about through an act of periodization in the eighteenth century. Like present-day geologists, climatologists and Earth system scientists as well as larger audiences, Enlightenment thinkers were involved in practices of 'self-periodization,' identifying and defining their own period (Edelstein 2010).

Whereas the Middle Ages or the Enlightenment refer specifically to human time, more precisely to that specific form of human time we call 'history,' which generally deals with the preceding 6000 years and predominantly the last 300, the main temporal framework for the Anthropocene is geology, or more precisely, the Geologic Time Scale, which covers the 4.2 billion years since the Earth was formed (Fig. 1). However, regarding the social and political impacts of periodization, it makes more sense to compare the Anthropocene with the Enlightenment than with the Holocene, let alone the Pleistocene or the Quaternary Age, even though the chronological systems are very different. Until the academic and public breakthrough of the 'Anthropocene' as the ubiquitous term for talking about climate change, no one outside of the discipline of geology took any notice of geological periodizations. Being able to define one's own period comes with some obvious advantages. Essentially, it is about selecting the elements in one's own context and environment that should be seen as representative of the period in question. The Enlightenment was the age when the light of reason, as understood by a small group of white, Western European males, spread through layers of society and among the nations of the world, empowering people to throw off the yoke of ignorance, religion and tyranny. The Anthropocene, on the other hand, is the age when humanity became a geological agent, changing the Earth system in irreversible and possibly fatal ways.

The making of a new geologic epoch

On May 21, 2019, following almost 20 years of intense debate between scientists of various kinds, the Anthropocene Working

Group voted to submit an official proposal to the International Commission of Stratigraphy, more precisely to the Subcommission on Quaternary Stratigraphy, to approve the Anthropocene as a geological epoch and add it to the Geologic Time Scale. The aim is to account for – by means of chronological periodization – the profound ways humans have altered the planet. The epoch that the Anthropocene is supposed to succeed is called the Holocene. 'Holo-' comes from Greek and means 'whole,' whereas '-cene,' also originally Greek, means 'new.' In other words, the 'Holocene' means something like 'the new or the recent whole.' Of course, 'recent' is a relative term since the Holocene began 11,650 years ago, when the last glacial period ended.

In the geologic system of periodizations, the Holocene has the status of an epoch, hence the Anthropocene would also be an epoch. Based on that alone, we could imagine geological time as a succession of epochs strung together to form a timeline. However, it is more complicated than that, as illustrated by the timeline or rather the table representing the Geologic Time Scale (Fig. 1).

As indicated by the word 'scale,' this presentation of geological time ranges from the shortest to the longest periods, from a few thousand to millions of years. In addition to epochs, geological time consists of ages and periods. Together with its predecessor, the Pleistocene, the Holocene makes up the period of the Quaternary, which began 2.6 million years ago when large masses of ice gathered around the poles. Furthermore, all this happened within the Cenozoic era, another geological periodization term, which goes back 65 million years and starts with the impact of a meteorite, probably the one that killed the dinosaurs. Even that is not all: Epoch, ages and periods are all encompassed by the largest periodization of them all, the eon, in our case the Phanerozoic, which began 542 million years ago with the emergence of active, mobile, multi-celled life forms.

GSA GEOLIGIC TIME SCALE v.5.0

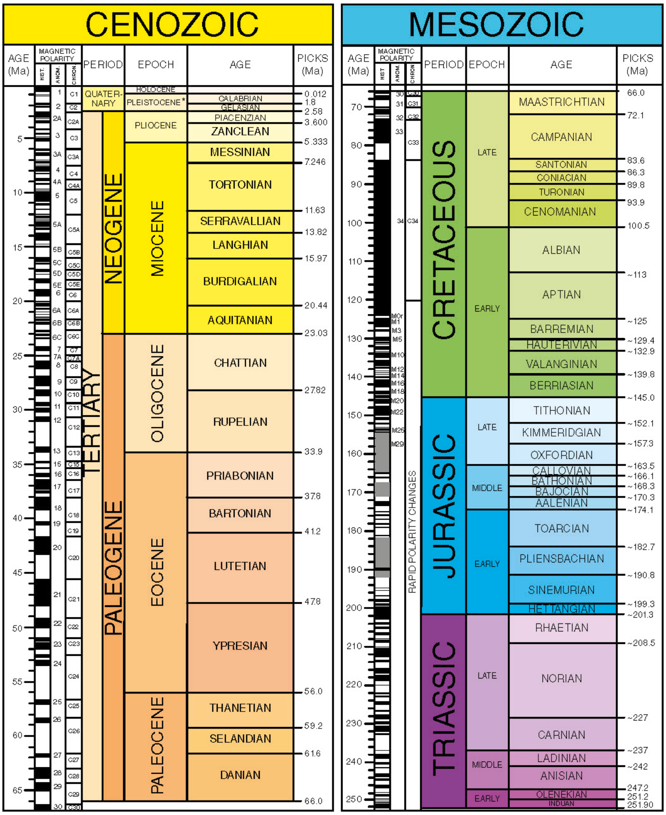
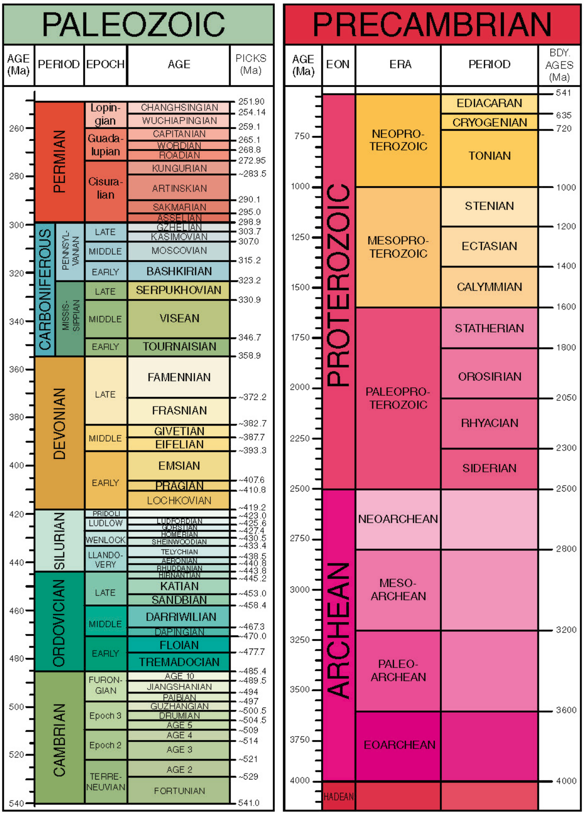


Figure 1. The Geologic Time Scale.

Whereas the Middle Ages and the Enlightenment originated in the discipline of history, the Anthropocene originated in geology and was established through geological chronology, or geochronology for short. In addition to chronostratigraphy, geochronology is the other way of managing time in geology, turning stratigraphical discoveries relative to places and materials



into an absolute abstract timescale. One important epistemological effect of the climate and nature crisis being based on geological periodization rather than human history is that current anthropogenic changes to the Earth system are put into the largest possible timeframe, involving millions, even billions of years. Hence, the Anthropocene offered scientists a way of communicating the magnitude and the epochal nature of the changes they were observing. Ongoing human-made changes to the Earth system are measured on a million-year timescale. However, even though the time-system itself is based on geology and adheres to geological – or, more precisely, geochronological and chronostratigraphical – practices of periodization, the phenomena that are listed by the Anthropocene Working Group as being associated with the Anthropocene cover various domains of the Earth system. They have their own knowledge formations and indeed their own times, hence the proposal from the Anthropocene Working Group:

> Phenomena associated with the Anthropocene include: an order-of-magnitude increase in erosion and sediment transport associated with urbanization and agriculture; marked and abrupt anthropogenic perturbations of the cycles of elements such as carbon, nitrogen, phosphorus and various metals together with new chemical compounds; environmental changes generated by these perturbations, including global warming, sea-level rise, ocean acidification and spreading oceanic 'dead zones'; rapid changes in the biosphere both on land and in the sea, as a result of habitat loss, predation, explosion of domestic animal populations and species invasions; and the proliferation and global dispersion of many new 'minerals' and 'rocks' including concrete, fly ash and plastics, and the myriad 'technofossils' produced from these and other materials (Anthropocene Working Group 2019).

In addition to the many references to different parts of nature, sea, air, rocks and soil as well as other materials like plastics, ash and metals, the passage is packed with time words describing different forms of temporal movements and patterns, such as 'cycles,' 'perturbations,' 'changes,' 'rapid changes,' 'explosions' but also other temporal qualifiers, like 'new' and 'dead.' All of them indicate some kind of accelerated shift or rupture. However, there are also words evoking a more long-term, continuous time, as in the case of 'duration,' 'preservation' and even 'permanence':

> Many of these changes will persist for millennia or longer, and are altering the trajectory of the Earth System, some with permanent effect. They are being reflected in a distinctive body of geological strata now accumulating, with potential to be preserved into the far future (Anthropocene Working Group 2019).

Which far future? In the proposal from the Anthropocene Working Group, pasts, presents and futures proliferate, depending on the lives and materials in which they are embodied. Urbanization and agriculture are usually studied in the framework of human history. Whereas the first significant increase in global urban population is dated to the first millennium BCE, the history of agriculture is traced back to the Neolithic Revolution, starting around 12–11,000 years ago. By contrast, habitat loss, predation, the explosion of domestic animal populations and species invasions are staples in the history of nonhuman life, rendered according to the timelines and narratives of evolutionary biology – also currently speeding up. Durations, speeds and rhythms, including the imminent threat of extinction, are relative to the species in question (National Research Council 1995). In other words, even though the Anthropocene – as presented by its dedicated Working Group – constitutes a unit, a period of geological time, bundled up in it are multiple different times, both long and short, with various intervals and rhythms. In that sense, the

Anthropocene can be said to operate as a synchronizer, a concept that pulls multiple times and histories together into one temporal framework, which is the Geologic Time Scale.

Why is this important? Why do we – also those of us who do not deal in geological terminology or chronology on a daily basis – need to know all this? Because the Anthropocene is by far the most effective neologism of our time, and we need to know both what it means and what kind of work it performs, in science and technology, in politics and in cultural life. Even before it is officially approved, the Anthropocene has gained a kind of self-evidence, as if we always already knew what it was. It has left the confines of geology, even of academic discourse, and become a mobilizing concept for the struggle against the effects of anthropogenic change, both on the climate and nature as a whole. A quick Google Ngram check confirms that the term 'Anthropocene' far surpasses 'climate emergency' in frequency, another term coined to conceptualize the dire and dangerous situation we find ourselves in that I will return to toward the end of this essay. At present, 'the Anthropocene' is no longer a disciplinary term reserved for geologists and other natural scientists for periodizing natural history but has crossed over into the human and social sciences as well as into public discussion. The changes that this term is designed to grasp are anthropogenic and presuppose humans as agents and human history as a space of experience (Demos 2017).

Like the clock and the calendar, the Geologic Time Scale grants both time itself and its respective intervals an almost unquestionable objectivity. We are prone to forget that the Gregorian calendar was introduced by Pope Gregor XIII in October 1582 in order to universalize Christian dogma, and that seconds did not come into being until clock technology was precise enough to measure them and did not enter everyday use until the wristwatch had its breakthrough during the First World War (Landes 2000). In the same way, the Anthropocene – that specific interval of the Geologic Time Scale – was invented in response to anthropogenic change at a planetary level as a tool by which experts and the public can come to terms with the climate emergency and biodiversity crisis. To show how time is not absolute, universal and objective but always historical and political does not reduce our ability to act against climate change; on the contrary, more knowledge of what the Anthropocene entails as a time tool multiplies the forms of agency it opens up.

Long-term: When did the Anthropocene begin?

As the German historian Reinhart Koselleck has argued, concepts contain temporal structures that interconnect pasts, presents and futures in specific ways (Koselleck 2011). The past is simultaneously the most graspable and the most scientifically controversial of the Anthropocenic time dimensions. For more than a decade, the beginning, especially, has been a hotly contested topic among biologists, geologists, geographers and others. Even more than periodizations, geological epochs are based on their beginnings, pinpointing an event that separates what is coming from what went before. This pin – to continue the metaphor – is at the same time a physical object, hammered into the rock face at a specific site somewhere on the globe, the so-called 'golden spike,' and an abstract border between two geologic periodizations, pinned down to a specific year or at least a decade or century. It is at the same time a chronostratigraphical and geochronological, spatial and temporal marker, with all the paradoxes this duality entails, much discussed in geological literature from the mid-nineteenth century onward.

The question of the beginning of the Anthropocene was announced already in 2000, when Paul Crutzen and Eugene Stoermer launched the concept in a newsletter from the International Geosphere–Biosphere Programme. Crutzen and Stoermer admitted that the start date was 'somewhat arbitrary':

> To assign a more specific date to the onset of the 'anthropocene' seems somewhat arbitrary, but we propose the latter part of the 18th century, although we are aware that alternative proposals can be made (some may even want to include the entire holocene). However, we choose this date because, during the past two centuries, the global effects of human activities have become clearly noticeable. This is the period when data retrieved from glacial ice cores show the beginning of a growth in the atmospheric concentrations of several 'greenhouse gases', in particular CO_2 and CH_4. Such a starting date also coincides with James Watt's invention of the steam engine in 1784 (Crutzen and Stoermer 2000: 17).

In addition to ice cores and the atmospheric concentrations of greenhouse gasses, the beginning of the Anthropocene is marked by the invention of the steam engine by James Watt in 1784 – a much-promoted moment in Western history of science. The suggestion also flaunts a striking synchrony with one of the most effective periodizations in the historical disciplines – 'modernity' – the beginning of which is often dated to the late eighteenth century and for which the steam engine, unleashing the forces of industrialization, plays a major role (Osterhammel 2015). In

May 2019, when the Anthropocene Working Group chaired by the British geologist Jan Zalasiewicz finally voted in favor of proposing that the International Commission of Stratigraphy adopt the Anthropocene as 'a formal chrono-stratigraphic unit,' they suggested another beginning: 'Should the primary guide for the base of the Anthropocene be one of the stratigraphic signals around the mid-twentieth century of the Common Era?' In the document preparing the vote, they give some explanation for this choice. They list four relevant points, defining what they mean by the Anthropocene:

1. It is being considered at series/epoch level (and so its base/beginning would terminate the Holocene Series/Epoch as well as Meghalayan Stage/Age);
2. It would be defined by the standard means for a unit of the Geological Time Scale, via a Global boundary Stratotype Section and Point (GSSP), colloquially known as a 'golden spike';
3. Its beginning would be optimally placed in the mid-20th century, coinciding with the array of geological proxy signals preserved within recently accumulated strata and resulting from the 'Great Acceleration' of population growth, industrialization and globalization;
4. The sharpest and most globally synchronous of these signals, that may form a primary marker, is made by the artificial radionuclides spread worldwide by the thermonuclear bomb tests from the early 1950s.

Far from just a name for a period, the Anthropocene is an advanced time technology that also includes a 'golden spike,' proxy signals, accumulated strata and a primary marker. Furthermore, these specifically geological time tools are aligned with historical

Table 1 | Potential start dates for a formal Anthropocene Epoch

Event	Date	Geographical extent	Primary stratigraphic marker	Potential GSSP date*	Potential auxiliary stratotypes
Megafauna extinction	50,000–10,000 yr BP	Near-global	Fossil megafauna	None, diachronous over ~40,000 yr	Charcoal in lacustrine deposits
Origin of farming	~11,000 yr BP	Southwest Asia, becoming global	Fossil pollen or phytoliths	None, diachronous over ~5,000 yr	Fossil crop pollen, phytoliths, charcoal
Extensive farming	~8,000 yr BP to present	Eurasian event, global impact	CO_2 inflection in glacier ice	None, inflection too diffuse	Fossil crop pollen, phytoliths, charcoal, ceramic minerals
Rice production	6,500 yr BP to present	Southeast Asian event, global impact	CH_4 inflection in glacier ice	5,020 yr BP CH_4 minima	Stone axes, fossil domesticated ruminant remains
Anthropogenic soils	~3,000–500 yr BP	Local event, local impact, but widespread	Dark high organic matter soil	None, diachronous, not well preserved	Fossil crop pollen
New–Old World collision	1492–1800	Eurasian–Americas event, global impact	Low point of CO_2 in glacier ice	1610 CO_2 minima	Fossil pollen, phytoliths, charcoal, CH_4, speleothem $\delta^{18}O$, tephra†
Industrial Revolution	1760 to present	Northwest Europe event, local impact, becoming global	Fly ash from coal burning	~1900 (ref. 94); diachronous over ~200 yr	^{14}N:^{15}N ratio and diatom composition in lake sediments
Nuclear weapon detonation	1945 to present	Local events, global impact	Radionuclides (^{14}C) in tree-rings	1964 ^{14}C peak‡	^{240}Pu:^{239}Pu ratio, compounds from cement, plastic, lead and other metals
Persistent industrial chemicals	~1950 to present	Local events, global impact	For example, SF_6 peak in glacier ice	Peaks often very recent so difficult to accurately date§	Compounds from cement, plastic, lead and other metals

Figure 2. Illustration from Lewis and Maslin (2015: 175).

chronology (mid-twentieth century) and historical events (the 'Great Acceleration, thermonuclear bomb tests). The 'Great Acceleration' names the surge in the growth rate of human activity from around the end of the Second World War: population growth, consumption growth, production growth, etc. (Steffen et al. 2015). They all begin to spike in the mid-twentieth century and continue until this day. For the Anthropocene Working Group, these processes are relevant to the extent that they leave traces in the accumulated strata of the earth that can serve as 'geological proxy signals' for the beginning of a new geological epoch. The most useful signals, however, since they are the most globally synchronous, are those left by the nuclear bomb tests from the 1950s, which spread artificial radionuclides worldwide.

So far, we have encountered two different beginnings of the Anthropocene. However, these are not the only dates that are discussed. In a by now famous article published in the journal *Nature* in 2015, entitled 'Defining the Anthropocene,' two British geographers, Simon Lewis and Lee Maslin, argued that the beginning of the Anthropocene should be dated to either 1610 or 1964. However, they also listed a series of other alternatives coinciding with megafauna extinction, the origin of farming and anthropogenic soil, to mention some examples (Fig. 2) (Lewis and Maslin 2015). For each of these alternatives, they propose a primary stratigraphic marker and potential GSSP date. GSSP stands for Global Boundary Stratotype Section and Point, which is the element of chronostratigraphy usually referred to as a 'golden spike.'

If we look more closely at one of the two dates that Lewis and Maslin suggest as a starting point for the Anthropocene, we recognize that the event in question, which they refer to as the 'New-Old World collision,' took place over a 300-year period, from 1492 until 1800. The year 1610 is selected as a

Potential GSSP date – not because of the discovery of another piece of the *terra incognita* of the New World but because the CO_2 levels in the atmosphere reach a minimum, an all-time low.[4] This purely chemical marker, seemingly without moral or emotional meaning, points to one of the darkest chapters of human history. According to regional population estimates, 54 million people lived in the Americas upon Christopher Columbus's arrival in 1492. The population was even growing rapidly. By 1650, there were only six million people left. The rest had succumbed to disease, war, enslavement and famine at the hands of the Europeans. The accompanying near-cessation of farming and reduction in the use of fire, Lewis and Maslin explain, resulted in the regeneration of over fifty million hectares of forest, woody savanna and grassland. Consequently, global carbon emissions reached their lowest point in 2000 years. The stratigraphic marker for this low point in CO_2 emissions is found in glacial ice cores.

The Lewis and Maslin article sparked a vivid debate in the pages of *Nature*. The most vehement rebuttal came from the Australian philosopher Clive Hamilton. The dip in CO_2 emissions around which Lewis and Maslin weave their narrative, he argued, was probably due to natural variability. Moreover, he accuses the Australian geographers of being so bent on finding a politically salient 'golden spike' that they ignore what the Anthropocene is about in the first place, human-induced climate change (Hamilton 2016). Both Lewis and Maslin's attempt at dating the beginning of the Anthropocene, and Hamilton's vitriolic response, testify to the diverse and often conflictual times operating in the Geologic Time Scale. These conflicts are part of what we could call the Anthropocenic Now.

Short-Term: the Anthropocenic now

Even though they might disagree about the beginning of the Anthropocene, geologists, geographers and Earth system scientists are in full agreement that if such a geological epoch exists, we – everyone and everything living at this moment – are in it. Hence, the simplest and maybe even most adequate response to the question guiding this essay – when is the Anthropocene? – is simply: now. Now is the Anthropocene. The Anthropocene is now. As a temporal dimension, the now – what the philosopher Walter Benjamin famously called *Jetztzeit* or 'now-time' – is radically different from the durations of the past and anticipations of the future (Benjamin 1968). For Benjamin, the now-time is when anything can happen, when something new enters the world, when surprising, transformative insights emerge, when history takes a different track, but also when the world as we know it might end. Other theorists of history have thought about the present in similar ways. In the eyes of the French historian François Hartog, the present is a 'monster' which expands infinitely and takes over both the past and the future – to the extent that all past is nothing but memories, trauma and guilt, and all future is fear and risk (Hartog 2015: 217). For now, I shall leave the question of whether the present is a black hole or a springboard into the future behind and concentrate on what kind of present the concept of the Anthropocene brings into being.

Whereas science and scientists seek to take control of Anthropocenic pasts and futures, the present remains fundamentally political. The now is the time of political agency and action, often in response to sudden and critical events like extreme weather, pandemics, terror attacks or hunger catastrophes. The now is also a time of crisis and emergency. At the end of their article, Lewis and Maslin acknowledge this tension as they move from the Anthropocenic past into the Anthropocenic present and, at the same time, from the epistemological to the political. Dating the beginning of the Anthropocene to 1610, they argue, 'implies that colonialism, global trade and coal brought about the Anthropocene.' They continue, 'Broadly, this highlights social concerns, particularly the unequal power relationships between different groups of people, economic growth, the impacts of globalized trade, and our current reliance on fossil fuels' (Lewis and Maslin 2015: 177). In this passage, the authors shift the impact of the concept of the Anthropocene from the scientific to the political realm; the question is no longer whether it is geochronologically or chronostratigraphically viable but whether it is politically effective. In this way, the Anthropocene is transferred into political time, and maybe this is where it always belonged.

This radical, even extreme now-ness of the concept of the Anthropocene is clearly visible in the origin story that has been circulating in articles trying to promote or debunk the concept. Here is a version by environmental historian Jane Carruthers from 2019:

> The concept of the Anthropocene has been buzzing around for nearly two decades. The first reference to the Anthropocene as a name for the current geological epoch arose in February 2000 during a meeting of the International Geosphere-Biosphere Programme (IGBP) in Cuernavaca, Mexico. On that occasion, Paul J. Crutzen, the Dutch, Nobel Prize-winning atmospheric chemist and then Vice-Chair of the IGPB, had become increasingly impatient with his colleagues' repetitive use of the word 'Holocene' and exclaimed, 'Stop using the word Holocene. We're not in the Holocene any more. We're in the… the…the…[searching for the right word]…the Anthropocene!' (Carruthers 2019: 1)

To refer to oral communication in a scientific article is in itself rare, simply because oral communication is a thing of the moment: Something is uttered, and then it is gone. Scientific evidence, on the other hand, comes in the form of writing, which can be repeated, quoted, relied upon, criticized, and transported from one site of research, in this case, Cuernavaca, Mexico, to another, like an 'immutable mobile,' as Bruno Latour once called it (Latour 1990: 26). For Latour, science changes character the moment that observations and results are put to paper and start circulating from one place to another while staying the same: immutable. Initially, there was nothing immutable about the Anthropocene. It was, rather, a sudden, unplanned, and transitory event at a conference.

The radical now-ness of Crutzen's exclamation is emphasized by his stammering, which takes us back to the exact moment before he lets out the word that is going to change the order of knowledge forever. Of course, as for almost every moment of radical invention, there is a prehistory or a predecessor. In this case, limnologist Eugene Stoermer, who had originally coined the term in the 1980s in a slightly different context and now went on to co-author with Crutzen the initial scientific publication on the topic in the IGBP Newsletter. Nevertheless, the concept continues to echo with Crutzen's stammer as a permanent reminder of his desperate attempt to name not a long-passed geological time but his own present. Probably the Anthropocene would have been a more useful concept if it always came with a stutter, a moment of hesitation, of tarrying.

Geological concepts are about the past and are defined by their beginnings. For obvious reasons, every other periodization included in the Geologic Time Scale has happened *post festum*, in most cases by millions of years. The only possible exception was the Holocene, the epoch we are still officially in until the International Commission of Stratigraphy accepts the proposal from the Anthropocene Working Group and we officially wake up in the Anthropocene. Then again, the Holocene was always defined from its beginning when the last glacial period ended, some 11,700 years ago, whereas the Anthropocene was a response to an experience of the present, a present of accelerating climate change, species extinction, overpopulation and overconsumption. To find a beginning was – paradoxically – an afterthought.

Until the International Commission of Stratigraphy agrees on a GSSP date, a 'golden spike,' the Anthropocene will continue to be a label for the present, the now, alongside other similarly now-based, presentist and equally gloomy concepts like crisis, emergency or disaster, to mention only a few. Up until now, I have taken the claim that the Anthropocene is a periodization of geological time, an addition to the Geologic Time Scale, at face value. But what if it isn't? What if it just pretends to be by adhering to the onomastic tradition, the naming practices of this particular chronological system, the Greek words, the ending on -ene? What if the most relevant rhetorical contextualization of the concept of the Anthropocene and its mobilization of different times is not the Holocene or the Pleistocene but much more political words and statements that aim to intervene in the present and change it, more or less radically?

To understand what times are at work in the concept of the Anthropocene, we need to explore its relationship to another concept, which belongs in the same discourse and semantic field but has different content and function. 'Climate emergency' does not come out of the sciences, be they geology, biology, meteorology, or Earth system science. Of course, the concept of 'climate' has its own history in the sciences, but in this case, faced with a conceptual shift from 'climate change' to 'climate emergency,' the load-bearing concept is 'emergency.' Historically, it derives from the Latin *emergentia*, the present participle of *emergo*, which means to come forth, to surface, as in the word 'to emerge.' To call the changing climate an emergency means this is something new, something that has just revealed itself to us. In the modern use of the term, however, it is not the emergence itself that is the significant element but the circumstances under which the emergence takes place – a moment of drama, immediacy, danger, an unexpected event that disrupts and suspends the ordinary ways and rules of the world – it might even suspend the rule of law. According to the *OED*, 'emergency' has a specific political and legal meaning: 'a condition approximating to that of war; occasionally as a synonym or euphemism for war; also state of emergency, wherein the normal constitution is suspended' (Oxford English Dictionary n.d.).

In a series of demonstrations in the spring of 2019, the activist group Extinction Rebellion demanded that governments worldwide 'declare a climate emergency.' To some degree, they were heard: On May 1, 2019, in the middle of the Brexit crisis, Jeremy Corbyn, the leader of the Labour opposition, climbed on top of a fire engine in Parliament Square and told the protesters that he was on his way into the British Parliament to present a motion to declare an environment and climate emergency: 'This,' he stated, 'can set off a wave of action from parliaments and governments around the globe' (BBC 2019). The proposal came in response to the protests in previous weeks and was also directed at U.S. President Donald Trump, making it clear 'that he cannot ignore international agreements and action on the climate crisis,' according to Corbyn. Only hours later, the British parliamentarians – happy for a respite from the mind-numbing Brexit discussions – approved the motion. However, since the motion did not go to a vote, the approval is merely a declaration of the will of the Commons, which does not legally compel the government to do anything. They then went back to discussing Brexit.

A declaration, the philosopher of speech acts John Searle points out, changes the state of the world in an immediate way (Searle 1975). Whether this was really the case with the declaration by the British Parliament remains an open question. What it did unleash was a wave of other declarations, some of them at national but many at subnational levels. States, cities, towns, parts of towns, schools, universities, newspapers and media platforms declared a climate emergency. By November 6, 2022, 2,291 jurisdictions in 39 countries had declared a climate emergency, according to an organization name Climate Emergency Declarations, which works to promote these kinds of speech acts. Populations covered by these jurisdictions amount to over one billion citizens (Climate Emergency Declaration 2022). But what does it mean; what do these declarations do? What do they do to history, to the innumerable incidents that make up any historical moment? And what do they do to questions of agency? Who can act in an emergency?

These are important questions. What until recently figured in government white papers, in political communication, in the press as well as in social media as 'climate change' shall now be renamed 'climate emergency.' In this way, an assemblage of facts about increasing levels of CO_2 in the atmosphere, rising global temperatures, species extinction and extreme weather is given another name – one which differs from the old name mostly in the way it deals with time. Whereas 'change' is ongoing, steady, regular and predictable, 'emergency' is sudden, emergent, decisive, dramatic and potentially life- and world-changing. In this way, the act of renaming changes the moment we are in, from a *chronos* moment to a *kairos* moment – enabling us, in the words of Greek Sophists like Gorgias and Isocrates, to seize a bald young man by the lock of hair hanging from his forehead.

A key goal for those third- and fourth-century BCE intellectuals, those socially and politically engaged thinkers who we know as the Sophists, who Plato taught us to despise, was to describe and give rhetorical shape to moments of contingency, unexpected moments in time when new possibilities but also new dangers arise. The term they developed for these moments was *kairos*. Different from the slow, long-term temporality of *chronos*, *kairos* referred to a particular and exceptional moment, a rupture or a turning point, a favorable moment to speak or to act, a decisive, fateful or dangerous situation. In Gorgias's own words, *kairos* referred to 'a decisive moment that must be caught in passing,' represented in art as a young man, shaved bald at the back but with a long lock of hair at the front by which the swift or foresighted could catch him (cited in Balibar et al. 2004: 813). To seize the occasion meant to speak, to say the appropriate thing. In the words of the Gorgias scholar John Poulakos, *kairos* refers to the need for language to 'take into account and be guided by the temporality of the situation in which it occurs' (Poulakos 1983: 41).

If the concept of 'the Anthropocene' is comparable to concepts like 'emergency' and 'crisis,' steeped in the temporality of the now, it might be associated with some of the same risks. The shift from concepts of development, reform, renewal, transformation or simply change to 'crisis' is not an innocent, innocuous or self-explanatory change of label. On the contrary, it carries a Janus face and brings with it conceptual meanings rich in discourses and practices that are colonialist, imperialist and globalist, in the worst sense of the term, projecting Eurocentric ideas about humans and their environment onto the rest of the world. In addition, the fetishization of the decisive – possibly fatal – now risks closing off the future by blocking every road other than the one leading straight into climate apocalypse, as discussed by the Swedish intellectual historian Julia Nordblad (2021) in a recent essay, 'On the Difference between Anthropocene and Climate Change Temporalities.'

Anthropocene as time-keeping device

More than anything, the Anthropocene is a time-keeping or time-management device with multiple moving parts, almost like the cogs and wheels inside a mechanical clock: the Geologic Time Scale, the practice of periodization and self-periodization, a set of rhetorical speech acts, the 'golden spike,' the Anthropocene Working Group and so on. Unlike the clock or the calendar, the Anthropocene does not posit a homogenous uniform time to which everything, event or life form in the world must adhere. On the contrary, it functions more like a prism in which the different streams of time – the lifetimes of the planet – are brought into convergence, synchronized into one singular time beam pointing toward the apocalypse of human civilization as well as the extinction of millions of species on Earth. In this situation, both responsibility and agency are placed squarely with humanity, the human species. We are to blame, and only we can avert our own doom. In other words, as a time-keeping device, the Anthropocene has more in common with Christian chronology than with the clocks and calendars of modernity.

Additionally, as I have discussed above, the Anthropocene operates on several timescales, both the short-term of politics and declarations and the long-term of rocks and strata. What is brought to convergence is not just the multiple lifetimes of the planet – from bacteria and viruses to the complex temporalities of human societies – but also the multiple chronological intervals – from minutes and hours of parliamentary negotiations and decisions to the millions of years of geological transformations, documented in the strata of the Earth's crust.

To understand what role the Anthropocene plays in current scientific and public discourse, we could do worse than to compare it with Medieval and Early Modern astronomical clocks, for example, the one in the Old Town Square in Prague. This clock shows the minutes and hours of the day but also the position of the sun and the moon in the sky and other astronomical details. Additionally, it has a calendar dial with medallions representing the months. Not least, the Prague clock manages Christian time: every hour, the wooden figures of the Apostles, various saints and other sculptures walk by, including the figure of a skeleton that represents Death striking the time. The Anthropocene tries to keep time in a similar way, combining different timescales, rhythms and durations but also different temporal qualities inherent in processes of anthropogenic change: the growing levels of CO_2 in the atmosphere, the loss of biodiversity, the rising sea. Every now and again, Death comes out to remind us what will happen if we do not change our ways.

Notes

1. Interesting discussions can be found in the special issue *Time, temporality and environmental change*, edited by Tim Edensor, Lesley Head and Uma Kothari (2020). Geoforum 108.
2. For a more detailed discussion of synchronization and concepts, see Jordheim and Ytreberg (2021); Jordheim and Wigen (2018).
3. For the case of biology, see Zammito (2017); see also Ekström and Bergwik (2022).
4. See Nightingale/Côte, this volume.

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Anthropocene, deep time and standing-by: an abandoned goldmining pit in North Burkina Faso. (Photo: © Muriel Côte)

CHAPTER 6

Geographies of the Anthropocene

Race, Feminism and Contested Histories

Andrea J. Nightingale
and Muriel Côte

Fundamentally, the Anthropocene is a universal story. It is a story that tries to make sense of rapid rate environmental change in the late twentieth and early twenty-first centuries, changes that are frightening for many, or at least worthy of concern. The Anthropocene has been proposed as a new geological epoch (Steffen et al. 2011), defined by human processes which can be tracked in soils, waters and rocks. Like the Cambrian Explosion, when the fossil record became significantly richer due to the evolution of calcium carbonate shells and other hard body parts of living creatures (Wood et al. 2019), the Anthropocene will leave its footprints in the fossil record through species extinction, radioactive isotopes from power generation and bombs, atmospheric carbon dioxide levels, and deposits of toxins and plastics that will form a distinct geological layer.

As the introduction to this book outlines, the Anthropocene has not yet been adopted as an official designation and there is not a consensus on when it began, although it has already been widely embraced in the scientific and mainstream imagination. Scientists are still debating which geological signals are the 'right' ones in terms of the stratigraphic record, but the question of origins carries with it the weight of a number of social processes as well. We, the authors, enter this debate as critical geographers studying the way power and politics shape the relationship between environment and society. A key entry point within our field has been whether industrialization, colonialism, capitalism, or the Trans-Atlantic slave trade provide the most appropriate starting dates, and which processes triggered the signals identified by geologists (Baldwin and Erickson 2020; Davis and Todd 2017; Gergan et al. 2020; Haraway 2016; Moore 2015). These are never neutral questions. Whether viewed from a stratigraphic or a social point of view, the debate concerns history and which aspects of history are considered more foundational to socionatural transformations in modern times (Jordheim 2014). While these signals will be uneven across different parts of the planet, the Anthropocene nevertheless encompasses the entire Earth. Difference is erased in this view of time (Baldwin and Erickson 2020).

Within these debates, no one is questioning whether human activities are causing major environmental changes. The main social science questions are, rather, 'what are the implications of embracing this time as the Anthropocene?' and more specifically, 'what processes or relations are prioritized or brought into view by using the Anthropocene as a definitional moment, and which are obscured?' These questions do not simply relate to the past and how history is written – they are also about the future because solutions to present environmental crises are imagined within the framing of the Anthropocene. In this chapter, we discuss some of the implications of this framing for which solutions are emerging.

Geographers have been part of the Anthropocene debate in a variety of ways. Many physical geographers have contributed research toward identifying signals and considering whether the Anthropocene is justifiable from a geological point of view. Some social geographers have embraced the idea and sought to help refine it either by engaging in debates about when it started – the timeline varies from 1610 to 1964 – or how to use it for organizing responses to rapid rate change. We are part of yet another group of geographers who are asking questions about what signals or markers are used to 'find' the Anthropocene, who defines them, how the logic underpinning them is linked to our colonial, racist, capitalist and gendered histories, and how it shapes the kind of management practices and changes we make today.

Before discussing these themes in more detail, a couple of key words need explanation. Capitalism is the dominant economic system in the world today and is based on the creation and extraction of value either through labor or the private ownership of land, machines and other infrastructures necessary for production (known as 'capital'). It is a system predicated upon growth, meaning that more transactions and value need to be created constantly or the system slows down, causing a loss of profits (and often jobs). People sell their labor power, but those who own capital profit by not paying for all the value that people create through their work (Harvey 2018). Colonialism is a political economic system that first became dominant during the rise of merchant capitalism. Both state-sponsored and private companies traveled all over the world seeking new resources, labor and markets. Colonialism has had major impacts on land and people. Plants, animals and people were transported all over the world and established in new places through merchant capitalism processes. Land ownership, governance structures, knowledges and education systems have been remade using models and logics developed by colonizers, and a massive amount of wealth has been accumulated by colonial powers (Said 1979).

Closely tied to colonial histories, racism refers to discrimination based on skin color and ethnicity. Racism is not a static categorization of people but rather reflects both everyday, embodied forms of exclusion, violence and discrimination, and structural or institutional forms of systematic exclusion of certain populations on the basis of skin color and ethnicity (McClintock 1995). Finally, gender refers to the way that society is divided based on presumed biological sex. It should not be conflated with biological sex but rather refers to how ideas about male, female and transgender, masculinity, femininity, and nonbinary identities operate to create social differences. Gender highlights how such differences are always relational, meaning that like racism, discrimination or divisions based on gender are not static and are both embodied and structural (Butler 1990).

This chapter is organized as follows. We first discuss the implications of how the Anthropocene is framed and some of the solutions that have emerged from the dominant understanding of it in the natural sciences. We then explore alternatives proposed by critical geography and elaborate on several issues these critiques put on the table. One key element that emerges from bringing dominant and critical approaches into the conversation is that while the scientific method aspires to universalist explanations, its application is traversed by power-laden partial observations. As a result, scientific findings and approaches tend to privilege particular dynamics while obscuring others, and often subsume other approaches to knowledge production (Hulme 2018; Jasanoff 2004). Universalist explanations seek to tell one story, in this instance, to encompass the whole Earth, which can hide the unevenness and specific challenges posed by the Anthropocene for different populations. We therefore conclude by thinking about what it might mean to imagine a story about environmental change that does not rely on universalist explanations.

Framing twenty-first-century challenges

The Anthropocene is a deeply anthropocentric idea, meaning that the challenges of the twenty-first century are viewed from the point of view that puts humans and their activities squarely in the center of the frame, even if the geological signals used are biophysical. Social scientists, who are also concerned about human-induced environmental change, have queried whether the Anthropocene is the right term. They show that not all humans *equally* are a geological force. They rather point to the ways in which some humans, and some human activities or cultural values, are more complicit than others in driving present rates of environmental change. So how should the Anthropocene be framed?

The question of framing is paramount. Framing refers to the logic that underpins ideas; how the world is assumed to work (known as 'ontology' in philosophical terms). What kind of connections are made and valued, and which are either invisible or never considered? What sort of data is needed to support our view of the world, or how can we know the world ('epistemology' in philosophical terms)? This is not to suggest that anything goes. Data needs to be valid within the conceptual traditions within which it has been assembled. Thinking about framing rather opens up space for querying assumptions and remaining open to other worldviews that can provide new connections.

The geological Anthropocene is underpinned by ideas that have been around since the Enlightenment. The Enlightenment, a period of deep philosophical questioning in Europe during the seventeenth and eighteenth centuries, helped create the intellectual backbone of science. The image of the Earth as a living being, which dominated in the Middle Ages, was replaced with a mechanistic view related to the industrial revolution: inert parts that operated together rather than being alive in themselves. Unsurprisingly, this framing led to greater exploitation of the Earth (Merchant 1982). This exploitation is predicated on a scientific understanding of nature-society relations that, by definition, reduce their complexity. The scientific method's claim to universality necessarily relies on partial observation, whereby isolating the parts of a phenomenon allows an understanding of it as a whole once its parts are reassembled. Modeling, for example, relies on data that have been collected in a manner that discards a variety of processes as noise rather than as integral parts of a particular phenomenon (Cote and Nightingale 2012). This is not a new, bold claim – these foundations of science have been debated throughout centuries in the philosophy of science, and they regularly re-emerge, for example, in issues around reproducibility or biases in statistics and, more recently, in machine learning (Baker 2016; Shimron et al. 2022).

Despite the partiality of science, most consider it the most efficient method to produce knowledge about social and environmental problems, as well as solutions. Geoengineering, for instance, is one such solution to environmental change and an example of the partial logic the current framing of the Anthropocene has created for responses to environmental crises.

Geoengineering solutions are varied both in scale and ambition, but include everything from seeding clouds, to changing the aerosols in the atmosphere, to capturing carbon to bury it back in the ground (Bellamy et al. 2012). What they have in common, however, is that they are firmly grounded within a partial, economically capitalist, modernist logic – they do not question current relations of production, consumption and labor but are rather devised so these processes can be maintained and expanded. If the problem is CO_2 in the atmosphere, then the solution is to put it back in the ground instead of redesigning our current system to emit less CO_2. Geoengineering solutions look for ways to inspire 'green growth' by creating industries intended to clean up different forms of pollution. Yet, many researchers have shown that capitalism, an economic system predicated upon continuous growth, is a foundational cause of pollution and environmental crises (Moore 2015; Schneider et al. 2010). They argue that solutions to the Anthropocene proposed in a capitalist frame cannot fundamentally shift the relations that have caused problems in the first place. If capitalist economic relations and the logics of extraction and growth that underpin them are foundational to how current environmental crises arose, then perhaps we need to shift the frame to find a way out (Haraway 2016).

Planetary boundaries

The frame of the Anthropocene becomes clearer when looking at the ideas that underpin it. One of them is the notion of resilience. Resilience is used in a variety of ways, but our focus is the way it has been conceptualized by colleagues aligned with the Stockholm Resilience Centre (SRC). The SRC has been a thought leader for decades in promoting a way of understanding ecosystems that recognizes dynamic change as vital to how systems evolve (Gunderson 2000). During most of the twentieth century, ecosystems were conceptualized to be in equilibrium, an idea wherein stability and lack of significant change were considered the 'apex' of evolution. Resilience, in contrast, recognizes that change is constant and inherent to ecosystem evolution. Cycles of growth and decay are normal, and ecosystems move within a dynamic set of system boundaries unless a significant shock or change occurs, which can then cause a 'phase shift.' A phase shift means that the ecosystem properties change into a new system, like a forest changing to a grassland, wherein new cycles of growth and decay then begin.

From these ideas of resilience arose the notion of planetary boundaries. A set of nine boundaries have been proposed, all of which are, notably, in the biophysical realm: climate change, biodiversity loss, nitrogen and phosphorus loading, land use conversion, ocean acidification, chemical pollution, freshwater withdrawal, air pollution and ozone layer depletion – the first four of which have been argued to be crossed already (Rockström et al. 2009). The boundaries are described as system properties of the Earth wherein limits can be identified, beyond which the Earth itself will undergo a phase shift. For example, there is a CO_2 concentration limit in the atmosphere, beyond which temperatures on Earth will rise significantly. This is a main concern with global warming – that the whole atmospheric system will undergo a phase shift and threaten life as we know it.

While planetary boundaries have been useful in thinking about interrelated aspects of our world and the potential implications of too much change, they are nevertheless firmly rooted in modernist thinking about human–environment relations.

Within this thinking, the environment is seen as the overall frame, or backdrop, that humans impact upon – rather than humans already being a part of the environment. For example, in the planetary boundaries cited above, 'land use conversion' is the only one that includes human activities. Thus, while resilience and planetary boundaries frames attempt to capture the interaction between social and natural dynamics, they continue to understand natural dynamics as the backdrop to human activities – rather than a 'signal' in and of itself. The point here is not that social science should be included by definition, but rather that the framing of the 'Anthropocene problem' is constrained by failing to take better account of how society–environment dynamics co-evolve.

Resilience scholarship has attempted to address this issue by conceptualizing the idea of social resilience: societies are defined as resilient if they can recover from shocks and absorb change (Folke 2006). Note that this idea is quite different from the original framing of ecological resilience wherein change was seen as important to overall ecosystem functioning. Socioecological resilience tries to bring these ideas together and overcome the conceptual separation of society from environment. Within this work, however, the terms of reference remain firmly in either natural systems or social systems. The Enlightenment separation between humans and the environment continues to lie at the center of the way modern problems are understood.

Social science critics have argued that this conceptualization of the environment as the backdrop to human action does not reflect a universal way of thinking about change (see, e.g., Ried and Sieber 2020). Below, we turn to two key conversations that have been important within geography, which help illustrate why universal understandings can be problematic. The first one questions what is rendered visible and invisible in the framing of a homogeneous 'human' group as the new geological force. The second challenges the boundaries between humans and environments in a way that brings into question the human-made solutions that aim to save the latter. These two are taken in turn below with a discussion of their implications for imagining future transformations.

Not all Anthropos are equal

Several alternative terms to the Anthropocene have been proposed. Beyond mere semantics, these point to different dynamics that are hidden from view by key concepts – like planetary boundaries and resilience – underlying the Anthropocene. A first set of social dynamics is around capitalism, colonialism, racism and patriarchy, and their uneven effects on the environment. Renaming the Anthropocene highlights the historical erasures that framing a homogeneous *Anthropos* creates.

Jason Moore and others have suggested the Capitalocene, since it is capitalism that has produced current environmental changes of concern (Moore 2015; Schneider et al. 2010). Rather than 'human activities' as some generic category, the Capitalocene is defined by industrial and financial processes that are deeply implicated in the rapid rate of environmental change, shifting the cause of change from human activities to political economies. This claim emerges from several previous decades of scholarship concerned with environmental justice. Environmental justice highlights that the starkest consequences of environmental degradation are felt by the poorer and more marginalized populations on Earth and created the concept of 'ecological debt' as a way to capture that relation (Warlenius et al. 2015). Placing political economies rather than human activities at the center, the signals of the Anthropocene then become labor relations, financial accumulation and resource extraction, rather than CO_2 levels or plastics. This idea has several merits, not least of which is the fact that many geologists argue that the Anthropocene should start at the dawn of the industrial revolution. This reframing places capitalist economic relations in the center of the Anthropocene, rather than environmental change itself.

Another metaphor proposed by social scientists is the Plantationocene (Haraway 2016). This framing draws attention to the radical changes in species composition, land use and distribution of people and plants that occurred as colonialism in Africa, India and South-East Asia, along with the Trans-Atlantic slave trade, created large-scale monoculture plantations around the world. This change in land use is stratigraphically visible (Lewis and Maslin 2015) and draws attention not only to capitalist economic relations but also to the uneven impacts inflicted on people and landscapes through the development of large-scale commercial agriculture. The overall point with these alternative framings is not to 'get the origin right' but fundamentally to bring into view the different violent relations that are erased in an anthropocentric framing that considers the 'Anthropos,' or humans, as an ahistorical, socio-politically homogeneous whole.

Among these relations, the impact of racism underlying colonialism and slavery cannot be underestimated. Millions of people were moved from one part of the world to another, most infamously from Africa to the Americas in what is known as the Columbian Exchange but also from South Asia to Africa and South-East Asia, along with the colonizers who moved to the colonies. This movement of people also moved plants, agricultural practices and animals and literally transformed the Earth.

The key point here is not that movement of people and plants is problematic but rather that the colonial logic underlying this movement dramatically transformed human–environmental relations. One key manifestation of this logic was plantation agriculture, which was established for food crops and industrial crops like cotton and palm oil as well as spices and drugs like poppy (for opium). This kind of agriculture relied on two premises: that the land being taken was either underutilized or poorly utilized because native people lacked a scientific understanding of resource extraction; and a racist view of the world wherein some humans were considered less human than others, meaning that they could be moved like objects, while others could not. Their labor could be used in inhuman ways that other labor could not.

The results of racist and colonialist plantation regimes are starkly evident in the geological record. In North and South America, at least fifty million people died through a variety of causes: war, displacement, disease and loss of land and livelihoods. Depopulation temporarily led to a massive decrease in agriculture and associated deliberate burning. Geologists have therefore proposed the 'Orbis hypothesis' to consider 1610 as the start of the Anthropocene, when a significant dip in CO_2 emissions is stratigraphically visible due to this change in land use (Lewis and Maslin 2015). It is worth remembering that plants like potatoes, tomatoes and chilies, which are integral to many diets throughout Europe, Africa and Asia, were brought from the Americas. The residues of these plants can be identified, and along with the dip in CO_2 emissions caused by land use change, are identifiable in the geological record. Yusoff (2018) poignantly demonstrates the racist underpinnings of this signal in what she calls the 'racialised equation of energy.' The agriculture and land use practices of native peoples were replaced by slave-based plantation agriculture in the Americas, in particular for the production of sugar, which fueled, among other things, the basic energy needs of coal workers in Europe. Coal extraction was, in turn, key to the rise of industrialization and massive changes in land use and increased CO_2 emissions, which is visible in the geological record. Yusoff (2018) and others insist that racist norms underlying imperial colonialism (McClintock 1995) is not a by-product of, but a necessary condition for, the Earth system changes that preoccupy discussions of the Anthropocene (Baldwin and Erickson 2020; Davis and Todd 2017).

These critiques of a homogeneous Anthropos have focused on reflecting the past in a new light and demonstrating the continuities between the past and the present. Through a materialist ecofeminist approach, Barca (2020) builds on previous critiques and focuses on the notion of work. She invites us to rethink the granularities of the Anthropos by paying attention to the uneven ways work is valued and the way value is extracted – for example, by systematically not paying some workers for all of the value they create. Her critique highlights the role of social reproductive work as crucial to rethinking the homogenous human of the Anthropos – both in the form of unpaid domestic work but also more widely in activist environmental struggles that are vital socionatural care relations. This work, and feminist scholarship more widely, has helped understand how sexist relations and the systematic undervaluing of social reproductive work are vital to the rise of industrialization and capitalist relations that drive current Earth system changes (Caretta and Zaragocin 2020). These critiques have been important tools for geographers to rethink the way oppressive dynamics of othering and the production of uneven social divisions *within* the Anthropos are rendered invisible from the dominant Anthropocene narrative.

All these critiques have been important in showing that difference matters. Universal narratives that erase difference are not only problematic because of the way they tell history; they also conceal the dynamics that perpetuate exploitative human–environment relations into the future. Conceptualizing the dynamics of Earth system changes through framings such as the Capitalocene and the Plantationocene provides room to *write* the making of difference and inequality *into* our conceptualization of change – not only as an outcome of Earth system dynamics but as an integral driver of them. A second point of contention within critical geographies of the Anthropocene relates to the heritage of Enlightenment logics, which holds the conceptual separation of human and social processes from environmental change as foundational to the science of Earth system dynamics. We now turn to critiques that begin precisely by rejecting this separation.

Rethinking human–environment boundaries

The dominant conceptualization of the world today, separating human activities and societal dynamics from environmental dynamics, is seen by many critical scholars and indigenous peoples as foundational to why there is an environmental crisis in the first place. Geographers concerned with universal narratives also critique the modernist or Enlightenment framing of the Anthropocene idea itself. They therefore promote alternative worldviews (or ontologies) that can help to reimagine relationships with other species, resources and indeed the planet itself as vital to solving Anthropocene overexploitation.

Within this conversation, the work of Donna Haraway has been particularly influential. She takes as her starting point the new forms of human–environment relations and processes that are occurring, focusing on capitalist drivers of change and the exclusions they create, and the binaries of nature–society that underpin those processes. She begins by querying the metaphors we use and then relates them to the practices they represent. She has proposed a different metaphor for the time we are living through, one that highlights the entangled relations through which socionatural change occurs – the Chthulucene (pronounced 'thooloocene'). The Chthulucene focuses on symbiosis and hybrid, multispecies combinations that are emerging in our rapidly changing world (Haraway 2016). She is inspired by lichens, organisms composed of bacteria and algae symbionts that grow on rocks and capture nutrients from the air as they very slowly break down rocks into soil. Lichens are pioneers that provide building blocks for soil through their growth and decay. Lichens are not only life givers; they are also unpredictable and quite uncontrollable, being both fragile and surprisingly robust. For Haraway, this metaphor helps us to face not only the change we are witnessing but also the future. It is a time where change is being driven by particular – and multiple – socionatural relations, the specific ways in which humans are symbionts creating uncontrollable and often unpredictable changes. We therefore need to talk of socionatural change and resist the conceit that we will be able to fix things in a planned and carefully mediated manner through technological advances that require more socionatural exploitation.

Today, Indigenous peoples have become vociferous in their own ongoing critique of modernist understandings of human–environment relations. In many of their worldviews, the Earth is alive and humans are kin with other animals (De La Cadena

2010). Other species are accorded the same respect as humans and are assumed to be vital to the processes of life. This kind of worldview, they argue, avoids some of the Anthropocene conceits. Within this framing, or ontology, humans are not placed in the dominant position, but rather our lives are so inextricably interwoven with other species that our survival is mutually dependent on each other. It fosters humility and values the integrity of the whole.

These indigenous framings have generated a wide-ranging conversation across the social sciences about the kinds of social relations (e.g., labor) and practices (e.g., work) that emerge out of current capitalist, racist framings of the world. One hypothesis driving this interest is that overexploitation of resources and other species is more difficult when these forms of life are assumed to be kin with humans (Diamond and Orenstein 1990). This ontological framework also articulates alternative ways we may 'know' the world (Blaser 2014) – for example, challenging the institutionalized division of labor between the social and natural sciences. These ontological discussions run deeper than questioning the human–environment binary. For example, learning from the Karrabing Indigenous Corporation collective, Povinelli (2017) shows that the distinction between Life and Nonlife (as distinct from Death) is not as universal as it may appear. Questioning the way this boundary is assigned (e.g., Nonlife being assigned to geology), she suggests that this distinction is also at the heart of certain current forms of governing. She proposes different ways in which the assignment of this boundary also implies hierarchies of Life, which then enable various forms of extractivism that are at the heart of Earth system changes.

Questioning established post-Enlightenment concepts does not mean, as some have feared, that nothing is knowable, that anything goes or that material limits and boundaries are altogether irrelevant. Rather, these discussions have triggered a buoyant conversation about the relation between current conceptualizations of the Human and the Living and how they enable resource extraction. Crucially, these conversations spur a rethinking of socionatures in ways that may produce new ones, materially. For example, a wealth of research and alternatives is building around the notion of degrowth, which challenges our current economic system predicated on growth and suggests ways to rethink a different foundational logic for supplying our needs (Reichel and Perey 2018).

History, white masculinist supremacy and CO_2

The impact of unevenness, racism and (new) divisions of the geological record brings us back to the idea of how we define the Anthropocene. We need to query the *implications* of what we look for in the geological record. The temporalities we define are not only describing history – when the Anthropocene starts – they also *make* history, as starting points legitimize the role of some dynamics, like imperial colonialism and capitalism and the racist norms that underlie them over others. They hold some ruptures and events as important while relegating others to the background. There can be good arguments for organizing an understanding of change in one manner or another, but it is never neutral. Whenever we attempt to systematize and define how change takes place, it is always a political act.

Many Indigenous peoples and anti-racist allies are nervous about universalist stories like those inherent to the idea of the Anthropocene. As mentioned above, not all parts of the world and not all peoples have had the same kinds of impact. Each of the alternatives to the universal 'human' implied by the *Anthropocene* draws attention to specific practices or processes that drive environmental change, be that capitalism, colonialism or racism. They insist on recognizing different ways of being and different responsibilities for the present crisis. There are two reasons why this insistence is so important as Anthropocene debates progress.

First is the issue of what histories are told and how that shapes our futures. This underpins all the renaming efforts we described. A focus on CO_2 levels distracts attention away from the mass genocide that took place in the Americas (Yusoff 2018; Baldwin and Erickson 2020). The geologists who proposed 1610 as the starting date of the Anthropocene describe the Columbian Exchange based on the significant movement of plants and animals not only from the Old World to the New World but also vice versa. What is missing from this account, however, are people. These plants and animals did not move themselves – specific political economic regimes moved them. They also represent significant disruptions to livelihoods, economies and well-being for millions of people worldwide, as we described above. Reflecting on this moment in history is important, but telling of its relevance through plant movements pushes the violent, racist histories of colonialism into the background.

Second is the issue of what signals and evidence we use to define and understand environmental change. Those mentioned above are the most popular (plastics, radioactive isotopes, CO_2 levels and species movements/extinctions). However, critical scholars and activists are wary of the hegemony of reductive science and the methods and institutions of Earth systems science that define these markers. In engaging with Earth system sciences, they are concerned about having room for other ways of knowing about environmental change and to shift the frame such that different relations and data get more attention than those that emerge from a geological framing. As the critiques above have shown, causality is not so easily ascribed to one kind of process or reduced to economy. Rather, the causes of twenty-first-century environmental challenges are outcomes of unruly relations – ones that we create but cannot control that emerge from current understandings of how the world works and the sociopolitical and cultural frames through which we engage nonhumans and nonlife – ways that can help bring difference and the violence done to certain populations firmly into view.

Critiques of the Anthropocene in geography invite us to consider violent historical moments not as an artifact of the past, of what came before, but as mirrors of the present and food for thinking about what may come next. For example, the oral histories of Native Americans who were forced to walk the 'trail of tears' describe not only the psychological scars of that traumatic experience but also the physical ones (Samuel Proctor Oral History Program 2022). Thousands of people were forced from their homes between roughly 1830 and 1850 and walked for weeks to reservations in Oklahoma. Their bodies, and those of their descendants, are reminders, a map of the impact of that forced relocation, one which tells a very different kind of story. It is one of multi-generational poor health and physical impairments caused by the malnutrition, violence and stress suffered not only on the walk but also by being displaced to a different socioenvironment, and the lack of political-economic embeddedness in those places. Their psychological and physical stories help to change the scale of environmental change, to personalize it, while at the same time helping us to understand the impacts on an entire population in a more emotional way. It brings into clear focus the way exploitation of humans and nonhumans is not 'another story' that remains external but rather an integral part of the dynamic that the Anthropocene story attempts to describe.

Third, and relatedly, emphasizing sociopolitical dynamics alongside technical and technological ones is key to imagining transformations and potential ways forward. Concepts of the Anthropocene and planetary boundaries have not fundamentally challenged the way we make sense of and use socionatures. Geoengineering and technological solutions aiming toward 'green growth' are often chosen for what they can accomplish without questioning the conditions under which they are produced and consumed. Geoengineering is fundamentally embedded in the idea that humans can and should control the complex human–environment relations taking place. If we take Haraway and others seriously, then these relations are either ill-conceived or inherently too unpredictable and uncontrollable for this strategy to succeed – which brings geoengineering into a different light. It appears as a poster child of the human conceit around the Anthropocene.

Taking CO_2 as a signal of the Anthropocene has been important in forcing us away from fossil fuels and from oil in particular. However, this is a partial story that requires bringing regimes of natural resource extraction into the wider view, regimes that have hinged on capitalist, racist and patriarchal relations of production and reproduction. If we consider this, oil is not the culprit – extractivism is, and so we can, for example, start thinking more carefully about electric batteries as a magic bullet. We start considering the extractivist socionatural regime on which it relies, and whether these are different from the ones that have led us to formulate the current epoch as the Anthropocene. In hiding these dynamics, the concept of the

Anthropocene also conceals solutions that rely on alternative socionatural regimes; it is not the right platform from which to radically rethink the status quo. While geographies of the Anthropocene seem to operate mainly at the critical level, deconstructing dominant concepts, they also offer pointers for 'transformation' – helping to open up space for reimaging our framings of nature–societies and allowing new kinds of socionatural histories to be told.

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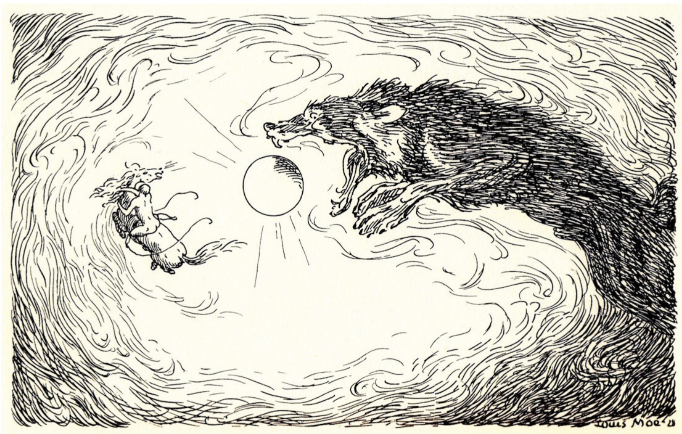

Fenrir, the monstrous wolf swallowing the sun. A graphic rendition of the Fimbulwinter narrative by Danish-Norwegian painter Louis Moe (1857–1945). (Photo: heimskringla.no*)*

CHAPTER 7

Archaeology in, of and for the Anthropocene

Felix Riede and Per Ditlef Fredriksen

Felix – Merapi 2014

In 2014, I attended a volcanology conference in Yogyakarta, Indonesia. As part of this conference, we visited a village that had been devastated by the most recent eruption of Mount Merapi, a volcano that is as dangerous as it is culturally significant (e.g., Dove 2008; Seeberg and Padmawati 2015). While my geologist colleagues busily studied the ash, I explored what remained of the houses and the artifacts of the village itself. In this Anthropocene Pompeii, I was greeted – or confronted – by a local who owned one of the houses. He told me that he had lost his wife and child in the cataclysm. Affected deeply by this entirely unexpected encounter, I began thinking about ways to make my research – already concerned with human–environment relations – relevant beyond the academy. This led me to seek out the environmental humanities, as they were emerging in the Nordic area at that time (Nye et al. 2013) and the emergent movement of geo-ethics. As a researcher situated between the environmental humanities and the geosciences, I was struck by how little ethical engagement there was among archaeologists in their work relating to humans and the environment.

Per Ditlef – Wayfaring with waste

Growing up on an island on the west coast of Norway, I went on treasure hunts along its shores. I knew the places where things got washed up by the winter storms. Every spring, the harsh weather had brought something new: driftwood, fishing equipment, tin cans and lots of plastic, all worn down and in various stages of decay. Sometimes, hardly discernible labels in strange languages helped fuel the imagination. I made my own narratives about geography and time: where things came from and their journey to our local beach. While terms like global capitalism, excessive consumption or the Anthropocene were obviously not in my vocabulary back then, my encounters with dirty flotsam led to a key question: How can I learn about and understand the world if I am to avoid the unpleasant? Nowadays, I am an archaeologist who engages with waste, decay and deep-time climate curves on a daily basis. My critical vocabulary has improved, but the drive for insight is the same, seeking to trace material trajectories in space and through time using a variety of scientific tools. Rubbish is a gateway into present and past sociality and human–environment dependencies, providing a specific archaeological point of departure: We humans always have and always will produce some form of waste. The question is what kind of waste we should make and how we should deal with it. We will not be able to alter our current destructive path by avoiding the unpleasant, and we need to understand what is happening in the present within a geographically and politically wide and temporally deep frame.

Writing deep history in the shadow of the volcano

Archaeologists and geologists are bound together in their intense focus on stratigraphy and superposition. The proposed new geological epoch, the Anthropocene, based on stratigraphic evidence and associated with material culture proxies – or technofossils – was therefore relevant and exhilarating for many archaeologists. Archaeology has long been concerned with the ways in which humans depend on, interact with and modify the environment, and many archaeological texts concerned with the Anthropocene seek to place its starting date or processual roots deep in time. As for many scientific fields, however, the history of human-environment studies in archaeology is marred by environmental determinism: the notion that climates and environments *directly* structure the fabric of society. This determinism – most commonly embedded in imperialism, colonialism and racism – gives rise to misguided moral judgment (Arponen et al. 2019; Livingstone 1991, 2012). During the twentieth century, this resulted in an often-acrimonious fragmentation of the intellectual and institutional landscape, separating those who aligned themselves with the natural sciences under sub-disciplinary labels such as environmental archaeology and geoarchaeology, and those who would rather see archaeology as a post-modern and fundamentally political discipline. Here, the powerful rhetoric of the environmental humanities offered fresh perspectives that broke with the tired 'two-culture' tropes of the science wars of the late twentieth century that have infamously pitched the soft humanities against the hard natural sciences. Bergthaller and colleagues (2014: 261), for instance, issued a call to arms thus:

> The emergence of the environmental humanities presents a unique opportunity for scholarship to tackle the human dimensions of the environmental crisis. It might finally allow such work to attain the critical mass it needs to break out of customary disciplinary confines and reach a wider public, at a time when natural scientists have begun to acknowledge that an understanding of the environmental crisis must include insights from the humanities and social sciences.

More specifically, historian Dipesh Chakrabarty (2009, 2014) suggested climate history should merge with political, economic and social history, just as other historians were seriously exploring the sources and implications of extreme environmental events more locally (e.g., Janku et al. 2012; Mauch and Pfister 2009; Schenk 2007). The number of studies on climate change in historical periods – often reconstructed using historical sources and concerned with their societal consequences – increased substantially around and just after the turn of the twenty-first century (Winiwarter et al. 2005). Similarly, Mike Hulme (2008) wrote forcefully about the need for more and better stories about past climate change and how it affected human society. He surveyed climate-focused humanities scholarship beyond history and invited the wider scientific audience to engage with the environmental humanities (Hulme 2011). Hulme's timely invitation resonated deeply with an environmental and political vision of archaeology. However, archaeology was not among the disciplines Hulme discussed, despite its long history of considering climatic and environmental aspects of the human experience.

We suggest the reasons for this omission are twofold. First, archaeology's status as a humanities discipline is ambiguous. This is partly due to its close relation to the natural sciences through a strong reliance on geology-like field and laboratory methods (cf. Pollard 1999) and some practitioners' predilection for quantification and for ecological and evolutionary explanatory mechanisms for culture change. These approaches are not irreconcilable with the environmental humanities, but their intellectual histories are such that epistemic divides are rarely discussed and even more rarely broken down. Second, and quite trivially, archaeology is simply not anchored in humanities faculties in all corners of the world. In the United States, archaeology is part of anthropology and therefore normally part of social science faculties. In some parts of Asia and Africa, archaeology is even part of the natural sciences. All else being equal, this institutional and perceived intellectual distance reduces mutual readings and opportunities for interdisciplinary contact at meetings and conferences. These are the prosaic barriers to interdisciplinarity.

As a result, archaeology has not played a role in the early development of the environmental humanities. Yet, the planetary and deep-time perspective of the maybe-geological-epoch Anthropocene (Chakrabarty 2018) already hints strongly at a perspective that goes well beyond the sources and frameworks of text-reliant disciplines such as eco-criticism and history. The evident long-term influence of human actors on environments and climate – a notion supported by ecologists (Ellis 2021), philosophers (Meneganzin et al. 2020) and environmental humanities scholars (Boggs 2016) alike – demands attention to prehistory as the temporal intermediary between the depths of geology and the shallows of history. Furthermore, key objects used as proxies for the Anthropocene – technofossils – have antecedents in the rich artefactual repertoire of the archaeological record. However we choose to define the Anthropocene, humans have always been entangled with their material environments. Precisely because the Anthropocene subverts older nature/culture binaries, it can be said to be ideally situated to describe the entire course of human history (Lane 2015). Furthermore, if we take seriously the idea that traditional ecological knowledge and ways of life might offer genuinely useful insights into alternative ways of living on this damaged planet (see Tsing et al. 2019), then prehistory offers a vast repository of such perspectives, albeit distorted through the vagaries of time, fragmentation and degradation. As Eric Wolf (1990) pointed out in relation to political history and representation many years ago, there are relevant worlds of human experience beyond the West. Wolf was thinking primarily in terms of geography but confined himself largely to the so-called ethnographic present of the last five hundred years. An archaeological perspective inspired by the environmental humanities stands to substantiate a similar argument in relation to the multifaceted human–environment relations of the societies of the 'foreign country' (Lowenthal 1985) that is the deep past. In this manner, and bearing in mind critics who have pointed out how the discourse surrounding climate change works to depoliticize key issues, despite the political rhetoric that claims otherwise (e.g., Swyngedouw 2011; Wynne 2010), archaeology has the potential to create wider intellectual spaces by considering the mutual co-construction of the world within a temporally deeper frame. In this way, the discipline may offer a perspective that is lacking in much of the science-driven debates of the Anthropocene. Such widened intellectual spaces are seen in recent expansions of archaeology's engagement with contemporary issues. Figuring prominently here is the move toward the environmental humanities seen in the form of the sub-discipline of contemporary archaeology (see, for instance, Edgeworth 2014; Olsen and Pétursdóttir 2016). Also, in the last two decades, the older sub-discipline of ethnoarchaeology has undergone a significant reconfiguration, seeking to align more closely with research fields such as ethnobotany, ethnopharmacology and ethnoclimatology.

Recent years have seen a rapprochement of archaeology and the environmental humanities (Hussain and Riede 2020; Riede 2019); volcanoes and volcanology, too, have found their way into the environmental humanities (Clark et al. 2018). Drawing upon research hitherto independently conducted we here seek to bring our perspectives into conversation. In the following, we draw together insights from environmental archaeology, environmental science and archaeology to illustrate – with a focus on the sixth century CE in Scandinavia and beyond – just how certain episodes of past culture change are reinterpreted with Anthropocene concerns in mind. The case of the sixth century CE has already served as a disciplinary meeting ground for us and for others. The rich archaeological and textual data associated with it serve environmental science by not only contributing vital direct contextual evidence for past human–environmental interactions and information on changing ecological baselines but by also providing evocative and affective narratives that resonate with contemporary concerns. At the same time, these same sources also illustrate the complexities of human resilience and response. In addition, archaeology provides materials and venues for reaching different parts of the public via museums, local interest groups and books written for education and entertainment. At the same time, and because of its broad public appeal, archaeological cases such as these may also serve the environmental humanities by providing earthbound material evidence and less academic jargon, and introspection – weaknesses the field has arguably inherited from the humanities more broadly.

536 CE – the worst year to be alive

The so-called 'Migration Period' (ca. 300–800 CE) and the subsequent centuries of the early Medieval period have long been considered tumultuous times. Classical texts written by scholars of Late Antiquity noted poor harvests, strange weather and a veiled sun. Complementing this, Axboe (1999) suggested over two decades ago that the year 535/536 may have been particularly significant. With specific reference to a group of archaeological finds of golden amulets called bracteates that have been ritually deposited *en masse* in Scandinavia right around that time, he suggested that there is a link to the depressed temperatures identified in dendrochronological proxies by Bailie (1991). Baillie (1994) further proposed that one or, more likely, multiple volcanic eruptions had instigated this temperature fall – a precocious suggestion later proven robust by detailed investigations of additional tree rings and ice cores (Büntgen et al. 2016; Sigl et al. 2015). Backed by still more analyses focused on reconstructing past climate from ancient tree rings (Helama et al. 2018, 2019) and climatic modeling that integrates large datasets (Toohey et al. 2016), there is now strong – albeit not entirely uncontested (Helama et al. 2017) – evidence for the climatic crisis in the first half of the sixth century CE. Indeed, the year 536 has been named 'the worst year to be alive' (Gibbons 2018).

Archaeological evidence has been marshaled to argue that, in eastern central Sweden, for instance, many traditional settlements and burial sites were abandoned and age-old ritual practices changed (Arrhenius 2013), a major population decline occurred and elite power was questioned (Gräslund and Price 2012; Price and Gräslund 2015), while the misery of the moment was also exploited in political machinations (Löwenborg 2012). The events were perhaps even marked on a runestone (Holmberg et al. 2020) and have remote echoes in the Nordic eschatology of the Fimbulwinter penned many centuries later (Nordvig and Riede 2018). In nearby south-eastern Norway, archaeological and ecological data also suggest a simultaneous population decline and feverish responses by a contested elite eager to retain power and legitimacy through monumental building works such as the massive Raknehaugen (Gundersen 2019; Solheim and Iversen 2019). Aggravated perhaps by the spread of the disquieting grain-borne disease ergot (Bondeson and Bondesson 2014), people adapted their subsistence and livelihoods to the climatic changes (Gundersen 2021), and daily practices such as cooking and eating changed (Bukkemoen 2021). Looking more broadly at southern Norway, we see that architecture changed (Gjerpe 2017), certain crafts died out (Fredriksen et al. 2014) and a new technology of remembrance emerged in graves (Fredriksen and Kristoffersen 2020). In this scenario, the years following 536 CE saw a major agricultural and societal crisis (Widgren 2012), to the extent that this aftermath is often eerily referred to as 'the quiet century.'

Looking east, the Baltic region was similarly impacted (Tvauri 2014); looking south, changes were different but no less dramatic. In Denmark, ritual responses took the form of the sacrifices of gold valuables – the iconic bracteates mentioned above – and the political landscape changed substantially. Some old centers of trade and power declined; new ones arose. In some regions, settlement intensity grew, while other regions became peripheral (Høilund Nielsen 2000, 2005) and others yet became practically deserted (Mortensen et al. 2019). In the southern part of Scandinavia, soils were generally more fertile, growing days longer and trading partners closer than in the north. Here, the societal change appears driven less by tragic population decline than by political uncertainties associated with the experience of unpredicted and unpredictable weather and climate. In a political landscape that was volatile already before the disruption of the volcanic eruptions and their climatic effects, this translated into a loss of power for minor chiefs and kings who had most likely built their power on a combination of agricultural wealth and trade control (e.g., Høegsberg et al. 2019).

It is easy and tempting to think that what happened in the sixth century CE is now figured out. Stimulated by better, more highly resolved climate reconstructions, we can finally see clearly how these past societies were affected (see van Dijk et al. 2022 for a recent, comprehensive and interdisciplinary summary). Yet, there are also good reasons to be cautious. Alternative explanations that foreground political reasons for the observed changes do exist (Wickham 2005), and alternative interpretations of the same evidence cited above are possible (Moreland 2018). Significantly, critics have pointed out that concurrency is not the same as correlation, let alone causation, and that we need to understand 536 CE and its aftermath within a wider framework of evidence, concern and narrative. A certain level of temporal resolution is necessary to be able to discuss cause and effect. To illustrate this, it remains an open question, for instance, just how many of the changes in the mid-sixth century CE are more saliently rooted in the geopolitics of the foregoing and deeply troubled fifth century, which after all saw the collapse of the western Roman Empire. Its collapse had a significant impact on trading routes and exchange networks and therefore also on the foundations of elites in the North. That said, the creeping decline of the Roman Empire itself may also relate to a changing climate such that the extreme events of the sixth century were merely catalysts that accelerated and exacerbated societal changes that were already underway.

536 CE – an allegorical doomsday fad of our times?

Equally open is the question of the relationship between the 536 CE event and the subsequent bubonic pandemic (the Justinian Plague) emerging in the 540s. We know it reached continental Europe and the British Isles, and it seems highly unlikely that it did not reach Scandinavia. Yet, the lack of written sources and archaeological data in this part of the world creates uncertainty as to the severity of the direct impact of such events.

The natural sciences – for instance volcanology (Riede et al. 2020) or climate modeling (Heymann 2010) – wield great epistemic power both vis-à-vis the humanities and in public debate. Driven by greater funding and long-established structures of team science and policy influence, the natural sciences have contributed with much new data and insights into, in our case, the drivers of historical change. At the same time, the rise of climate history also reflects contemporary preoccupations and fears – among researchers and funders alike. Climate is relevant, and looking at history through the lens of climate provides new forms of relevance (cf. Degroot et al. 2021; Schenk 2015).

Lurking behind these epistemic entanglements hides the question of causal primacy. Many recent studies that postulate climate change as the driver of cultural change in the past follow rather linear and often implicit models of causal relations between climate and culture. The debate between McConnell et al. (2020a, 2020b) and Strunz and Braeckel (2020) lays some of these differing viewpoints bare (see also Arponen et al. 2019 and subsequent comments). Critics warn against falling into the trap of simply replacing the primacy of one kind of archive and motor (written history and politics) with another (natural science data and climate) when constructing new archaeological grand narratives (e.g., Moreland 2018). However, human decision-making at the level of the individual, the small economic unit (i.e., the household) or larger political collectives relates not so much to climate but to the effects – often themselves complex and delayed – on relevant environments and the specifics of any given society. It is not clear whether a society or culture, usually defined as an ethnic or linguistic entity by reference to more recent history, are the most useful units of analysis to understand how humans perceived and reacted to past climate. Evidently, personal observations of weather sometimes albeit not always show clear relation to climate reconstructions (e.g., Pillatt 2012), and traditional weather knowledge does not necessarily correlate with a successful navigation of the environment (Reyes-García et al. 2018). This is not to question the efficacy of non-Western ways of knowing the environment (see Reyes-García et al. 2016) and their relevance in meeting present and future climate change challenges (Barthel et al. 2013; Gómez-Baggethun et al. 2013); it is merely to say that we can probably still do better in constructing truly robust narratives of climate-society relations across deep historical timescales, which meet the epistemic standards of both the environmental sciences and the environmental humanities. In the West, for instance, in Norway, archaeology may serve to highlight how ancestral societies related and reacted to climate change in the past as an effective and affective link between now and then.

Why telling climate prehistory is important right now

One needs go no further than the most recent IPCC report to get a clear idea of the urgency of the contemporary climate crisis (IPCC 2021). If science in the inclusive sense of *Wissenschaft* (i.e., not only the natural sciences but all scientific endeavor in the widest meaning) is to contribute to meeting the challenges ahead, and perhaps even contribute to solutions, then all disciplines should play a part. Each discipline comes with strengths and weaknesses. It is encouraging how eloquently the field of environmental humanities argues for ethical and political engagement, for a plurality of perspectives and for widened participation. At the same time, the specific jargon often adopted by environmental humanities scholars can be arcane and, indeed, at times, actively alienating to other scholars, as we have ourselves observed on numerous occasions during interdisciplinary seminars, workshops and conferences. The environmental humanities define themselves in part as complementary and in part in opposition to the natural sciences. Archaeology cannot operate well without the natural sciences. The discipline values and uses numerous biological and geological techniques and approaches as well as demanding digital techniques. Much archaeological knowledge is genuinely co-created across the humanities–science divide.

Archaeology can and does provide an immediate and often intimate human face to past societal consequences of climate change. Operating from the minute scales of individual objects, graves or houses to vast cultural landscapes tracking the expansion and contraction of human enterprise, archaeological data can unfold how climate and society relate – via environments – beyond urban elites and selected literate societies. Some of the more recent narratives that have emerged are of human engagements with their surroundings stretching back several millennia, way before the earliest farming societies and urban settlements, thereby evoking the antiquity of the Anthropocene. Archaeology cannot, of course, 'solve' the climate crisis. But it can, we optimistically believe, both serve to build bridges between entrenched humanities and natural science perspectives, epistemologies and vocabularies and provide critical narrative elements that can boost the communication of climate concerns in the public sphere.

Communicating climate change risks benefits from narrative framing (Carter and van Eck 2014; Daniels and Endfield 2009; Morris et al. 2019). This insight is most often interpreted to mean that contemporary and future climate change should be packaged in stories. But recalling Hulme (2008), we suggest that packaging past climatic and societal change in such a narrative form also can play a substantive role. While necessarily constrained by evidence – pots, flints, stratigraphies, postholes and burial mounds – archaeology also shares important features with fiction. We construct, write and tell stories about the past. While this claim can be taken to diminish the relevance and impact of archaeology, it is salubrious to remember that stories – also those of climate change – do change behavior, values and the world (Schneider-Mayerson 2018, 2020; Schneider-Mayerson et al. 2020). When we add to this the fact that archaeology is taught in school curricula, is ubiquitous in museums and gets airtime on national TV, its relevance to how we think and act vis-à-vis the environment is hard to deny. In articulating archaeology with the environmental humanities, the natural sciences are our allies, as are modelers, as are museum curators, educators and journalists. With due diligence but also due courage, it is time to ask bold new questions about what the past can tell us about human–environment dependencies and how we can make these relevant to the contemporary debate. In juggling the diverging scales of deep geological time, the millennia and centuries of prehistory and the minutiae of daily practice, archaeology can tell stories of how human societies rise and fall with climate change – global and local – but also how the actions of individuals – tiny and monumental – make history.

Archaeology is a discipline engaged in an epistemic and disciplinary balancing act. It is by necessity strongly aligned with the natural sciences and benefits enormously from this engagement. At the same time, archaeology has long been inspired by theoretical and conceptual thinking in the humanities at large. This dual orientation has led to an internal divide in epistemology, practice, purpose and publication. The notion of the Anthropocene and the emergence of the environmental humanities, however, offers a platform for bridging this rift. Recent interest in re-examining iconic cases of prehistoric culture change in light of climate illustrates this shifting landscape and provides new information and incentive to communicate these matters to the wider public. It is here, through its innate connection with museums, school curricula and similar forms of established outreach domains that archaeological work under the remit of the Anthropocene can contribute to contemporary debate (Riede 2022). Moreover, the intense light that the Anthropocene shines on time and temporality also impacts archaeology. The vast geological timescales often discussed in relation to the Anthropocene are akin to those of archaeology; and archaeology provides concrete evidence of the ever-increasing impacts humans have exerted on other species and the global climate. More importantly, perhaps, this temporal depth also extends into the future with archaeological thinking entering conversations about long-lens climate change adaptation (Lyon et al. 2022) and the role of archaeological heritage in any such adaptation processes (Holtorf 2016).

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Empty poultry factory ready for new animals, Scandinavia 2022. (Photo: © Yamile Calderon)

CHAPTER 8

Examining the Links between Meat, Viruses and Disease in the Anthropocene

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I am a professor of human geography working at the Centre for Development and the Environment at the University of Oslo. Geographers focused on a range of issues relevant to the Anthropocene even before the term was invented. Food production is one such issue that has interested geographers for many years. During my whole career, I have been interested in understanding ecological change by considering the political and economic structures and institutions in which such change is embedded. I never imagined, though, that I would one day become interested in chicken.

Some years ago, I remarked to my children how difficult it was to find chicken in the supermarket when I moved to Norway. Chicken was central to many dishes I ate growing up, from *pollo al jerez* to *pollo en jocón* and every variation that can be found in the Guatemalan kitchen, characterized by the blending of European and

Maya ingredients and techniques. *Pollos* (chicken) with plumages in different shades of red, brown, white and black accompanied my childhood. They were everywhere, roaming about – happily, I assumed – in the backyards of many houses in the city where I grew up. Sometimes, I witnessed chickens attempting to run away in the yard of our house, as they were being captured in order to be converted into Sunday's dinner. I remember, in particular, the yellowish nakedness of the bird's body before entering the kitchen, after a long process that went from chasing a moving and breathing animal to delivering a piece of meat that was subsequently transformed into one or several dishes of food. As I grew up, the sight of running chickens and the smell of blood and feathers became less common as we bought the chicken we ate for dinner in supermarkets.

My children did not believe it had been more difficult to find chicken in the supermarket twenty years ago than today; they could not remember it being any different ever. Now consumers can buy not only a whole chicken but also chicken nuggets, chicken wings, pulled chicken, chicken sausages, chicken spreads, marinated chicken, chicken filet, minced meat of chicken, chicken ready to use in salads and more. There are numerous fast food restaurants selling chicken in Norway's major cities, and one can find fried chicken in the convenience shops of petrol stations across the country. However, statistical information helped me show my children that I was right. Meat production in Norway increased by 165 percent between 1959 and 2009. Poultry meat production increased from 2.4 kg per head per year in 1990 to 10.2 kg per head per year in 2019. Over the past thirty years, Norway has caught up with a global trend of increased meat production and meat consumption, particularly poultry and pork, starting after the Second World War in the USA (Silbergeld 2016). At the global level, poultry production increased from 3 kg per head per year in 1961 to 14 kg per head per year in 2013, whereas pork production increased from 8 to 16 kg per head in the same period. However, the increase in meat production and consumption has followed an uneven geographical pattern. While meat consumption has more or less stabilized in Europe and North America, it has increased in some parts of Asia and Latin America, with few changes in Africa south of the Sahara. Various parallel processes and changes have stimulated the increased appetite for poultry and pork in these parts of the world. On the one hand, policy changes to promote cheaper meat production, several free trade agreements[2] and changes in how production is organized contribute to increased meat production and consumption around the world. On the other hand, changes in lifestyles, like dining out more frequently, greater reliance on ready-to-use food and an expanded meat offering in supermarkets and restaurants have also contributed toward 'meatified' diets across the world (cf. Hansen 2018).

Higher meat production and consumption have devastating consequences for the environment and global human health. In my research, I am interested in understanding and explaining how different dimensions of the capitalist meat production regime, e.g., technology, labor, ecology and finance, shape outbreaks of diseases that can become epidemics or pandemics.

Poultry and viruses as markers of the Anthropocene

The above is an interesting paradox. While living chickens have disappeared from sight, today, there are more chicken products than ever in supermarkets. The UN Food and Agriculture

Organization (FAO) estimates the global chicken population to be 22.7 billion, the largest standing population of any single bird species, wild or domesticated, in Earth's history (Bennett et al. 2018). Some researchers contend that together with plastic, concrete and black carbon from fossil fuel combustion, broiler chicken bones will stand as markers of the Anthropocene in the fossil register (Bennett et al. 2018).

Poultry production is organized in a vertical integration system that coordinates separate broiler breeding units, farms, slaughterhouses, processing plants, supermarkets, marketing and finance capital. Technology, infrastructure and capital are key to understanding the dominance of broiler chicken as the world's most numerous bird species. Poultry production operates as an interconnected system that is more than the sum of apparently fragmented units of production or processing (cf. Arboleda 2020).

If the Anthropocene is a distinct planetary epoch, we are currently living in what can be defined as the pandemic era. As declared by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) in 2020, this is an era of increasing disease transmission between animals and humans – zoonoses – and between wild and domestic animals. The IPBES points to trade and consumption of wild animals, agricultural expansion and industrial meat production as interlinked global changes driving pandemics. Over 60% of new human pathogens are estimated to have crossed from animals to humans (Molyneux et al. 2011). Forest habitats of wild animals have historically provided a 'firebreak' that buffers against inter-species disease transmission (Wallace et al. 2020; Brenner and Gosh 2022). However, recent incursions into wild forests through, for example, land enclosures for commercial forestry, industrial farming and mining compromise this ecological buffer. New venues for pathogenic circulation beyond the forest ecosystem into global circuits of capital arise. As domesticated animals are more often in contact with wild species, for example, at the fringes of contracting forest ecosystems, they might become vectors of infectious disease transmission in relation to human and nonhuman hosts. Because wild animals are increasingly sold as part of commercial markets, they connect wildlands more directly to hinterlands, peri-urban and metropolitan zones of production, exchange and consumption. This accelerates pathogen circulation across both human and nonhuman populations. Industrial animals, such as poultry and pork, are produced in densely stocked livestock factories composed of genetically homogenized species with accelerated population throughput by shortening animal lifecycles and standardized metabolic rhythms using caging, machinery and biotech inputs (Brenner and Gosh 2022). Technological development plays an important role in controlling the temperature, humidity and light of poultry production plants, which, together with computer software, electricity, transportation vehicles, refrigeration and feed processing facilities, allow for more efficient production. Three to four multinational biotech corporations control poultry breeding and genetic selection and produce the chicks that are raised worldwide. The diversity of chicken varieties bred to produce meat or eggs has been reduced to a handful. The life cycle of commercial poultry has been remarkably shortened. Eggs are laid in broiler breeder facilities and transported to hatcheries, where they incubate artificially for 21 days. After hatching, the one-day-old chicks are transported to high-capacity finishing units housing up to fifty thousand individuals in climate-controlled sheds. For the first week of life, chicks are kept at temperatures of 32°C to 35°C and relative humidity of 60% to 70%. At five to seven weeks old, broiler chickens (those that produce meat) are transported to the slaughterhouse (Bennett et al. 2018).

Pandemics as entanglement

I find the notion of 'entanglements' useful to explore the connections between meat production and epidemics and pandemics. The dictionary defines entanglement as 'a condition of being deeply involved' and as 'a complicated or compromising relationship or situation' (Oxford English Dictionary 2020). Our entanglement with microorganisms has contributed to our *becoming* the humans we are today (Kelly and Nading 2019), and the risk of zoonoses has accompanied us ever since we began to rear livestock for food (Scott 2017).[3] However, the speed at which zoonotic diseases emerge has accelerated during the last thirty years.

In every piece of meat we eat, there is a web of social and material relations hidden from our eyes. These relations extend beyond our dining rooms and our kitchens, even beyond the concrete site where animals are reared or killed – from international trade rooms, stock markets, company board rooms, advertising bureaus and bureaucrats' desks. Consequently, the entanglements that sustain meat flows include unintended attachments with pathogens, feed and fodder, land use change, antibiotics used to prevent the outbreak of animal illnesses, corporate models of organizing meat production and sophisticated models of scientific animal husbandry. In this way, a zoonotic disease is not caused by a pathogenic entity that suddenly invades otherwise healthy organisms out of nowhere; diseases emerge as an effect of the interaction among multiple agents. Zoonotic diseases are rhizomatic phenomena, brewing in silence out of sight and emerging anywhere (Nading 2014). Zoonotic diseases emerge, thus, as an effect of interaction among multiple agents.

How did we arrive at a situation where these diseases emerge more frequently? The short answer is very simple: The processes and practices of industrialized meat production and industrial agriculture break the barriers that separate humans and wild animals more often and at more locations, and thus humans and livestock more easily come into contact with pathogens that occur naturally in the wild.

A series of conditions that make industrial meat production possible make animals and humans susceptible to pathogens. These include confined housing operations where thousands of genetically homogeneous animals live together, requiring the use of antibiotics in high volumes to ensure that animals can not only cope with infections but also grow faster. The excessive use of antibiotics increases the occurrence of antibiotic-resistant bacteria. The feed used to rear animals depends on ingredients produced in locations far away, detached from the ecosystems where the animals are kept. Soya is one such important component. The industrial cultivation of soya has expanded and continues to do so, into forest areas. Indigenous people and small-scale farmers are displaced into more marginal areas, where they live lives that are even more precarious. The labor conditions required to process millions of animals each day resemble assembly lines. Timothy Pachirat has written an account of industrialized killing in his book from 2011, *Every Twelve Seconds: Industrialized Slaughter and the Politics of Sight*. The name of the book alludes to the fact that in the slaughterhouse where he conducted his ethnographic work, 2,500 cattle are killed per day, or one every twelve seconds. All these factors make animals and humans more susceptible to the attack of any given pathogen.

The globalization of industrialized meat production

During the second half of the twentieth century, a remarkable change occurred in meat production in the United States, which was later adopted by poultry producers in other countries. Livestock went from being reared in family-owned farms to industrial operations that resemble animal factories, where thousands upon thousands of animals are confined. Animals were no longer slaughtered in close-by slaughterhouses owned by a number of local firms but in concentrated and massive animal slaughter operations. Independent animal transport firms disappeared in a few years. The so-called 'Tyson model' emerged, named after one of the world's largest poultry producers in the world, Tyson, which began developing a model of industrial meat production characterized by consolidation and vertical integration. With this, I mean that control and ownership of many of the processes in the commodity production chain are integrated and owned by a handful of companies. Asia has the highest production of meat in the world, but the largest meat production companies are based in the United States. A smaller number of meat production business groups own meat processing plants, slaughterhouses, transport companies and distribution operations, and they own the animals as well. Farmers are subcontracted to raise the animals, with inputs from big companies. Industrial meat production also involves the decoupling of animal husbandry from the surrounding nature. This means that soya and maize used to prepare animal feed is produced in different places than where animals are raised. Geographer Tony Weis conceptualizes modern meat production as a grain-oilseed-livestock complex of integrated husbandry and plant cultivation (Weis 2013).

In the 1990s, two important geopolitical changes occurred that transformed global meat production. The first was that China opened its economy to foreign direct investment, welcoming Western capital and industry. With support from the Chinese state, industrial meat production advanced quickly. The number of farms producing meat fell considerably between 1991 and 2009, while the number of larger farms increased notably (Oliveira and Schneider 2016). For example, between 1991 and 2009, the number of pigs in Chinese meat factories increased from 945 per farm to 8,389. The second geopolitical change was that Brazil and Argentina implemented a series of neoliberal policy measures that attracted an influx of international capital to soya production. Transnational companies started to buy and concentrate land where soya was already being produced, and domestic companies expanded into areas where soya had never previously been cultivated, like the Cerrado region in Brazil. Today, South America grows 57% of the world's soybeans, and East Asia is the world's largest soybean market.

The expansion of industrialized agriculture has displaced small-scale farmers. Some migrate to nearby cities, while others migrate to foreign countries. The exodus of people from Central America comes to mind. Migration from Central American countries to the United States has increased since the end of the 1990s; the number of people displaced by industrial agriculture and trying to find a means to survive abroad is now higher than when Central American countries were mired in civil war. Many of these migrants end up working in meatpacking and meat processing plants. While in the past, meatpacking in the United States was an urban industry relying heavily on immigrant men from diverse backgrounds, the industry has shifted production to rural areas in recent decades. In some areas, like the U.S.

South, poultry processing was rural for decades and relied on Afro-American women and men; presently, the industry in this part of the country has turned to immigrant labor as well. Rural areas had weaker unionizing traditions and weaker unions; thus, workers can be exposed to more exploitative working conditions (Schwartzman 2013).

Policy changes at national and international levels and free trade agreements meant to stimulate the production of cheap meat, as well as technological development and improved infrastructure, have facilitated all the above. The globalization of industrial meat production occurred in an extremely short period of time within the context of the world's history of husbandry. Economic globalization is pivotal for these changes. Functional integration of economic activities across country borders, including finance, commerce and labor, defines globalization. Functional integration involves a certain degree of dependence between actors.

Pork production is an illustrating example. The world's largest pork producer, Smithfield, owned by WH Group of China with Chinese and international capital, owns production facilities in several countries, including Mexico, the United States, Vietnam and China. The fodder used to feed the animals contains soya produced in Brazil and other South American countries. The sperm used to impregnate sows is imported from Great Britain. The workers who work in meat processing plants in the United States are mainly immigrants. Meat produced by various companies in the Chinese WH Group conglomerate is sold in European markets.

Linking pandemics and industrial meat production

The key causal ecological link between zoonoses and meat production has three axes. Firstly, viruses emerge within industrial operations, which can spill over to humans. Secondly, viruses spill over to humans via their contact with wildlife. The third axis consists of viruses that spread from wild to domestic animals and subsequently to humans. I will give examples of each later. First, I want to delve briefly into the nature of viruses.

Viruses contain the key elements that form all living organisms, DNA or RNA, but they are incapable of reading the information in these proteins to reproduce themselves. Viruses use the machinery of a host cell to read the genetic information contained in their DNA or RNA in order to build proteins that allow them to survive. Once they infect a host cell, viruses use parts of the host's cell to produce their own protective membrane. Viruses are involved in processes and interactions that are also beneficial to other living organisms. For instance, we carry viruses in our guts that help protect us against bacteria. Viruses are microbial predators that influence global biogeochemical cycles and drive microbial evolution (Rohwer et al. 2009). Viruses are fundamental to the regulation of saltwater and freshwater ecosystems, contributing to the recycling of carbon in marine environments by infecting and destroying bacteria in aquatic microbial communities and subsequently stimulating the renewal of bacteria and algae.

Many viruses are host-specific (plant viruses do not affect animals, bacteria viruses do not affect plants or animals etc., and they are even specific in regard to the type of cell within each organism that they affect), but some are generalists and infect a range of hosts (Fermin 2018). Occasionally viruses cross between species by developing the ability to spread to a new host that was not previously exposed or susceptible. This phenomenon is known as spillover and is the key mechanism behind zoonosis. Spillover involves increased exposure to a particular virus and/or the acquisition of genetic variation, allowing the virus to overcome barriers to infection in the new host (Fermin 2018). During the last thirty years, spillover events between species – that is, viruses that cross the species barrier – have increased. The World Health Organization concludes that over thirty new human pathogens have been detected in the last three decades, 75% of which originated in animals. Since the turn of the millennium, there have been three pandemics: severe acute respiratory syndrome, or SARS, in 2003; H1N1, commonly known as swine flu, in 2009; and COVID-19 in 2020, but major regional outbreaks of zoonotic diseases have also been observed.

Back to the three axes that link zoonoses to meat production. The case of the 2009 swine flu pandemic illustrates the first axis. The virus that caused the swine flu pandemic originated in and around one of Smithfield's pork factories in Mexico. Researchers investigating the origin of the virus documented that the virus came from and was confined to a very small geographical area in Mexico and also that it had been there for ten years before one strain developed the capacity to infect humans (Mena et al. 2016). The viruses that caused the swine flu pandemic were a genetic cocktail. They had some parts that were not known to exist in any part of the world, some parts that came from a strain that had been circulating in Europe and Asia for years, and another that had been circulating in North America. The latter was known, and Mena and his colleagues documented that that particular strain originated from the blending of an avian, a human and a swine virus (Mena et al. 2016). The virus that caused the swine flu was, in other words, the result of a ten-year process of nature's trial and error, if you may, that finally resulted in a strain that could jump to humans. The 'mother virus' still exists in Mexico. An interesting question that arises is how viruses that circulate among pigs in Europe meet viruses that circulate in North America and viruses that were native to Mexico? Insofar as the meat industry continues to contribute to mixing influenza strains from different global geographical locations, the next pandemic might originate in areas where industrial meat production takes place.

COVID-19 illustrates the second axis. Many early cases of the SARS-CoV-2 virus were connected to a wet market in Wuhan, China, and the animal source from which the virus jumped to humans was probably there. The virus that infected humans is similar to SARS-CoV, occurring naturally in bats, and scientists believe that bats serve as a reservoir host for the progenitor of the virus that caused the latest pandemic. Pangolins, illegally imported into Guangdong province in China, also have coronaviruses similar to SARS-CoV-2. It is unclear if the virus jumped from bats to pangolins and from them to humans, but it is clear that the viruses in the three species are similar. The expansion of China's industrial meat production has also spread to other countries, restructuring the agricultural sector in large parts of Asia. Eating 'exotic' wildlife like pangolins is not a traditional practice in China but rather a practice among the upper classes that have expanded in the country since the 1990s. The economic opening of the country and the rise of the middle class has created an enormous market for the consumption of goods and services that signalize who is better off economically. Displaced small-scale farmers are forced to find new livelihoods, and animals once hunted and consumed for subsistence by rural folks have become 'exotic' animals that can be sold in nearby wet markets. Such exotic animals are now bred in captivity to be sold as food to more affluent consumers (Akram-Lodhi 2021). But small-scale farmers also supplement their livelihoods with domestic animals that are consumed as food, like pigs and poultry *and* higher-value domestic animals that are not traditionally eaten as food but for which a food market exists, like dogs and cats (Akram-Lodhi 2021). The conditions of possibility for spillovers between wild and domestic animals and humans are thus created in the places where large-scale meat production displaces small-scale agriculture.

The highly pathogenic avian influenza virus H5N1, the world's largest pandemic threat, illustrates the third axis. H5N1 occurs naturally in wild birds and occasionally spills over to domestic poultry, but in 1997 this virus infected eighteen people, and in Hong Kong, six of them died. The outbreak was linked to poultry in Hong Kong's poultry factories. The culling of 1.5 million chickens prevented the further spread of the infection to more people. But between 2003 and 2006, the virus spread to parts of Asia and Africa, causing outbreaks in birds and sporadic human deaths. In 2007, wild geese were found dead around Poyang Lake in China; these birds were infected with H5N1. This lake is the largest freshwater body in China and a significant congregation site for waterfowl. Surrounding rice fields and poultry grazing have created an overlap between wild waterbirds and domestic poultry, and the region has since established itself as the epicenter of the highly pathogenic avian influenza H5N1. Reports of healthy wild ducks at Poyang Lake highlight the potential of migratory birds transmitting the virus outside of China (Takekawa et al. 2010). The virus has been reported in countries in the Middle East, Russia and Canada. Between 2003 and 2020, the WHO reported 862 infections of H5N1 in seventeen countries resulting in the deaths of 455 people. The persistence of this virus is linked to its ability to evolve quickly and to poor biosecurity at live bird markets and poultry farms, husbandry methods and multispecies livestock farming, and transboundary transmission through the poultry trade and transcontinental migratory birds (Fasanmi et al. 2017).

A final reflection

I started this chapter by recalling how the smell of blood and feathers disappeared from my life and became a distant memory of the period before economic liberalization as I entered adolescence. Supermarkets became dominant players in most of the agrifood economy of Latin America, going from ten to twenty percent of the retail sector in the early 1990s to fifty to sixty percent in 2000 (Reardon and Berdegué 2002). In just one decade, the retail sector underwent changes that took fifty years in industrialized countries like the United States. Supermarkets and large-scale food manufacturers have profoundly altered agrifood markets not only in my native Guatemala but across the world (Reardon and Timmer 2008). This transformation coincided with changes in food production and consumption, the most notable being the increase in the production and consumption of poultry.

I have briefly visited the processes and dynamics that shape the complexity of relations in industrial meat production, including changing consumption and production patterns, technology, policy and ecologies. In this essay, I have argued that epidemics and pandemics can be better understood by fleshing out relations involved in meat production. These relations occur across distant geographies and involve humans, forests, viruses, animals, feed, fodder, antibiotics, free trade agreements, agricultural policies and changing food habits. Living in the pandemic era, means living in a reality in which humans and nonhumans co-exist in complex and, at times, dangerous relationships. As I outline above, zoonotic epidemics and pandemics render visible the excluded, the mute and the exiled (cf. Ranciére 1998) – that is, migrant workers, contract farmers, farm workers, viruses, disappearing forests, captive animals etc. Epidemics and pandemics disrupt and reconfigure what is perceptible, sensible and countable (cf. Ranciére 2004). The three pandemics we have experienced in the last twenty years, and the largest pandemic threat hovering over us, are clearly related to the ecological destruction associated with industrial agriculture and meat production.

Notes

1. Some of the ideas presented in this essay still being developed through discussions with my colleagues Jostein Jakobsen, Mads Barbersgaard, Ada Eldevik, Solfrid Nordrum, Niels Nielssen, Inga Haugdahl Solberg and Rebecca Rutt Leigh within the framework of the research project 'Pandemic entanglements: the political ecology of industrial meat production in the "Pandemic Era" – PANDEMEAT.'
2. For example, several bi- or multilateral free trade agreements launched under the auspices of the World Trade Organization. For a detailed list of free trade agreements impacting poultry and pork production, see the WTO website, https://www.wto.org/index.htm.
3. However, it is important to remember that microorganisms contribute to regulate a diverse range of ecological processes that are essential for the maintenance of life on Earth.

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Fighting for nature with documents. Environmental activist Frederic Hauge at the former offices of the environmental organization Natur og Ungdom. Photo: Marianne Gjørv.

CHAPTER 9

The Nature and Politics of Documents

The Anthropocene as a Document Site

Kristin Asdal

Before I became an academic, I was a full-time environmental activist for many years. I was reminded of my former activist office when the leader of the organization that I used to co-direct was interviewed in one of our daily newspapers. In the interview, Gina Gylver (Hovda 2022) describes what she considered a wonderful atmosphere, yet in an extremely messy office. I guess, however, that the office she was describing must be in considerably better shape than the older office space where many of us used to work and stay – and partly live – thirty years ago as full-time activists of Natur og Ungdom (Nature and Youth).

Our offices, at the time, consisted of a series of quirky rooms and a relatively dirty kitchen along a dark and narrow hallway at the very top of an old, now demolished building in Stenersgata in downtown Oslo. In between a mishmash of random objects and run-down furniture were stacks of papers and newspapers, magazines and books. We also had a computer, a printer, a fax machine, a telephone line and, of course, a mailing address and a mailbox. What we cared for and were working to protect was nature, the environment. But what we worked *with* was loads of paper – documents and technologies to write and distribute facts, protests and arguments in a range of different formats: press releases, background notes, articles in our own activist magazine, meeting agendas, calls for meetings, posters, banners and so forth.

When caring for nature and the environment, studying documents and paperwork may seem like a detour, away from the real thing, real nature, the real issue at stake. In order to enable the caring *for* nature, it comes easy to think that we need to be *in* nature, to have direct access to it, to be able to feel, smell and perhaps touch it. Surely, the importance of living with, in and by nature should not be underestimated. Yet, in caring for nature, paperwork is an indispensable part of the struggle. In fact, nature care and nature struggle very often happen with the help of, via and also *in* documents. To put it differently, documents are significant sites of nature care, and they are key tools in the environmental struggle (see Asdal 2015). Getting close to nature struggles entails getting close to documents that often work as tools that intervene in and act upon nature. In short, documents are key to the Anthropocene, the environment and sustainability issues. If you want to access the environment, sustainability issues, nature and the Anthropocene, you often must do so via paper, documents, texts and paperwork.

Examples of this are legion. Just think of the UN Report *Our Common Future* (Brundtland 1987), a commission launched by the UN and headed by Norway's then Prime Minister, Gro Harlem Brundtland. When we for decades now have been discussing the issue of sustainability, this goes back to this report and the approach to the environmental issue and the concept of sustainability that it launched. Documents are also key in other ways. Another example is international environmental negotiations. Here, other forms of UN work are significant, too. For instance, what would have become of the climate issue if not for the climate negotiations and the Intergovernmental Panel on Climate Change (IPCC) report? Obviously, in combatting climate change, not only are such final formal reports significant, but so too is the very document work that precedes it: how sentences are formulated so that they can both strictly direct action (or the opposite, preclude action) and yet be sufficiently open as to include multiple divergent interests and nations (see, e.g., Lahn 2022; Riles 2000). And there are other examples, too: propositions put forward to parliament, later to be voted upon to ban, for instance, whaling, the fishing of vulnerable cod stocks, the free emission of sulfur dioxides that cause acid rain, and so forth. All are documents that direct action upon nature.

This essay is about the nature and politics of documents and their role in and for the Anthropocene and the environmental issue. Like any other document, it is written in a particular genre. The genre in which it is written draws on the essay format just as much as the standard academic journal article. How will you, as a reader, recognize this? Throughout, I refer not only to academic work but also to my former activist work. In doing this, I seek to emphasize the link between documents and nature work not only by way of academic reasoning but by demonstrating and outlining a personal example. By this example I will seek to convince you about the importance of paperwork in nature-work. Thus, the paper has a clear academic ambition and it aims not only of telling my own story, but to outline different academic positions and ways of reasoning around this issue of documents and paperwork. My aim is to do also this quite lightly, but in providing references, I will point you toward further reading. Throughout this writing, the objective is moreover to invite you into my own particular method and way of working – what I call a practice-oriented approach to documents and to that of analysing them (Asdal 2015), a method consisting of six methodological and analytical moves that I have developed with colleague Hilde Reinertsen (Asdal and Reinertsen 2022). I will point you toward these six moves as part of this essay. I will show that this method can be read as a way of combining resources from the humanities and the field of science and technology studies (STS) – or, put differently, I want to show ways of working across the humanities and science and technology studies and the actor-network theory that was developed in this latter field of research. I will address how this is a move toward what I will call a double material semiotics. I will return to this latter point later in this chapter.

Documents and their counter-movements: return to sender

How do documents come to act upon and intervene in the world? Documents do not travel by themselves or travel alone. Sometimes, however, a simple 'click' on your keyboard can be all it takes to move a document from one place to another. Digital documents travel by other means, infrastructures and machinery than physical copies do. In any case, no matter how documents move and travel, they need to be assisted in their movements. As for the Brundtland report, it must have been moved by a range of different actors and agencies to come to life not only as a report but also as a concept to which we now all refer. I have not traced the life and movements of the Brundtland report, but I do know that I assisted in its movement. Financed by public money and a state-funded agency, the organization that I worked for received funding so that we could travel around Europe equipped with the Brundtland report in order to distribute it to environmental activist groups and organizations throughout the continent. Such document work and document movements (Asdal and Reinertsen 2022) may have both surprising and different outcomes than initially intended. In our case, not only did we help distribute *Our Common Future,* but we also, in the same movement, helped install the cutting-edge inscription device (Latour and Woolgar 1979) of the time – telefax machines – at the offices of the environmental groups that we visited. In fact, this later enabled a counter-document movement when we became dissatisfied with how the Brundtland report was followed up in practice by its eponymous author, who was the prime minister. Protesting against what we saw as measures that were far too weak to combat climate change, a series of document protests were sent on the move – to Brundtland's prime ministerial office – via telefax. Inscriptions were literally inscribed on paper, put into this machine – an inscription device in Latour's words – and in our particular way, put to work as a document tool to combat climate change. Yet, maybe leaning toward *texts* was nevertheless the wrong thing if what we wanted was real change to combat acute environmental problems?

When I left the youth environmental organization (there are quite strict age limits for members) and started studying philosophy and history, I encountered what to me stood out as an exotic and surprising discourse. I understood that what I learned, went by the name 'the linguistic turn' (for an introduction, see Asdal and Jordheim 2018). Plainly put, I was introduced to the academic understanding that there was no connection between the textual and the written on the one hand, and that which was beyond the text – on the text's outside, on other. In short, the real world could not be understood via texts. Texts were, so to speak, encapsulated in their own reality.

Later, when I encountered what goes by the name *the material turn* (e.g., Bennett 2010), this was, in a way, the same problem approached from the opposite angle. The argument here is that we, as students and researchers, must go directly to material objects, nature and technology in our analysis. Sometimes this way of thinking includes the understanding that the textual world is in opposition to and excluded from the world of materiality and objects. Rather than being concerned with texts and the textual, we should move straight to things, objects and materialities.

In this way, the world seems to be split in two: materiality and the real world on the one hand, and discourse, the linguistic and the textual, on the other.

What I want to demonstrate is not only that these are unsatisfying positions but also that there are alternatives to them. We do not need to base our work on this split between the textual and 'the worldly' – between words and worlds. In fact, there are ways out of this problem, and one of the resources for this can be traced within a particular branch of science and technology studies – in combinations or re-combinations, as I wrote above, with the humanities, including environmental humanities.

Let me turn to a short story.

Since the inception of science and technology studies in the 1960s, environmental issues have been one of the main research interests. In fact, the environmental problem was one of the reasons why this research field was established. 'Science for the People' used to be its credo, motivated by bringing knowledge back to those who were most affected by problems caused by science and technology in the service of warfare or environmental destruction (Asdal, Brenna and Moser 2007). One of its key beliefs was that science ought to be more socially relevant.

Science and technology studies (STS) remains a socially engaged research field. But at its core, it is also oriented toward analyzing and understanding the production of knowledge (e.g. Knorr-Cetina 1981), be it in medicine or care settings, laboratory research or the models and market-making of economics. It is a form of sociology of knowledge that is both empirically driven *and* oriented toward theory and philosophy. In short it is a form of empirical philosophy (e.g., Mol 2002), and a version of this empirical philosophy is the method and approach that goes under the name of actor-network theory or ANT. ANT was, in fact, developed by borrowing semiotics from the humanities, which was then developed further into a *material semiotics*. Researchers who spearheaded the direction of research that would come to be known as ANT (people like Bruno Latour, John Law, Madeleine Akrich, Michel Callon, and, in later versions, Annemarie Mol, Vololona Rabeharisoa and Ingunn Moser) became famous for researching knowledge practices and the material artifacts by which the production of facts as well as human agency were enabled. What this research direction is *particularly* known for, however, is for urging students and researchers in the social sciences and humanities to bring nature into account in our analyses (e.g., Latour 1999). It was said that nature should not be left to natural science and that the division of labor that used to exist between the scientists taking care of nature and the social sciences and humanities taking care of the social represented a huge problem (e.g., Asdal 2005). Such a division of labor between the social and natural sciences was unattainable, it was reasoned. Moreover, ANT was directed not so much toward studying and analyzing *meaning* as social change – practices and transformations as they unfold. However, this turn to materiality is not to imply a move toward an unmediated materiality. As I referred to above, the concern was rather with how inscription devices are indispensable instruments in producing and moving knowledge. The understanding is that scientific facts are realized through inscription devices. Hence, within this way of reasoning and working, there is no such division between our writing and inscription devices and the real world that is assumed to be beyond them. Science is about employing such instruments, largely called inscription devices, to produce, to realize facts (Latour 1987). So, what about the role of documents in the environmental struggle?

'Document work' in preparing to act for the environment in the Anthropocene

Let me return to where I started, with the offices of Natur og Ungdom. What were we actually doing there? Most institutions and offices that work for the environment work with the aid of documents – be they digital or in other formats. Different offices and institutions also often work on different genres or versions of documents. Policy documents – white papers, governmental propositions and what in the Norwegian context is called 'NOUs,' Norwegian Official Reports (*Norsk offentlig utredning*) – come to mind. All of these documents are written, if not in the same genre, then at least in a related one: They often aim at being quite neutral and unemotional in their form and tone. Often they prepare the ground for how an issue, for instance an environmental issue, should be handled. In fact, this is a cornerstone in a well-functioning democracy: You can disagree strongly on how to handle an issue – but the information provided *on* the issue should be correct and trustworthy.

In the offices of Natur og Ungdom (see Persen and Ranum 1997), we did not write policy documents (even if we very often read them and very often tried to influence what was to be written in them!). Often, we worked on a quite particular genre that we called a 'background note.' That is, when we were out on a campaign, for instance, to protest against a polluting factory, we made sure to arrive well-prepared – which implied that of having done our document work. Our actions were often meant to come as a surprise, but when we were there, at the gate, we had collected detailed information about the factory, its polluting activities, what the problem or issue was, why it was illegal or ought to be illegal and what, we reasoned, needed to be done about it. The background notes were not long, only a few pages, meant to be read quite easily by journalists for instance, for whom it was partly intended. But the background notes were also written in a very factual way. Like in the NOUs, the information was to be trustworthy so that it could be built upon and taken further by others. In fact, without this document work, it would be difficult to act on the pollution problem, difficult to participate in defining the problem and difficult for others to bring the case and the issue further. In short, environmental action is document work (Asdal and Reinertsen 2022)! And, if we are to understand how environmental issues are handled and environmental problems are acted upon or come into existence, we need to attend to document work. As I wrote above, the examples are legion, with scientists spending years writing and negotiating the different versions of these documents.

Documents as key tools in democracy

From the above example, it should be quite clear that documents are also tools. Documents are not simply 'flat'; they are items that are meant to address problems, issues and cases somewhere else – beyond themselves. A white paper submitted by the government to parliament is a tool for producing a policy on a particular issue, for example, renewable energy, the petroleum industry, green taxes, etc. Not only can documents be tools for the government to realize *its* policy, but they can also be tools that invite the public in and give the people a voice. Documents are key tools in democracy; they are 'little tools' of democracy (Asdal 2008) that may allow for viewpoints and positions to be articulated, to be taken into the democratic process – and perhaps even be heard and taken into account. A very concrete example of this is the 'hearing round' or public consultation process, in the format that follows the submission of a public inquiry (an NOU), for instance, or the process that is regularly initiated when there are plans, public or private, to establish a factory, an installation or a new activity that may have environmental consequences. In fact, such public consultation processes have been vital in the development of Norwegian environmental policy, and this is something environmental activists and NGOs (non-governmental organizations) will often take advantage of and actively use. This is related to how documents often move by established procedures; they are part of document movements (Asdal and Reinertsen 2022) that follow a particular well-established route, by law or by custom.

In a very interesting study on the quite recent conflict over the construction of wind turbines in areas where there are also strong interests and established Sámi rights, master's student Linnea Aslaksen (2021) followed this process through the document circuitry and document movements that made up the case. It is already an established right that the state shall take steps to ensure that the Sámi people can further develop and strengthen their own culture. Moreover, as Indigenous people, they have the right to be consulted on issues that affect them (Regjeringen.no, n.d.). So how did the process proceed this time? Not only do such processes very much proceed *via* documents, but they are also interesting to study as document practices. This particular case turned out to be rather complex to follow. For instance, Aslaksen shows how the document process involved efforts to determine the value of the landscape – thus, there were also tools of quantification and calculation involved – all of which was important to investigate in analyzing the document work and its outcome. In addition to being complex, the case was also long and cumbersome. In fact, the case made it all the way to the Supreme Court, where the Sámi won the right to the area where the wind turbines now are standing. Aslaksen was not there in person to follow the case throughout this process, which lasted several years. But she could follow it nevertheless through the documents. In this way, a practice-oriented approach to studying documents may help us understand how the environment is shaped and transformed, acted upon and also very often contested. Moreover, we can grasp how the very struggle happen in and by way of documents and document movements.

To be sure, documents are not mere tools or movements. They are also texts (and, in fact, their textuality is partly what enables them to act as tools). Documents are composed of signs, words, sentences and narratives – often in combination with a series of different textual devices such as charts, figures and perhaps photos. They are also sometimes written according to a particular template. If we return to the NOUs, for instance, one soon notices how these documents belong to a particular genre of documents that are part of a series. For instance, the NOU on climate change vulnerability (NOU 2010: 10) not only has a title, but it also has a number that is part of a series referring to where in the series of a particular year it belongs. As I mentioned earlier, they are often also written in a particular style – NOUs are quite often written rather drily, fact-based and produced in a distinctly styleless style. Comparing how different public documents perform this style may also teach us quite a lot about the very issue in question – issues that will also be modified and sometimes transformed by the way they are written.

Documents as sites for the forming of nature issues

Not only may documents *teach* us about issues, but they may also take part in enacting – forming and shaping – the relevant issue. In short, there are document issues (Asdal and Reinertsen 2022). This means that public documents, despite their careful and neutral form, may be rather active. They may act upon issues – modifying and transforming them by the way they address the matter at hand. Yet, it can sometimes take a lot of time, many readings and 'deep dives' into such documents to see how this happens and its effects or consequences. This means that we often need to be quite patient, read closely and – not least – curiously and open-mindedly. Sometimes, documents that at face value stand out as quite insignificant, not particularly interesting or different, initially appear as though they do *one* thing, can be seen to be doing something else entirely when we look into them more closely.

This was the case with a document that, in the history of Norwegian environmental politics, was made to appear as a document where the government was finally taking the environmental issue on board and acting upon it. Very concretely, the issue in question was pollution, most notably from large enterprises, which had turned into a huge problem in many local communities in the post-Second World War era. One particular controversy played out around the aluminum smelter in Årdal, a community on the Norwegian west coast, which was also an agricultural region. And as the aluminium produced at the factory were sold globally, the emissions from the smelter – fluorine most notably – stayed behind in the local community and polluted the factory surroundings.

When the farmers' livestock fell sick, with difficulties standing on their feet and chewing, the farmers suspected that it was connected to the emissions from the smelter. The factory management denied any such connection, but the causal relations were later established by veterinary science, which proved that the animals had attracted fluorosis – a sickness caused by fluorine poisoning. My own research into these events took the form of a close document study – where I was tracing the material and document process of samples from the factory surroundings being moved on to the veterinary lab, and the ensuing animal feeding experiments at the veterinary institute in Oslo. Thus, this also became a study of how environmental facts are produced and how politics build on such facts to act vis-à-vis the environment. Coming back to how such processes also take part in establishing the very issue in distinct ways, it is worth noting how the pollution issue was to be formatted very much as an *emissions issue*. The farmers were compensated for their economic losses but also had to change their ways of practicing agriculture to be less vulnerable vis-à-vis the factory. However, as it turned out when I read and re-read the archive documents: The expert report – in the format of what we today call an NOU, which was commissioned to handle the growing pollution problem – farmers and others were not viewed as the relevant actors to partake in solving the problem. To the contrary, it was noted that people too close to the problem could end up being – as it was called 'smoke-minded' – that is as if themselves polluted by the issue, assumingly too involved to be able to think clearly and rationally. Those who were deemed to be the relevant actors in solving the problem were engineers who *knew* the industry.

The report, I realized, did not so much establish the environmental issue as formatting an *industry issue*. This also meant that it was the Ministry of Industry – and not, for instance, an independent environmental agency (the Ministry of the Environment had not yet been established) – that was tasked with responsibility for the issue, under which a new pollution agency came into being. In fact, reading these documents closely, we can see how this way of 'modifying' the issue into belonging to the industry occurred at many levels in the expert-report document. For instance, it was each polluting factory that were detailed by name, localization, history, and production activities, and then carefully written into the report, and not the farmers, their biographies, their ways of living. We learn how the industry is important to economic development and that even if pollution issues are problematic at local levels, one can not risk such 'neighbor issues,' as they are called, hindering an industry that is welcomed and encouraged at a national level.

From this expert report document, we can also read how nature was made governable in important and consequential ways: New substances, namely pollutants, are described by their different names and effects. Then next it is precisely such substances that the new pollution control agency is being equipped to target.

In narrating and analyzing the above events, I have taken documents in themselves to be document sites – sites for events (Asdal and Reinertsen 2022). Documents are not only written texts that inform us about what lies beyond them. Documents are also sites where events happen, form and play out in their own right. This is part of the practice-oriented method that I suggest we equip ourselves with when working with documents. I have tried to show how documents can take part in forming issues, and I have also suggested that we can try to detect how this happens by searching for an ongoing 'modifying work': the various moves that happen in the text that may, when taken together, transform the issue. And remember, in defining issues in particular ways, one also quite easily comes to define who – with what competence and expertise – should handle the issue and problem.

Obviously, expert and commissioned reports do not always do the same thing, even if the format or genre is relatively similar. Sometimes the act of *comparing* different reports can be a viable strategy to understand what is happening in an environmental issue. In the history of the environment, the climate problem is a relatively recent problem for governments to tackle. For many years, the main issue was rather that of trying to agree about whether there *was* such a thing as a climate problem. The NOU 10 (2010) about climate change vulnerability is different. Here, the problem is accepted. In fact, when reading this document, which is also written in a quite sober style, neither very emotional nor outraged, the reader is told that the problem *is* real and, in fact, is here to stay. Elsewhere we have called this a kind of 'brutal governmental prose' (Asdal and Reinertsen 2022). Why is that? Because the combination of its sober style and careful, detailed way of laying out the problem, delineating how things we care about may be lost in the future brings the brutal consequences of the climate problem to the fore. We can explore how this is done in the report, we can observe how different reports do nature-issues differently, and thus work differently as tools to act upon them. We can also seek to trace how different reports come into existence: the controversies around them as well as beyond them.

The climate problem was one issue that strongly occupied Natur og Ungdom. This was during the second half of the 1980s, and it was when the above-mentioned Brundtland report was quite new. Not only did this report establish the concept of sustainability, but it also established how the the environmental issue was to be tackled: caring for the environment while still pursuing economic development and growth. Thus, in a sense, the environment and the economy were brought together by the concept in a quite particular way. The Brundtland report may also serve to remind us that not all documents have equal effects and consequences. Some documents are almost immediately put into a drawer, never gaining prominence. Others have a major influence and play a part in defining problems; they also do conceptual work that is later brought into policy reports, media and our daily vocabulary. The concept of sustainability is a case in point. So how does this happen? This is related, as I already alluded to at the beginning of this chapter, to document movements – to how documents can travel between actors and between agencies and also in and across time. It may be interesting and important to know how and by which means documents travel. Sometimes these means are financial support.

Let me return to the document protests, document-counter-movements and the telefax campaign as a protest against the government's lack of ambitious climate action. Today the technology is certainly outdated. But the point remains: Documents need to be set 'on the move' in order to have any impact.

Technologies such as telefax machines and computer networks are technological arrangements that allow this to happen. Still, different technologies enable this in very different ways, and the means and arrangements by which documents travel are certainly part of what we can bring into a practice-oriented document analysis on how nature and the environment are addressed and how actors engage in such struggles.

Government offices and parliaments can be approached and studied as document sites in their own right. In fact, very little can happen in a parliamentary setting without documents. Here, regarding document movements, the itineraries of documents are quite well-defined beforehand. How documents travel is part of the parliamentary procedure. However, sometimes documents enter these circuitries and change the ways parliaments work and also add immensely to parliamentary work. The whaling controversy in the late nineteenth century is a case in point. This certainly changed parliament – new groups of actors were elected because of it, and parliament came to decide upon an experimental law to protect the whale from being hunted. Having studied this case and the immense document work in which it became encapsulated also helped me understand parliaments differently: Not only are they document sites, but they are also quite profoundly sites for politics of nature (Asdal and Hobæk 2016), a site where members of parliament not only work on social affairs and underpin decisions on nature, based in science. Parliaments are also sites where the social and the natural meet and where the social and the natural converse with one another in interesting and often surprising constellations. This speaks importantly to the topic of document movements: Documents travel, but documents also bring things with them. It is via document movements that the species, which at the time became known as the blue whale, entered parliament. Because the whale entered via a range of different document formats for then to be worked upon, hunted, sought reined in, understood and regulated, all as part of parliamentary document procedures that make and remake the politics of nature and shape the conditions of the Anthropocene – and democracy.

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The plow. (Photo: © Marianne Elisabeth Lien)

CHAPTER 10

Domestication and Multispecies Relations in the Anthropocene

Marianne Elisabeth Lien

From the anthropology of food to multispecies ethnography: an anthropological journey

My first anthropological fieldwork as a graduate student was all about food (Lien 1987). With a background in nutrition, I knew plenty about why certain diets were more beneficial than others. But nutritional advice is rarely followed. So, why do people eat what they eat? Anthropologists were generally not that interested in food at the time, while nutritionists knew very little about food dimensions beyond the body. Puzzled by this twofold ignorance, I also found my niche. The 'why-do-people-eat-what-they-eat' question shaped me as an interdisciplinary scholar. Guided by the legacy of ethnographic fieldwork and its emphasis on 'being there,' I moved to Båtsfjord, a fish-processing community in Finnmark in Northern Norway, to explore food habits from an anthropological perspective.

Fieldwork in Båtsfjord in the mid-1980s was a culinary delight – but not for everyone. Cloudberries, blueberries, reindeer, Arctic char, fresh cod and *boknafesk* (dried and salted cod) were rarely available in the grocery store. Access relied on social skills and networks, as well as local knowledge unavailable to most outsiders. I wrote about the significance of gift giving and about how food signals identities and subtle negotiations of value. I ate lots of cake, made friends for life, and my fieldwork focused on human sociality as it is mediated through food. Culinary delights were rarely cultivated. Instead, they were affordances of the regional seascapes and landscapes where access to food relied more on embodied, environmental and social skills than property rights. The foods we shared could easily have been marketed to urban consumers as 'wild.' But in an Arctic region unsuited for common cultivation, the distinction between wild and domesticated did not make a lot of sense, just as the distinction between nature and culture seemed irrelevant or much too sharp.

Ethnographic fieldwork traces connections between contextual realms that are often kept apart, such as economy, ecology, politics and belief. In anthropology, we call it holism, and it remains an ideal that makes anthropology well suited for interdisciplinary engagements. Returning for fieldwork in this region more than thirty years later, my approach is more attentive to landscapes and archives and more often interdisciplinary. Perhaps it is closer to the ideals of holism as well. Inspired by multispecies ethnography (Kirksey and Helmreich 2010) and what is loosely referred to as the nonhuman turn (Grusin 2015), I am attentive to sociality beyond the human. Rather than assuming that nature derives its agency, meaning and value from cultural, social or ideological inscriptions, an approach that places the human at the center of analysis, I try to follow relational connections that unfold alongside, or even disconnected from, human intentions. Additionally, I try to notice colonial legacies and stuff that people no longer talk about, as well as slow changes to the landscape, such as rivers that no longer freeze or berries that grow in new locations. Climate change is strongly felt in the Arctic – the natural environment is becoming unstable and somewhat unreliable. All of this allows me to notice things I did not see before and to take part in conversations that engage with the Arctic Anthropocene.

Why focus on domestication in a region where there is practically no arable land and farming was never a reliable option? One reason is that domestication is a story that has shaped people and landscapes everywhere, even in the Arctic, and that it continues to haunt; Like a shadow, or an old habit, the idea of domestication as control informs a set of unexamined practices that shape our modes of responding to novel challenges we now think of as Anthropocene. But domestication haunts landscapes as well; drainage ditches that were made a century ago still shape landscapes in the Arctic, long after the farmers are gone. Arctic soil transforms slowly, and agricultural traces remain visible for a very long time. Another reason to consider domestication is that attention to landscapes and multispecies relations unfolding through regimes of domestication helps us understand the dual role of people as both villains and victims of environmental transformations. This prepares us for the challenges of the Anthropocene, challenges that are strongly felt in the Arctic.

The notion of the Anthropocene is a universalizing concept that ushers a new understanding of the relationship between humans as a species and the Earth we inhabit. It represents a unifying planetary concept (Sörlin and Isberg 2021) as it aligns a watershed moment in human history with geological time. It replaces the notion of nature as the timeless foil within which human activity unfolds by an image of nature as vulnerable, dynamic and in need of urgent care and repair. With climate change, erratic weather events and massive biodiversity loss, nature has become unpredictable and out of control. In this way, the Anthropocene can be seen as the ultimate proof that humanity has failed to care for what we all rely on, a thriving and self-sustaining natural environment.

Why domestication?

A chapter on domestication in a book about the Anthropocene is not an obvious choice. But the story about domestication, which is usually told as a story about agriculture, the so-called 'Neolithic revolution,' has become what anthropologists would call 'a story we live by.'[1] It is taught and presented as unexamined common knowledge about how things have unfolded in the past and how we – as human beings – came to be who we are. The story of the agricultural or 'Neolithic' revolution is associated with shifts that happened in the Middle East some ten thousand years ago. It is backed by tons of archeological evidence, and it speaks to broad public audiences. In the book *Domestication Gone Wild: Politics and Practices of Multispecies Relations* (Swanson, Lien and Ween 2018), we call it the secular origin story of European civilization. As I shall detail below, this story is deeply intertwined with the challenges that are now associated with the Anthropocene.

Our book was the result of collaborative exchanges between anthropology and several other disciplines, especially archeology. We learned what archeologists had known for a long time, namely that the most common stories told about the 'Neolithic Revolution' were largely simplifications and often misleading, if not plain wrong. Archeologists had for years discussed much more nuanced models of how domestication unfolded in ancient times. Some had argued that a preoccupation with domestication as an event has led to a lack of curiosity about evolutionary changes that happened later (Gifford-Gonzalez and Hanotte 2011). Others had shown that ancient domestication was indeed a two-way process marked by mutualism and cooperation (Losey et al. 2018). But few people follow the latest advances outside their own field. Beyond archeology, the story of the Neolithic Revolution had taken on a life of its own. It had become a popular story, a story we keep telling, a story we live by.

When popular stories of human history are not in sync with recent research in archeology and even at odds with research in anthropology and biology, it should give us pause. But the response is not straightforward. In anthropology, we teach religion, narrative and myth, and we know that these stories are powerful. They offer models *of* society, stories that help us imagine our own position relative to others but also models *for* how to act and how to behave toward fellow humans as well as other-than-humans who share our surroundings. In this way, stories really matter. They are both descriptive and prescriptive at the same time. Anthropologists often take the position of cultural relativism, which means that we suspend judgment and try to refrain from challenging other people's myths. This is a helpful method when our aim is to try to grasp another person's point of view, which is key to anthropological epistemology. But when it comes to hegemonic stories about European civilization and stories that fundamentally concern our relationship as human beings to other-than-human beings and our shared environment, a different response is called for. When the stories we live by turn out to be outdated and no longer supported by scholarly knowledge, it is important to call out and say, 'Hold on: we should not be thinking about the world this way anymore.'

In this chapter, I shall reiterate the popular story of domestication and, drawing on our book, indicate where it goes wrong. I shall argue that we need to reconceptualize domestication in order to prepare for the challenges of the Anthropocene. But first, I will take you to the site of my first fieldwork, which is a good case for thinking through challenges both of domestication and of the Anthropocene.

Arctic domestication – Arctic Anthropocene[2]

Syltefjord is an abandoned coastal settlement facing the Barents Sea, at the end of the county road 891, on the Western Varanger peninsula. It belongs to Båtsfjord municipality, a community of around two thousand inhabitants, located about half an hour's drive by car in the summer (in the winter, it is only accessible by snowmobile). At 70 degrees north, this is, technically speaking, the Arctic. It is far north of the Arctic Circle, which means that the midnight sun and the polar night mark distinct contrasts in the seasons. Average temperatures in July are rarely above 10°C, which is another way of delineating the boundary of the

Arctic that tends to overlap roughly with the tree line.[3] But the Arctic is a problematic term. One might, for instance, argue that 'the Arctic' is not really a place that people inhabit. It is an abstraction imposed from the outside (Bravo and Sörlin 2002) or a line that you may draw on a map based on features such as average temperatures. Perhaps you are excited by the prospect of traveling to the Arctic, as tourists and explorers often are. Then it is important to remember that the Arctic is also a claim, and a marketing device, with a distinct affective component. Finally, there is a geopolitical scramble for the Arctic these days, partly due to the prospect of warmer ocean temperatures that could open the so-called North-East passage for transcontinental container ships and allow western extensions of China's Belt and Road Initiative. All these dimensions relate to what we think of when we talk about the Arctic Anthropocene. We might add that the Anthropocene is strongly felt in the Arctic and is about to usher in transformations with implications that are yet uncertain or hard for anyone to imagine. But for now, and for my friends who spend the greater part of the year in Syltefjord, this is not the Arctic and it is not remote.

The house in Syltefjord where my friend Vibeke grew up in the 1960s consists of a farmhouse, a barn and a woodshed. Now used as a second home by Vibeke and her husband Øystein, it still looks like a farm, which is what her father wanted it to be when in the late 1950s, he invested in a tractor and plowed a small field to grow alfalfa. The hay was used to feed the sheep, which were abundant in the Syltefjord valley back then, but grazing pasture was scarce. Prior to the arrival of the tractor, grass was collected by hand, carried home from what is called *utmarkslått* in Norwegian, a term that denotes a patch of grass in a landscape that is neither cultivated nor formally owned but part of an extensive transhumance adaptation where grazing animals such as sheep and goats transform the grass into milk, meat, wool, skin and other necessary goods. The patches of grass known as *utmarkslått* were easily distinguished by local people. Often named after the people who cut the grass, they indicate an informal sharing of the landscape that is often referred to as the commons. Now the sheep are long gone, and there is no longer any farming in Syltefjord (Lien 2020).

For most outsiders, Syltefjord is remote. The valley appears fairly pristine, which is a feature so valuable that the Norwegian environmental authorities decided in 2006 that it must be protected as a nature reserve. Protecting nature can often entail protecting it against people (see Nustad 2015). That, at least, is how it felt for my friends when they discovered that with the establishment of the nature reserve, their seasonal practice of securing firewood had become illegal. Birch trees grow along the Syltefjord river that runs through the valley, and some of the trees break under heavy snow during winter. Easily accessible and not far from their house, this forest is where my friends have always fetched firewood, carefully selecting the broken branches and tree stems.

When more sheep were grazing in the summer, the valley was less forested and more densely populated, so Vibeke's father and grandfather fetched their firewood in a side valley upriver,[4] known as Rasjokdalen in Norwegian, which is a slight twist on the Sámi name Rássejohka. Collecting firewood along the river is nothing new, and it seems unlikely that this practice has degraded the birch forest or made the valley less worthy of protection.

But that has not prevented Norwegian authorities from intervening in such practices through conservation measures. The nature reserve authorities erected signs in the landscapes that mark its boundaries. They show that the boundary of the nature reserve runs just up behind my friends' old barn. The signs announce, in Norwegian and Sámi: Syltefjorddalen Naturreservat/Oarddu luondumeahcci, and cite selected legal paragraphs such as this one:

Nature reserve sign by the Norwegian authorities. (Photo: © Marianne Elisabeth Lien)

> Vegetation, *including dead bushes and trees,* is protected against injury and destruction. It is prohibited to remove plants and parts of plants from the nature reserve (author's translation and emphasis).[5]

At first, my friends refused to believe that their traditional practice of fetching broken birch branches could be harmful. They contacted the county governor to ask for permission to continue to take out birchwood as they had always done. They even invited a forest inspector to see how they did it, hoping that he would conclude that their traditional practice was harmless to the forest. But in the end, there was no room for an exemption. Firewood would need to be sourced elsewhere, such as from the local gas station that sold imported firewood (expensive and hardly sustainable) or from Tana, a two-hour drive further south (laborious and also less sustainable).

Nature conservation is never easy, and the example above is hardly unique. Anthropologists have shown, time and time again, that conservation measures are often at odds with local and indigenous uses of land (Nustad 2015; West 2016). Yet, the challenges of the Anthropocene call for protective measures. This begs the question: What, exactly, is being protected here? And what relations are being discontinued in order for other relations to be sustained?

Erasures

Curious about the rationale behind the Syltefjord nature reserve, Vibeke and I took a closer look at its website. This was in 2016. We learned that Syltefjord Valley Nature Reserve is protected in order to secure a 'nearly untouched river-near deciduous forest area.' We read that it is of 'particular scientific significance as a reference area' and unique 'due to a lush salix (and *høgstaude*) forest near the Arctic forest boundary.' Furthermore, we learned that a range of species are found here at 'their absolute Northern limit' or are 'at the margins of their habitat.'[6]

Valuation is never straightforward. Here, plant species are valued not for their intrinsic beauty or utility in heating houses but for their spatial location: Qualifiers like 'absolute Northern limit' and 'Arctic boundary' are relational qualities referring to a conceptual image of a species' habitat as it appears on a two-dimensional map. In other words, their northernmost limit signifies a uniqueness that calls for protection. This is an abstract relation that is only meaningful when seen in relation to more general categories such as 'habitat' or 'river-near deciduous forest.'

I cannot help thinking about the irony that hits people whose ancestors succeeded in carving out a living (and with minimal environmental footprint) here, on a coastline (and with a minimal environmental footprint), where the ocean continues all the way to the North Pole and where practically everything that grows exists, by default, at its northern limit. Trapped by the coastline, their entire world could qualify for protection – but then it doesn't, because Vibeke notices another phrase, which indicates that this place's value as an object of protection, i.e., the valley where she grew up, does not include people like her:

> The purpose of the protection is to secure a nearly untouched [*tilnærmet urørt*] river-near deciduous forest area.

Nearly untouched? Hadn't her father, grandmother and great-grandfather lived here all their lives? Had they not cut the grass, fed their sheep, collected firewood, hunted, fished, and raised their children for as long as anyone can remember? And aren't there archaeological traces in the landscape indicating human habitation for thousands of years?

The words 'nearly untouched' serve rhetorically to justify an area that represents a pristine and authentic example of a particular constellation of plants. It is relational by negation: It is the *absence* of human intervention that makes it worthy of protection. This logic reflects the sharp conceptual distinction between nature and culture that underpins conservation measures and notions of wilderness (Cronon 1995). Scholarly debates in the social sciences and the humanities have tried to undo this, but the distinction remains stubbornly with us and gets repeated again and again (Law and Lien 2018). Untouched is what qualifies as true, authentic nature, but it is hard to find. Hence, the word 'nearly,' which suggests an awareness that this valley was perhaps not *entirely* untouched by people after all. The rhetorical effect is shocking and clear: Whatever human practices unfolded in the Syltefjord valley can be disregarded. Norwegian authorities can safely manage the Syltefjord Valley Nature Reserve/Ourddu luondumeahcci as if people weren't here. As though they didn't exist, not then and not now. How does it feel to be erased?

Since 2016, my friends' concern with fetching firewood has become less urgent. As temperatures are rising, trees are growing taller and forests are becoming denser. In 2022, they sourced nearly all their firewood from their own property, near the house and barn, on fields that were never forested before. Their experiences are not unique. Anthropocene effects are strongly felt in the Arctic, which is heating three times as fast as the global average, according to the Norwegian Institute of Polar Research,[7] while the Arctic permafrost is thawing faster than previously thought[8] (see also Nitzbon et al. 2020). Ironically, this means better conditions for birch trees: The mean temperature in Vardø (the closest town) has increased by a little more than one degree since the 1970s, according to climate scientists. Gardeners in Vardø notice that summer flowers now flourish in their gardens earlier than they used to (NRK June 24, 2019[9]). But their current access to local firewood does not alleviate my friends' resentment toward the nature reserve. Fetching firewood is important but somewhat trivial. Being written out of the story of the valley and literally made to disappear is a provocation of a different order.

Sorting people, sorting land

It is not the first time that people in Finnmark have been made to disappear. Centuries of racial and cultural oppression have partly erased the legacy of Coastal Sámi settlements along the coast. This is due to Norwegian policy measures that systematically favored Norwegian speakers over Sámi and Kven (a local language related to Finnish, spoken by immigrants with their origins in present-day Finland), agricultural adaptations over reindeer herding and Norwegian place names and surnames over Sámi names. When Vibeke's father purchased a tractor in the late 1950s and began plowing a field that now borders the nature reserve, he enacted precisely the vision of prosperity that the Norwegian state had carefully laid out through agricultural economic incentives.[10] But his admirable efforts were to little avail: The topsoil, it turned out, was too thin, and after a few years, the alfalfa harvests dropped. Subsidized artificial fertilizer could not undo the fact that this site was never meant to be plowed, never meant to be farmed according to a model invented further south. So why did he even try when there were clearly other ways to carve out a living here than farming? And why did Norwegian authorities subsidize such a utopian vision?

At this point, finally, let us return to the narrative of domestication. As the story from Syltefjord shows, the sharp boundary between nature and culture, or between the wild and the domesticated, has been imposed on the landscape and on people and their practices. It has been imposed from the outside, by the state, through nature conservation as well as the promotion of agriculture. On one level, it is a story of an ideology of agricultural farming stretched to its 'absolute northern limits' against the reality of thin Arctic topsoil. On another level, it is the story of becoming civilized, becoming properly Norwegian.

In a nutshell, the story of domestication begins with that historical moment when humans began to grow plants and control animals to procure food. The Neolithic Revolution in the Middle East marks the beginning of this journey that paved the way for human population growth, the division of labor, social stratification and state formation. In our book *Domestication Gone Wild* (Lien et al. 2018), we argue that the narrative of the Neolithic Revolution performed the sequencing of human difference into a single evolutionary story. Domestication is a key element in this origin story of civilization, underpinning distinctions between culture and nature; civilized and savage; us and them; and then and now. The story of domestication is a story of universal human progress, from savage to civilized, from who we were to who we are. Many, if not most, people in the world did not take part in this historical journey, either because their home environment did not lend itself to agricultural cultivation or because other practices were more efficient, desirable or otherwise meaningful to them. Obvious examples are people living in the Arctic, in deserts or in jungles; the Northern Sámi in Finnmark are but one example. But the thrust of the story of domestication as a marker of civilization has shaped national sentiments and self-identities far beyond the Nordic Arctic. Hence the domestication narrative underpins and justifies state policies in Europe and elsewhere of agricultural settlement as the unrivaled mode of engaging with natural surroundings (Campbell 2020; Hetherington 2020). As agriculture is juxtaposed against 'vernacular' landscape practices – signifying progress – it orders people along the same scale as more or less civilized, based on whether or not some shifting ideals of agriculture are being performed.

The story of the agricultural revolution is not entirely wrong. When agricultural practices did take hold in ancient states in the Levant, many things followed. But the story inserts a distinction between nature and culture, savage and civilized, which cannot be upheld and is also historically and archeologically misleading. In our book, we summarize our critique as six corrections (for details, see Lien et al. 2018: 14–18):

First, rather than a revolution that happened suddenly, the domestication of wild plants and animals to cultivated plants and domestic animals is a gradual process that lasted centuries or even millennia and, in some sense, is still ongoing (e.g., Smith 2001). Secondly, unlike an irreversible journey from wild to domestic, domestication is a reversible process for humans as well as for many animals and plants. Hence, and this is the third point, it has occurred in many places, even where agriculture no longer has a hold (e.g., Zeder et al. 2006). Fourth, rather than being the result of human agency alone, domestication should rather be seen as a mutual process in which agency is distributed, and humans do not always have the upper hand (e.g., Stépanoff 2012; Losey et al. 2018). Fifth, following from this, the implications of transformative processes of domestication on humans and nonhumans are open-ended and often unintended (e.g., Leach

2007). More precisely, while humans may aim for control, the actual outcome may be losing control, hence the title of the book: domestication gone wild. Finally, domestication transforms not only the human-animal or human-plant dyad but can have ripple effects on other species as well as distant landscapes (Swanson 2018). Hence domestication is a multispecies relationship. And so is the Anthropocene.

The problem with the story of the Neolithic Revolution is not only that the narrative is wrong. The problem is rather what it *does*, what unexamined paradigms and practices it sustains. One is a notion of linear progress through the association of domestication and civilization described above. Another is the universalism implied by this idea of civilization, as if all people followed the same route to what others imagined as a more 'advanced' state. Both are proven wrong, yet they continue to do work, often implicitly, in relation to nature conservation, agricultural policies and debates about human–animal relations. But the most urgent critique of the domestication narrative in light of the current challenges of the Anthropocene concerns the assumption of human agency as a driver of human progress or, more precisely, the idea of control.

Control revisited

Popular narratives of the Neolithic Revolution tend to assume human intentionality and agency as the main explanation for human progress. More precisely, the active agent is 'Man,' a figure who invents, designs and confines natural surroundings in ways that change the course of history. The most important shift that

'Man' allegedly made was the shift to agricultural cultivation. A typical example is the title by the much-cited archeologist Gordon Childe,[11] *Man Makes Himself* (Childe 1951 [1936]). The man who allegedly makes himself is 'no longer subject to the whims of nature, he has become a subject who acts on a world at his fingertips; he is a man in control' (Lien et al. 2018: 7). Classic definitions of domestication reproduce this idea, such as when domesticated animals are defined as 'bred in captivity for purposes of subsistence or profit, in a human community that *maintains complete mastery of its breeding, organization of territory and food supply*' (Clutton-Brock 1994: 26, emphasis by the author). This understanding fundamentally ignores the agency of nonhuman beings who, in many cases, were at least as active drivers in the process of domestication as humans (see, e.g., Losey 2021; Anderson et al. 2017; Stépanoff 2012). It also ignores the ways in which humans typically fail to control the way domestication unfolds, ecologically and otherwise. As many authors have shown, control may be an ideal or an overarching objective, but it is hardly realized in practice. Not even in the confines of a hyperindustrial pig farm (Blanchette 2020), in the expansion of soy monocrops (Hetherington 2020) or in the pens of salmon aquaculture (Law and Lien 2018; Lien 2015). Nature continues to 'overflow,' transcending human-made barriers and muddling domains of alleged control, just as culture is part and parcel of what is deemed to be natural and protected (cf. a nature reserve).

Yet, the notion of human agency and human control continues to haunt. As a *model for* human relations with domesticated animals and plants, it has prompted an infinite array of technological devices designed specifically to control, oversee or confine domesticates, including infrastructures designed to address the challenges of the Anthropocene, such as carbon storage and capture. Along with this idea, we cling to the notion of progress, as exemplified in the notion of 'sustainable growth' through enhanced precision farming through drones and satellite images that promise to revolutionize agriculture by enhanced control.[12]

Can we even imagine human–nonhuman relations in ways that do not assume control, confinement or humans as the primary agential force? How might we get on with living together across species barriers in a world that is already intertwined, messy and frail, and where the boundary between nature and culture is not – and never was – an order to be trusted? Rethinking domestication as relations across species boundaries in which humans and nonhumans inhabit each other's worlds seems like a good way to start. Acknowledging that nature and culture were always two sides of the same coin, never completely separate, may help us, too. We inhabit webs of relations that cannot be protected by upholding a simplistic notion of separation, as in 'nearly untouched.' Exploring this mutual space together, we may find that even within relations of domestication, vital relations can flourish.

The concept of the Anthropocene has not only aligned and synchronized cultural and natural history with geological time (Sörlin and Isberg 2021). It has also presented a set of challenges that no discipline can solve alone. This has urged archeologists, geoscientists, social scientists, philosophers and ecologists to engage across disciplinary boundaries and to take each other's work seriously (Swanson 2016), to explore new modes of working together and to reconsider the foundations of their own respective disciplines (Petursdottir 2017; Tsing et al. 2019; Ogden 2021; Mathews 2022). This calls for curiosity and mutual respect. Exploring the common ground that the Anthropocene offers is an opportunity to reconsider the narratives we live by.

Notes

1. See for example the popular series aired on the History Channel in 2012 called *The Story of All of Us*, and the episode entitled 'The Birth of Farming.' Trailer preview on YouTube: https://www.youtube.com/watch?v=bhzQFIZuNFY. For an extended argument, see Lien, Swanson and Ween 2018.
2. The story of the nature reserve is previously published in an article titled 'Dreams of prosperity, enactments of growth – the rise and fall of farming in Varanger' (Lien 2020).
3. See for example Barents Watch's definition of the Arctic, Barents Watch n.d. (Accessed as What Is the Arctic? (barentswatch.no) November 2022.)
4. Vibeke recalls that the river used to freeze solid and could therefore be crossed easily or serve as an opening for the transport of firewood with horse and sleigh. Today, it hardly ever freezes solid and such transport would be dangerous or impossible.
5. 'Vegetasjon herunder døde busker og trær er fredet mot skade og ødeleggelse. Det er forbudt å fjerne planter og plantedeler fra reservatet.'
6. 'Formålet med fredningen er å bevare et tilnærmet urørt elvenært lauvskogområde … Området har særskilt vitenskapelig betydning som referanseområde og er egenartet i form av en frodig vier- og høgstaudeskog nær den arktiske skoggrensen, med en rekke arter som har sin absolutte nordgrense eller ligger i utkanten av sitt utbredelsesområde.' www.nasjonalparkstyre.no/Varangerhalvoya/verneomrader/syltefjorddalen-naturreservat-oarddu-luondumeahcci (accessed first in 2016, then again in February 2022).
7. Source: Norske Polarinstitutt. www.npolar.no. (Klimaendringer i Arktis, downloaded February 2022.)
8. 'Forskere roper varsko for den arktiske tundraen.' Forskning.no, https://forskning.no/arktis-biologisk-mangfold-klima/forskere-roper-farsko-for-den-arktiske-tundraen/1860101 (accessed February 2022). See also 'Permafrost may thaw faster than previously thought – Centre for Biogeochemis-

try in the Anthropocene' (uio.no) (downloaded November 2022).

9. https://www.nrk.no/tromsogfinnmark/vardos-arktiske-klimaer-i-ferd-med-a-forsvinne-1.14593306 (accessed February 2022)
10. Like other small-scale farmers in Norway in the 1950s and 1960s, he received loans, subsidized seed and fertilizer and regular visits from the agricultural officer who was advising him (for details, see Lien 2020).
11. The same Gordon Childe who coined the term 'the Neolithic Revolution,' Lien, Swanson and Ween 2018.
12. See for example 'What is the difference between precision, digital and smart farming?', https://www.agrocares.com/2020/11/02/what-is-the-difference-between-precision-digital-and-smart-farming-2/ (downloaded November 2022).

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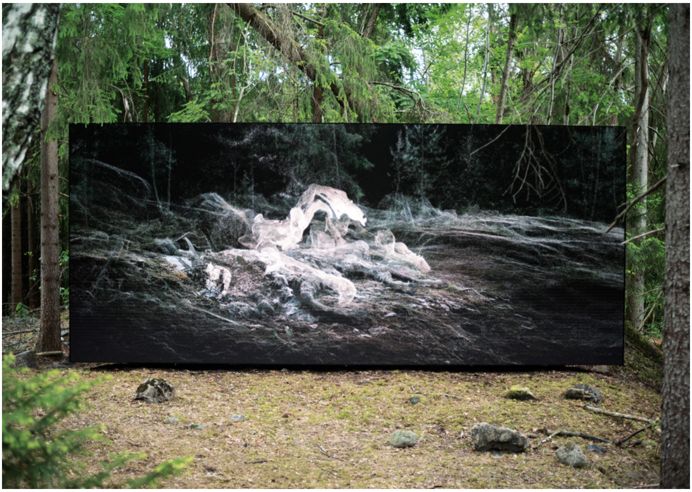

Pierre Huyghe, Variants (2021–ongoing). Scanned forest, real-time simulation, generative mutations and sounds, intelligent camera, environmental sensors, animals, plants, micro-organisms and materialized mutations: synthetic and biological material aggregate. (Courtesy of the artist; Kistefos Museum; Hauser and Wirth, London. Photo: Ola Rindal © Pierre Huyghe)

CHAPTER 11

Unthought Environments

Art and the Anthropocene

Ina Blom

I

I am a so-called child of the TV age. One can discuss the precise meaning of that label, but I take it to mean growing up with TV as a medium that was at once ubiquitous and taken for granted. Yet, within a larger cultural horizon, the TV was still new enough to warrant constant, high-pitched concern. Even in a Northern European context, where TV entailed only one or two state-sponsored channels for a long time, its powers were described in quasi-mythological terms – perhaps because its impact seemed elusive. Some worried about TV's supposedly violent and populist content, while others worried it created passive audiences and an increasingly privatized public sphere.

The idea that it 'tied' the world together in a global present was cause for both celebration and fear. Personally – and I believe this is a sentiment shared by many in my generation – TV seemed less like a medium than an environment, its screens appearing as ambient light sources, glowing animated nodes in the expansive but invisible matrix of global information networks. In fact, the less you actually 'watched' TV, the more you tended to 'sense' its particular form of presence: the blue light enveloping entire neighborhoods at night, the way it formatted people's schedules and habits, the waves of sentiment that would sweep across entire populations following real-time TV events, the industrial drive to make the apparatus itself as invisible as possible, naturalizing screen realities by making them part of the architecture. TV did not want to be a piece of furniture set against the wall; it wanted to be *on* or *in* your wall. The ultimate design fantasy was that it would *be* your wall.

Sensing TV rather than actually watching it coincided with my studies of modern art history and my work as an art critic. It seemed to instigate a mode of art-critical vision that led to the discovery of the increasingly ambient or environmentally oriented features of twentieth-century art. From the late nineteenth century, artistic practices began to turn away from the emphasis on the picture screen or the single image frame that had been dominant in Western art since the Renaissance. Images increasingly presented themselves as spatial 'surrounds' or 'flows': mobile, multiple, networked and closely aligned with the new media technologies that transformed modern societies. It is an important but little-known fact that mathematician William Henry Fox Talbot's invention of photography took place in close dialogue with Charles Babbage and Ada Lovelace's 1834 invention of the *Analytical Engine* – also known as the first model for a programmable, general-purpose computer. Digitally defined, photographic images were thus available for signal processing, so to speak, from the moment of their inception; the idea of telegraphic image transfer soon followed (Batchen 2006). Proto-televisual image scanning was invented in 1885; television, or real-time image transfer, became technologically feasible in 1925 – a time during which numerous artists became obsessed with signals, networks and transmissions, as well as the idea of images traveling through time and space, crossing historical and geographical boundaries.[1]

To become an art historian at the end of the twentieth century was, in other words, to be caught in the long feedback loops between ambient art and ambient television. And it was perhaps not surprising that the very question of feedback itself became a major topic of postwar art practices that increasingly presented themselves in environmental terms. Feedback was, essentially, a form of reflexivity that produced new and dynamic connections between art, technology, social life and a natural world that was increasingly understood as being 'in crisis.' But if the question of feedback appeared in the field of art, it was because it was already key to a broader environmental or ecological turn that swept through a number of different fields and disciplines. The concept of dynamic ecological systems first emerged in biology and zoology, where Jakob von Uexküll used the term *Umwelt* to describe the dynamic co-constitution of living beings and their surroundings (von Uexküll 2001 [1937]). However, Erich Hörl has suggested that we see the twentieth century as an age of 'general ecology' and 'environmentality': Just like the technical feedback systems of the computer age produced an image of the world as a multitude of different ecologies or feedback systems, environmental thinking and acting constituted a new power formation (Hörl 2017).[2] But this also means that the concept of ecology was increasingly denaturalized. In fact, the feedback loops between ambient television and ambient art indicate that art in the twentieth century became an arena where intuitions about the emergence of a new type of nature – a hybrid of biological, technological and social processes – were explored.

In art and technology circles in the 1960s and 1970s, terms like *noosphere*, *media ecology*, *the electromagnetic spectrum* and *the TV environment* attested specifically to a growing preoccupation with the expanding technical Umwelt, the so-called 'technosphere.' If art often functions as an early warning system for tendencies that have not yet reached the wider public consciousness, this type of art signaled the qualitatively new types of environmental changes that were taking place due to the radically increased speed of human technical development, as well as the ecological impact of the ever-growing mass of communication devices and information infrastructures that keeps the modern world 'connected.' As noted by video artist Bill Viola, media technologies, constructed from minerals, come 'from the earth' and, in turn, also transform the earth into an electromagnetic waste dump (Viola 2002). In the early 2000s, such ideas found a scientific outlet in the theory (or theories) of the Anthropocene, lending support to a growing suspicion that the processes of the natural world were no longer simply knowable and predictable but subject to transformations that challenge our capacity to imagine and plan.

Still, a sense of worlds spinning out of control – so familiar from the contemporary discussions of out-of-whack weather systems and planetary patterns forever modified by human intervention – was already experienced as a byproduct of the scientific and artistic interest in cybernetics that emerged alongside the development of radar technology and other weapons systems during and after the Second World War. Cybernetics famously used feedback models to describe both living beings and technical systems. And as computing and surveillance video became established features of postwar society, the more radical consequences of feedback also came to inform social and cultural thought. In 1968, Hal Sackman, a personnel researcher for a RAND Corporation spin-off charged with developing the systems software for the SAGE air defense project, claimed that real-time information systems – systems that collect and analyze social data in real-time – would open for *social experimentation* on a scale not seen before and in a bewildering variety of forms. Real-time feedback would eliminate the traditional separation between knowledge and action and thereby speed-up processes of social self-reflection in ways that would make a qualitative difference to the dynamics of social formation as well as sociological modeling (Sackman 1968). Jump forty years ahead in time and this is precisely the effect of Google's ranking algorithms and social media tracking, which reinforces and scales up behavioral patterns, producing new social and political phenomena at unprecedented speeds. Today we know that the institution of television – once so massively important – was just a brief stage in this general, dramatic and multifaceted environmentalization.

II

This was the historical and technological context in which art produced its own dynamic interconnections between nature, technology and the social. The story of modern art's environmental turn is too complex to be summed up in neat terms, but what seems particularly important and interesting to me is the many cases in which art does not simply represent or reflect on some predefined, pre-existing environment but rather engages in the construction of what we may perhaps call 'unthought' environments, new realities at the crossroads of the living and the technological, exploring and exacerbating the increasing blurring of those categories. One important starting point for this tendency was the intuition, shared by many artists in the late 1960s and early 1970s, that the analog video and TV technologies that were just becoming available to artists at that time, had life-like, quasi-biological properties. It was an intuition that was scientifically confirmed some years later when James P. Crutchfield, a physicist at the University of California in Berkeley, started to research analog video feedback – that is, the type of strange visual phenomena that occur when you connect a video camera and monitor in a closed circuit and instead of pointing the camera at some external object (as in the closed circuit surveillance systems used in supermarkets, banks and train stations) just point it to the TV monitor itself so that the system simply keeps reprocessing its own production of signals. Crutchfield established that video feedback was, in fact, a fast and cheap simulator of the type of complex behavior that had been introduced as a possible model for the very dynamics of life. Like most 'new media,' video is primarily understood as a technology that produces, stores and manipulates time – but the key point for Crutchfield was that the unpredictable patterns that emerged on screen were not simply the effects of time modulation: In analog video feedback, space itself was behaving in unruly and unpredictable ways, and this was also why it might give insight into the dynamics of biological morphogenesis, among other things (Crutchfield 1984).[3]

In this context, nature was neither a 'condition' to which one should return nor a separate entity whose need for protection could simply be proven with accurate scientific representation. Along with the idea of 'video life' emerged a new conception of techno-natures and wholly new approaches to environmental activism. At a time (in the early 1970s) when notions of 'protecting nature' and 'returning to nature' were gaining mass appeal, these approaches tended to question the idea of nature as a specific realm set apart from everything else. In recent years, philosopher Timothy Morton has echoed such thoughts by calling for the abolition of the very concept of nature. In his view, the focus on 'nature' is symptomatic of a form of ecological piety that refuses to consider the many agents and modes of mediation that are part and parcel of a constantly changing biological/technical world: In reality, the love of 'nature' keeps nature at arm's length rather than causing us to get closer to it (Morton 2007). The group of artists, writers and activists assembling around the American journal *Radical Software* (1970–1974) – a hub for early video art – tended to focus precisely on questions of mediation. Rather than speaking 'for' a nature in crisis or presenting nature as an image, they invented a mode of direct involvement that was technical, materialist and pragmatic through and through. The point of departure was the notion of potential sympathy between live video systems and living beings more generally, since they share a basic capacity for perception that determines their specific connection to their immediate environment.

Paul Ryan (1943–2013), an artist and activist with close ties to the anthropologist and cyberneticist Gregory Bateson, used the term 'video perception' to underscore that whatever was produced by the video camera was not a representational image but an immediate, live 'taking in' of the world itself, shaped by the technical/perceptual apparatus – just as the human nervous system and the cultural systems in which it is formed always pre-shapes the visions that seem to just 'hit' the eye. Hence, both the imagination of environmental crisis and the means to crisis management lay in constant perceptual and aesthetic involvement, a nonstop innervation of the senses that, so to speak, enforced new types of feedback loops between industrialized humans and their larger biological world. His friend and colleague, Frank Gillette (1941–), used video surveillance or monitoring to make exactly this point. 'Monitoring' was, in fact, a mode of perception that was intimately associated with television and the specific way in which television approaches the world. As philosopher Stanley Cavell puts it, when we watch a film, we tend to see a recorded world that is separate from us, even if we often want to be part of it. In contrast, the constant stream of live TV signals keeps us connected to a here and now that is understood as *this* world, *our* world, no matter the distances of transmission or the timing of the programs (Cavell 1986; Doane 1990). It is an anxious form of perception: Monitoring essentially presents the world as a precarious entity whose survival seems to depend on our constant watchfulness. In fact, the increasingly influential image of a fragile little planet threatened by human activity could perhaps be seen as a byproduct of television and its never-ending real-time monitoring of life.

The point of view in Gillette's 1981 work *Symptomatic Syntax* is, very emphatically, that of surveillance: A still camera monitors what appears to be a small aquatic biotope, its feed presented on three separate monitors, as in a typical control room. Images or camera angles shift abruptly, as if produced by a closed-circuit multi-camera system and a set of automated switches. And yet the construction of life, nature and the world in this work is far from obvious. For here, the reduction of the world to a precarious object – the crisis version of McLuhan's 'global village' – is counteracted by the contingencies that take place in the interaction between technical systems and the natural world. These may, of course, be normal effects of monitoring, since surveillance cameras tend to capture strange passing shapes that are often hard to make out. But in Gillette's work, the strangeness of what we seem to be monitoring is of a different order. The video images seem to produce another form of life, as if engaging a set of uncategorizable forces that disturb the normal gauges of mediation and measure: At exactly what distance will the objects of this world start to make sense to us? In what timeframe? Related to which preconceived patterns, which forms of knowledge? A biologist might have precise ideas about this and might choose to use a microscope or a satellite depending on the scientific argument at stake; if making a television documentary, she would make sure the natural objects were clearly identified and inscribed in a coherent narrative. But Gillette's video surveillance system is not a biologist and bases its environmental engagement on technical affordances that may seem random compared with the established scientific, journalistic and artistic disciplines of nature representation. One of them is sound: *Symptomatic Syntax* relays a constant wavering between the 'realistic' sound of water and the type of indefinite ambient noise that only recording with a microphone will produce. What we encounter here is, above all, an unknown or emergent world – multifarious and expansive, even monstrous. To monitor such a world is to confront, head-on, the fact that this world is also invented by the affordances and velocities of the video system – that is, by electronic microtemporalities and techniques of frequency modulation at odds with any human sense of time.

Media technologies are, above all, time technologies: devices in which the complex temporalities of machine operations support and interact with various types of human/cultural timescapes. In early video art, audiences were directly engaged in staged interconnections between biological, technical and human/cultural feedback systems. 'Media ecology' was the name for such approaches, a key topic in the pages of *Radical Software*.

Techniques and technologies of mediation are inevitably part of whatever it is that we call nature – but the realization of this fact also opens new avenues of engagement. From an activist perspective, the problem was how such experiences might be effectively shared – how thousands of human nervous systems might become part of such feedback loops. Where *Symptomatic Syntax* simply produced a model – a complex and disquieting perceptual biotope – Paul Ryan wanted something more systematic and distributed. The answer came in the form of his *Earthscore Notational System* (1971–) and its corollary, the planned *Ecochannel* television-monitoring project. According to this plan, teams of videographers would constantly broadcast from various critical locations. Over time they would pick up behavioral patterns in the individual ecosystems, what biologist C. H. Waddington called *chreods* or 'necessary pathways.'[4] Identifying such chreods might provide the basis for a notational system to interpret signs of environmental change. *Earthscore* was essentially a perceptual syntax: the whole point was to create a veritable 'orchestration' of perceptions, so that a collective of TV viewers would start to intuitively see and feel both regularities and critical changes in the environment. Ryan called it 'a short-cut to ecological sanity by way of aesthetics' since knowledge about possible ecosystem damages would no longer be disembodied facts thrown at you by specialists but part of a shared perceptual apparatus. Subtle but symptomatic changes in water flows, plant growth or spawning behavior might become as much of a conversation piece as a sudden rainstorm and perhaps also generate as much hurried action.

It was, of course, a project doomed to fail. Given the ever-more monolithic channeling of TV perception into the feedback loops of the entertainment industries, the project came across as pure utopianism. And given the guerilla tactics of much of the 1970s counterculture – attacking institutions and corporations at the macro level, exacerbating antagonisms – a project built around the kind of habit-driven TV-viewing that was also the driving force of capitalist media did not have much political leverage. However, Ryan's overarching idea (if not his technical solution) may seem less quixotic today. Faced with the difficulty of producing political and legal consensus on efficient environmental action, thinkers as different as Gernot Böhme and Bruno Latour have argued the need for increased aesthetic and perceptual sensitization to the issues at stake: scientific facts need feelings in order to mobilize and public atmospheres in which to expand (Böhme 1995). Today, we are familiar with, for better and for worse, the technologies of tracking, coordinating and scaling up the most microscopic sensibilities, the 'likes' and 'dislikes' that make up vast informal communities. No politician today would fail to take into account the tangible reality of these volatile clouds of psychological attachments and their various ecologies of thought and action.

III

Today, many see the hyper-speedy feedback loops of online perceptions and sentiments as our new unthought environments – emergent, atmospheric, realities whose scope we are only beginning to understand. In fact, N. Katherine Hayles uses the term 'unthought' to argue that nonconscious forms of cognition should be understood as the main connecting points between humans and computers. Drawing on a wide range of scientific sources, she defines nonconscious cognition as the basic process that allows any life form to discover and act on environmental stimuli and shows that this hyper-rapid and subjectively unknown information processing at the neuronal level is precisely the capacity that living beings share with computational systems – even though data processing and brain functions are very different material systems. Her point is that computer networks function as an extension of human nonconscious cognition enabling us to handle information streams so large and complex that they could never be processed by our brains alone. And this extension of our capacities also transforms our interactions with broader planetary ecologies (Hayles 2017).

It is perhaps telling that such ideas are accompanied by what we may perhaps call 'intramachinic environments' in the realm of art production. While much early computer art focused on the digital manipulation of symbols, a world increasingly permeated by machine sensors triggers fantasies about the environmental dimension of all these newly fabricated sensory capacities – and, just as importantly, the role of sensing itself for any kind of environmental engagement. It should not come as a surprise that such work is oriented around atmospheric concepts – weathers, climates, moods – since these are precisely phenomena that are sensed long before they are consciously thought. Take, for instance, the emphatically digital worlds of Ed Atkins' computer-generated films, which are dominated by phenomena that we may easily identify as meteorological even though they have little in common with what we call weather in our world. This is not the simulation of nature you find in computer games. There may be wind, for instance, or something reminiscent of wind, because it makes the hair of his emphatically computer-generated characters move about in ways that obey a different set of physical laws than those familiar to us. There is also constantly changing light: sudden blinding flashes, layers of rainbowlike shimmers and reflections and dramatic changes in overall color and tone. Starry skies appear indistinguishable from illuminated specks of dust on some screen surface and cloudy blurs appear randomly, only to change abruptly into the crisp whiteness of a trademark Apple-design universe. It is the kind of weather in which subtitle strips cast dark shadows and brown liquid spills from the sky in elegant splashes, all accompanied by their own sound registers. The point is that this weather appears to be genuinely 'lived in' – a fully formed machine climate proper to the works' rather moody protagonists, profoundly impacting their actions and behaviors.

The ecological turn in society and culture has engendered a distinct interest in atmospheres – elusive environmental phenomena that are at once objective entities and purely subjective feelings. It is, however, too simple to see atmospheres as something that simply 'surrounds' us. The more interesting question is how atmospheres form or shape sensing in relation to a changing environment – how they fabricate new sensory capacities (McCormack 2018). Atkins's work presents such fabrication as fiction – a reflexive allegory of intramachinic environments. In sharp contrast, in the work of composer and sound artist Florian Hecker, we are no longer in the realm of fiction. Here, the creation of intra-machinic atmospherics is oriented around the difficult question of the *concrete*, *actual* fabrication of sensing. The result is a strange form of music that is based on sound phenomena that are – *at the technical level* – as fleeting, evanescent and inherently complex as the movements of air, clouds, vapor and light effects. And key to all these sounds is the fact that they are not primarily objects for listening but rather newly fabricated sensory capacities.

In fact, Hecker's work puts a wholly new computational spin on a distinctly environmental phenomenon in music – the elusive realm of auditory textures that is generally referred to as 'timbre.' Timbre is, in many ways, a problem. It is a well-established musical term, but its significance is largely founded on the fact that, unlike 'pitch' or 'harmony,' no one can say exactly what it is. It could be the overtones you may hear as the sound of a piano chord lingers. It could be the warmth of a particular violin or the sudden shrill edge of an angry voice. There are many ways a singer can hit the high C, and timbre is, essentially, what differentiates them. Timbre is in many ways like the weather – the uncontrollable, shapeshifting, atmospheric dimension of music. And this was precisely why a late nineteenth-century culture obsessed with scientifically capturing, analyzing and reproducing even the most fleeting sensations would become fixated on it. Composers such as Wagner and Debussy became obsessed with timbre and tried to foreground and celebrate its complexities in their music. Others tried to synthetically produce it. In the field of electroacoustic and electronic music, composers such as Pierre Schaeffer, Karlheinz Stockhausen and Iannis Xenakis attempted to modulate and replicate pre-existing sound textures and create new ones from scratch. But even so, timbre remains elusive. Since sound textures are essentially the hybrid effects of a whole concatenation of events that include not just the specific qualities of the sound source but also the ear/brain of the individual listener, *how do* you actually produce them? Can timbre be fabricated?

Hecker's answer is a cautious yes – but only if what you fabricate is not simply 'sound' but the very sound of hearing. You need, in other words, to synthetically fabricate a capacity for hearing – and this is a process that takes us deep into the realms of machine sensing. The difficulty and abstractness of the process were underscored by the fact that, on the occasion of his sound art exhibition at the Kunsthalle Wien in 2017, Hecker produced a book publication where 277 of the pages consisted of nothing but endless columns of tiny numbers – unreadable and incomprehensible for human eyes. But the numbers were machine-readable

– in fact, they were a printout of a computational process that replicates the very process of machine listening. The ciphers represent the 'inner sound' heard by a machine and might, in principle, also be used to regenerate such hearing.

The key context here – the field of research in which Hecker's work intervenes – is the crossroads between neurology and computer music. In the mid-1990s, researchers managed to create an exhaustive map of mammals' primary auditory cortex, connecting each individual neuron to the specific auditory stimuli – the so-called 'time frequency representation patterns' – that would maximally excite it. At this stage, no attempt was made to invert the process – that is, to use such data to synthetically produce the sound of hearing. Such listening to the very act of sensing was only made possible when machine-listening researchers Vincent Lostanlen and Joakim Andén developed what they called 'time-frequency scattering' – a form of signal synthesis that is comparable to the training of a deep neural network that approximates the brain's multifaceted encoding of sound as sensation. The 'scattering' was, in fact, a reference to a term used in quantum mechanics for microscopic phenomena such as the shimmering of a pearl or the reddish shade of a sunset – evanescent effects that, like timbre, seemed to involve a radiating maze of nonuniformities.

The research was purely scientific. It wasn't until Hecker heard about the technology that it was appropriated for aesthetic purposes. As he saw it, time-frequency scattering could create a new type of sound texture – a timbre that would effectively replicate the very event of listening, in this case, by machine ears. A collaboration ensued in which time-frequency scattering software was used to take us back to that late nineteenth-century moment when the intertwined problems of timbre and the synthetic fabrication of sensing signaled the start of a new and distinctly environmental orientation in modern art, alongside the industrial invention of synthetic smells, colors and sounds. This orientation was perhaps nowhere more marked than in the passage from words to sounds to bodily movements that took place as Stéphane Mallarmé's 1877 poem 'The Afternoon of a Faun' inspired the creation of an airy symphonic poem by Debussy in 1894 and, in 1912, a ballet by Vaslav Nijinsky, in which the dancers were made to perform artificial, inorganic movements never before seen onstage. In their various media, these works all tried to evoke the effort to capture and retain the fleeting sensations of an erotic dream. This is what the speaking faun in Mallarmé's poem is trying to do, in words that never quite manage to capture anything.

Hecker's *FAVN*, produced for the Alte Oper in Frankfurt in 2016, only exacerbated the difficulty. The music was essentially extracted from nothing – or, more precisely, from an undifferentiated timbral field produced by a machine learning, or listening, procedure known as 'wavelet scattering.' Wavelets are analytic tools – a means of describing sound signals or data by reading sound as several discontinuous features that may be understood as the synthetic counterparts to the multifaceted way in which sound is sensed by the individual neuron. The sound of hearing is, of course, elusive, and an individual wavelet – a brief oscillation with an amplitude that starts at zero and, after a brief increase, returns there – is not something you can actually listen to. But they can be scaled up. The swooshes, swishes and swathes of white noise that start off the first movement of *FAVN* are the sounds of a vast multitude of wavelets listening to an initial signal provided by Hecker. But from this point onward, this entire timbral field kept being reprocessed or relearnt, listening to itself in ever new versions. And out of this repeated feedback situation, identifiable signals – individuated sounds – started to appear in bits and pieces. By the second movement, one could hear distinct patterns, and by the third movement, those patterns had gained traction, complexity, and dimensionality, confidently taking on space. You were, in short, immersed in an environment produced by a host of newly fabricated, sensing, computational beings.

It might sound like science fiction, but it was not. This was not a work of fiction or representation but a real, actual phenomenon. And if the work might seem abstract, it is only so in the sense that we are all living amid abstractions – abstractions that arise from new and complex forms of synthesis and have real, material effects. Think, for instance, of what Matteo Pasquinelli calls the 'metadata society'– a regime in which harvesting information about collective behavioral patterns is an economic and political instrument vested in the effort to control the future (Pasquinelli 2014). Or consider the efforts to simulate natural language by training AIs on exponentially big data sets. Not only do data sets this size tend to scale up all sorts of social biases, but they also turn language itself into a synthetic modeling of something that might *look like* meaning, but that is removed from the contexts on which actual understanding depends (Hao 2020). These are among the unthought environments that art is trying to understand today. But they are part of the longer history of art engaging in new media technologies less as tools for 'art production' than as key features of the changing conditions of planetary life itself. Along the way, such art may often highlight the economic and political forces that underpin these changes: Should we, as art historian TJ Demos wonders, perhaps use the term 'Capitalocene' rather than the more neutral 'Anthropocene' (Demos 2017)? Yet, more pointedly, works such as these are aesthetic in ways that must be understood as fundamentally critical. Above all, they explore what it means to be a perceiving and sensing being in the strange new techno-natural ecologies where new and as yet unknown types of sensory capacities keep proliferating.

Notes

1. The so-called Nipkow disc – a mechanically spinning scanning disc – was patented in 1885 by the German scientist Paul Gottlieb Nipkow. On January 26, 1926, the Scottish inventor John Logie Baird gave the first demonstration of a true television system, a pictorial-transmission machine he called a 'televisor.' His televisor relied on the use of Nipkow discs.
2. Hörl presents the concept of environmentality as a rejoinder to, and update on, Michel Foucault's concept of governmentality.
3. The website of the Daniel Langlois Foundation for Art, Science and Technology describes Crutchfield as 'a well-known intermediary between artistic and scientific circles, respected for his ability to establish links between the concepts of chaos theory and those found in the electronic avant-garde.'
4. Ryan's system was more complex than this short essay allows for. Among other things, it was important to him that the videographers, who would always work in teams of three, would not just record and represent nature 'out there' – they had to work according to a relational dynamic in which their video-perceptions would represent different states of being or levels of signification. The model for this operation was Charles Sanders Peirce's triadic semiotics.

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Remains from the Anthropocene. Nils-Aslak Valkeapää, No title*, 2000. Asphalt, mirror glass, driftwood and acrylic. Privat owner. (Photo: Øystein Thorvaldsen/The Lásságámmi Foundation)*

CHAPTER 12

Ecocriticism and Petroculture Studies as Translation Work

Sissel Furuseth

When I embarked on my academic career in 1996 at the Norwegian University of Science and Technology (NTNU) in Trondheim, frustration seethed among my colleagues in the humanities. The management had decided, inspired by the prestigious institutions MIT in New England and KTH in Stockholm, that the recently merged NTNU (former University of Trondheim and Norwegian Institute of Technology) should have science and technology as its main profile. Scholars of language, history, philosophy, arts and the social sciences protested but to no avail. The situation was troubling. Some worried that the hard sciences might expel the soft ones and that the merge heralded the end of the humanities as we knew them. Yet, necessity is the mother of invention, and many of us saw new possibilities emerging within the NTNU framework. Some of my colleagues started to investigate the interfaces of aesthetics and technology, while others engaged in combining narratology and medicine. For me, a young lecturer of Scandinavian literature, equally attracted by science and arts since childhood, NTNU proved a good place to be in the late 1990s and early 2000s. The working environment stimulated intellectual curiosity across faculty borders. But there were also constant stress and fear of disciplinary extinction.

A quarter-century later, I find myself in Oslo engaged in ecocriticism and petroculture studies, pondering the similarities and differences between the NTNU fusion frenzy and the hectic life at the Oslo School of Environmental Humanities. I recognize the energetic imperatives to initiate challenge-driven research and collaborate with scholars in other disciplines. I also recognize discussions about the instrumentalization of research and what it means for scholars to be useful to society and give something back to the taxpayers. Yet, due to the strong position of the humanities in the capital, the situation in Oslo is fundamentally different from how I experienced the academy in Trondheim. As a literary scholar and philologist, I live a more protected life in Oslo, where Scandinavian Studies have existed since the mid-nineteenth century. Currently, the Nordic Literature teaching staff is at least double that of Trondheim, Bergen and other Norwegian university cities. The very combination of size and tradition means disciplinary security, which also means that I do not have to collaborate with scholars in other fields to survive as an academic. So why am I still – even more strongly – engaged in interdisciplinary research? Why am I involved in research groups with unsettling names such as ECODISTURB, and what motivated me to join the OSEH working group and initiate the collaboratory Critical Petroaesthetics project?

The answer is Anthropocene awakening. Although I often find the Anthropocene concept too grandiose for literary analysis, I acknowledge its value as a label for the environmental consciousness-raising that has become so urgent due to the global climate crisis. I have also come to realize that the Anthropocene discourse, or perhaps, more specifically, the UN Climate Change Conference in Paris in 2015 (COP21), has been crucial for synchronizing Norwegian ecocriticism with broader international trends. There is a before and an after the Paris Agreement. The Ecocritical Network for Scandinavian Studies (ENSCAN) was established in 2016, twenty-four years after the establishment of the U.S.-based Association for the Study of Literature and the Environment (ASLE, founded 1992) and twelve years after the European Association for the Study of Literature, Culture, and Environment (EASLSCE, founded 2004). ENSCAN has been vital for increased international collaboration between scholars in ecocriticism and the environmental humanities working with Nordic cultures (Hennig, Jonasson and Degerman 2018: 9).

It is also worth noting that a majority of Norwegian ecocritics today are, in one way or another, involved in teachers' education programs. Many of us have come to realize that the Anthropocene awakening is deeply entangled in linguistic policy as we are constantly deliberating on the relationship between native and foreign languages in the education for sustainable development curricula and its implications for diversity and democracy (cf. Furuseth and Hennig 2023). Questions of (in)translatability pop up everywhere. In this chapter, I take a meta-approach to the work of translation and the problem of synchronizing academic discourses in the environmental humanities, starting with ecocriticism, my own field of research and teaching. Ecocriticism is not an academic discipline as such but a 'green' way of reading and analyzing cultural artifacts. On the one hand, it is deeply rooted in classical hermeneutics and philology, attentive to words and their many layers of meanings, and on the other hand, it is socially engaged, focusing on environmental crises and how different types of texts might help advance political awareness and the necessary transition to a more sustainable future.

Ecocriticism in and out of sync

Ecocriticism has been defined as 'the study of the relationship between literature and the physical environment' (Glotfelty 1996: xviii). This generic description covers a wide range of approaches depending on the researcher's situatedness in terms of institutional affiliation, theoretical education, ideological conviction and generational identification, etc. Deep ecology, ecofeminism, eco-Marxism, animal studies and postcolonial ecocriticism are some of the positions Greg Garrard presents in the introductory book *Ecocriticism* (2012 [2004]). New materialism can also be regarded as a branch of ecocriticism. As the labels above indicate, ecocriticism often operates in the border area of philosophy, literary criticism and ecology. Thus, 'eco-criticism' is, by definition, an interdisciplinary practice.

The first explicitly ecocritical Ph.D. thesis in Norway, Henning Fjørtoft's *Jordsanger: Økokritiske analyser av Inger Christensens lange dikt* [Earth songs: ecocritical analyses of Inger Christensen's long poems], was defended at NTNU in 2011 and promoted as an instance of second-wave ecocriticism (Fjørtoft 2011: 21). The way the study came forward as something 'second' and 'first' at the same time may illustrate the belatedness of Norwegian ecocriticism, at least when measured with an Anglo-American yardstick. Following Lawrence Buell's classification in *The Future* *of Environmental Criticism* (2005), Fjørtoft distances himself from the 1990s first-wave ecocriticism and its associations with deep ecology activism and organicist models of conceiving the environment as untouched nature. The time had come to acknowledge that natural and built environments are blended (Buell 2005: 22).

This nature-culture mix is exactly what the Anthropocene is about, one might say, but the term was not widely used in ecocritical discourse ten to fifteen years ago, especially not in Norway. One reason was that second-wave ecocritics aimed for institutional acceptance within their respective disciplines – that is, the national literatures, first and foremost. Literature teachers already had a hard time explaining 'anthropomorphism,' 'anthropocentric' and similar foreign concepts to their students, so dragging in a new 'anthropo' word that pointed beyond rhetoric was not appropriate at the time. Fjørtoft was situated in a literature department recently modernized by poststructuralist theory, and he assured his readers that he would pay equal attention to formal-rhetorical structures and scientific contexts when analyzing Christensen's exceptionally learned poems. This may illustrate how second-wave ecocriticism strove, as Lawrence Buell put it in an updated essay on ecocritical trends, 'to make the movement look less like an outlier within the contemporary critical theory scene' (Buell 2011: 94). Thoroughly close readings and theoretical sophistication were prioritized when the first Norwegian ecocritical monograph came into being. A more political approach would have been too risky.

Five years later, the situation had radically changed. Activism was no longer abandoned. In his book *700-årsflommen* [The seven-hundred-year flood] (2016) – a collection of essays addressing the urgency of the climate crisis – author and critic Espen Stueland challenges academics to utilize the political potential of ecocriticism more actively. Is it the imperative to act that makes deep ecology so frightening, he wonders (Stueland 2016: 267), worried by the bad reputation ascribed to first-wave ecocriticism. Given today's nature crisis, are romanticism and organicist thinking really so bad, he asks rhetorically.

Stueland's critique of Fjørtoft, Timothy Morton and other scholars illustrates how academics may be institutionally constrained in ways that authors and artists are not. Probably more important for the change of tone in Norwegian ecocritical discourse was what occurred between 2011 and 2016, both locally and globally: public disputes about Statoil's tar sand projects in Canada, the 2013 launch of Forfatternes klimaaksjon (Norwegian Writers' Climate Campaign), COP21 in Paris in 2015, of course, and extreme weather and flooding close to home – as if posterity demanded we take the forces of nature more seriously.

When I started working at the University of Oslo in 2016, I was struck by how the ecocritical awakening in the capital was very much a bottom-up enterprise initiated by students. Master's students in their early twenties came knocking on my door, asking if I could be their supervisor if they chose deep ecology as the theoretical framework for their literary analyses. I understood from the ways they posed their questions that they had experienced some skepticism and resistance from other professors. But it was precisely those studies (Bogen 2016; Hagen 2019) that turned out to be particularly strong because they refused to buy into some of the usual stereotypes of anglophone ecocriticism and postcolonial theory. They illustrate the importance of translation, both in terms of concepts and contexts, and that true criticism happens when texts and artifacts give something back to theory.

For instance, in a study of Sámi Nils-Aslak Valkeapää's poetry collection *Beaivi, áhčážan*, Marte Hagen questions Greg

Garrard's claim that 'The Ecological Indian is clearly a stereotype of European origin' (Garrard 2004: 125). The second-wave reductive (no matter well-intentioned) labeling of indigenous dwelling as stereotypical is all the more problematic – and, in fact, Eurocentric – according to her (Hagen 2019: 47). She supports her argument by referring to works by Christopher B. Teuton, an expert on the cultural practice of the Cherokee Nation and the Sámi scholars Harald Gaski and Kikki Jernsletten, among others, in addition to Valkeapää himself. 'Surely nature teaches. The reindeer determines where and when to go,' he writes in the essay 'The Sun, the Thunder, the Fires of Heaven' (Valkeapää 1998: 7). Hagen draws lines between Valkeapää's poetics and Arne Næss's philosophy, especially the concept of 'the ecological self.' One of these lines runs through James Nolan's book *Poet-Chief*, in which he describes the shaman as one that 'becomes what he sings to the extent that the otherness he approaches sings through him in its own voice' (Nolan 1994: 158). The shaman's ability to transform himself, being in a state of transformative flux, can be related both to Næss's concept of the ecological self and to the yoik-influenced poetry of Nils-Aslak Valkeapää.

In other words, while it was imperative for Henning Fjørtoft to distance himself from deep ecology to make ecocriticism academically acceptable a decade ago, as one branch of literary theory among others, Marte Hagen embraces the spiritual and activist implications of indigenous poetics and Næss's philosophy. This illustrates how apparently outdated worldviews may become relevant again. Fjørtoft and Hagen illustrate the span of approaches allowed to unfold in the field more than being representative of a general trend in Norwegian ecocriticism. One might also say that the Hagen example illustrates the shortcomings of the wave model for understanding ecocriticism as a global enterprise: The co-existence of contradictory tendencies is more of a rule than an exception. What Fjørtoft and Hagen have in common, though, is their emphasis on poetry. They both underline, with their different arguments and academic styles, how poetic language may help sharpen our attention to environmental issues.

The interconnectedness of everything voiced in Valkeapää's poems derives from his own physical experiences and direct contact with landscape, reindeer, plants and seasonal changes. This is not romanticism, contrary to what some second-wave eco-critics would claim. Poetry can also reflect harsh environmental realities, as in poem number 537 in *Beaivi, áhčážan* (translated as *The Sun, My Father*):

> in these cold lands we migrate, day after day
> year after year, for now at least
> we trek this barren tundra
> from generation to generation
> and over time we become a part of this land
> where our roots spread
> (Valkeapää 1997)

I have elsewhere pointed out how this poem articulates a circular rather than a linear notion of time (Furuseth 2020b: 76). Its concept of human history and understanding of time and space are seasonal, first and foremost. Furthermore, as the title *The Sun, My Father* indicates, the vertical axis between the sun and earth is as important as the horizontal migration across the tundra, pointing at *how* the Sámi people have become part of the land. They are not explorers or settlers as such but nomads considering the entire Arctic tundra – one of the coldest land ecosystems on Earth – as their home.

While post-colonialism internationally has been an important source for critiquing 'the parochialism of predominant early stage ecocritical thinking' (Buell 2011: 101), postcolonial and decolonial critique in Norway often means finding back to the Indigenous perspectives that inspired the so-called first-wave ecocriticism. Kikki Jernsletten and Troy Storfjell's place-based re-reading of Knut Hamsun's Nobel Prize-awarded novel *Growth of the Soil* (*Markens Grøde*, 1917) – a novel today perhaps best known for its attempts to erase Sámi presence in its fictionalized northern landscape – can be interpreted as an example of such a reclaiming of native systems of knowledge. They explain how they, as Indigenous researchers, have

> a broadened range of sources, owing to our own position in a complex network of relationships. The land, the trees, the lakes, streams, mountains, bogs, bays, inlets, islands, and the fjord itself are part of us. Or rather, we are part of these things; each of us is a person due to our relationships with them. And these things are not actually just *things*. They have agency. They have voices (Jernsletten and Storfjell 2017: 92).

It is worth noting, though, that Jernsletten and Storfjell do not apply 'ecocriticism' – or 'deep ecology' or 'new materialism,' for that matter – as labels for their critical practice. Their place-based approach is based on Indigenous methodologies, which means that they, among other things, see their knowledge as fundamentally dialogic, emerging 'from an ongoing conversation between people, and with place, story, and non-human beings' (90). Whether such an approach is unique for Indigenous peoples can be disputed, but the crucial point in my argument is the observation that the academy today, to a greater extent than before, allows nature to 'write back' in ways that would be regarded as theoretically naïve a couple of decades ago.

In a Scandinavian context, Sámi perspectives are still under-represented in ecocritical research, but recent publications such as *Arctic Environmental Modernities* (Körber et al. 2017), *Nordic Narratives of Nature and the Environment* (Hennig et al. 2018) and *Norrlandslitteratur: Ekokritiska perspektiv* (Degerman et al. 2018) include examples of how ecocriticism and postcolonial approaches can be successfully combined. The Arctic point of view complicates the usual line of argument in postcolonial and decolonial discourse. Although many of these readings are still sensitive to stereotypes of Indigenous peoples as particularly close to nature, it is my view that ecocriticism can profitably be mobilized to problematize versions of postcolonial theory caught in a simple Global North–Global South dichotomy. Energy culture may be a case in point.

Energy infrastructures, world ecology and world literature

Contemporary knowledge about the relationship between fossil energy and climate change challenges postcolonial ecocriticism in new ways. For decades, the fight for Sámi rights and fights against environmental degradation have been two sides of the same coin in the northern parts of Norway, Sweden and Finland. The damming of rivers and expansion of windfarms in reindeer grazing areas have provoked resistance from a lot of people, not only the Sámi population but almost everyone living on and by the land in the affected areas. The Anthropocene discourse, however, has in many ways altered our notions of environmental living; having a large herd of reindeer is not necessarily more sustainable than running a wind farm.

From a climate point of view, energy from wind and water is regarded as cleaner than energy from oil and gas. In this respect, the Sámi population and the majority population in Norway share a common destiny, or perhaps more precisely, a common responsibility. In the energy humanities, an interdisciplinary field partly overlapping with the environmental humanities, terms like 'petroculture' and 'petromodernity' are often used to describe the energy regime we are subject to – that is, the dependency of oil in everything we do (cf. LeMenager 2014). In the Anthropocene, petromodernity has left its marks everywhere, even on the barren tundra described by Valkeapää. This unfortunate development is something he laments in the essay 'The Sun, the Thunder, the Fires of Heaven':

> In working with reindeer these days, the Sámi use snowmobiles, automobiles, helicopters, radio, and telephone communication systems. The ideals of Western thought, the products of Western technology that make life easier, and Western economic thought are in the game. The view of life that is directed inward and strives to forget the borders between humans and nature seems likely to be left in the dust. When the pressure of a foot sets hundreds of horsepower spinning, one can easily believe oneself to be the lord of nature (Valkeapää 1998: 9).

Observing how the Indigenous way of life is threatened by the seductive power of speed, effectivity and noise, Valkeapää connects the Sámi to the petrostate at large. From the perspective of postcolonial ecocriticism, the snowmobile empowers man in the most ambivalent way, illustrating how fossil fuel-driven technologies both liberate and corrupt.

So, what does it mean for our research that we are all petrocitizens? I have no satisfactory answer to that question beyond being convinced that it is an important question to ask. Over the last couple of years, OSEH's collaboratory Critical Petroaesthetics project has been occupied with the natural-cultural impact of petroleum and the assumption that the aesthetics of oil might be a factor hindering a transition to alternative energy. The interdisciplinary research group has studied books, films, exhibitions and other media critiquing everyday oil consumption and the powerful petroleum industry but also investigated less explicit documents and artifacts in which oil is hidden, greenwashed or denied (cf. Bjørkdahl 2021; Furuseth 2021; Ritson 2022). At reading group meetings and workshops, we have compared similarities and differences between specific petrocultures worldwide, discussing how oil's ambivalences act differently in the Arctic than in California, the Niger Delta, the Middle East and Brunei, or in the North Sea region, for that matter.

Petroculture is also a fundamentally global phenomenon, of course, and interestingly the notion of *world literature* has become a common focus of attention in both translation studies and petrofiction studies. Regarding the latter, Graeme Macdonald and Michael Niblett at the Warwick Research Collective have approached world literature as 'the literature of the capitalist world-ecology' (Niblett 2012: 28), emphasizing 'the necessary "worlding" of petrofiction and other resource texts' (Macdonald 2017: 291). But as Ursula Biemann has underscored, oil is always interwoven in 'regional histories and local textures of interaction between infrastructures and social communities' (Biemann and Pendakis 2012: 8), which brings me back to questions of translation and translatability, because the regional and the global can perfectly be thought together as long there is a reflective meta-perspective on the work of translation involved. As accentuated by

Lawrence Venuti and Pascale Casanova, translation as a linguistic and cultural practice is 'unique in initiating events on an international scale, potentially affecting not only the hierarchy of values, beliefs, and representations in the receiving situation but also the global hierarchy of symbolic capital' (Venuti 2013: 4) – a hierarchy that structures the relations between national literary traditions (Casanova 2004).

As a native Norwegian ecocritic somehow caught in the middle of this hierarchy, I am aware of (at least) two methodological pitfalls: on the one hand, the risk of overlooking or misrepresenting Sámi perspectives and on the other, the risk of too easily submitting to anglophone worldviews. Since ecocriticism was coined in the United States in the 1990s, American literature has set the tone for many debates in the field. One peculiar outcome of internationalization is that scholars of Scandinavian culture are driven toward the exotic and most Indigenous expressions, often linked to similar Indigenous expressions in the U.S. and Canada. The consequence is that majority Norwegian culture – if such a thing exists – tends to fall between stools. True, the international success of cli-fi novelists Maja Lunde and Jostein Gaarder has, to some extent, opened up for investigating this middle space (or perhaps lower space) in the global cultural hierarchy as well.

The Anglophone dilemma

In *Anthropocene Fictions* (2015), the first systematic examination of novels about anthropogenic climate change, Adam Trexler appreciates that Nordic writers such as Jostein Gaarder, Yrsa Sigurðardóttir and Johanna Sinisalo have been translated into

English, but he laments the difficulties of locating such novels, especially as 'there is a vital need for the cross-cultural insight they could provide and a commensurate need for scholarship by critics specializing in other languages' (Trexler 2015: 10). In a similar vein, Buell excused his skimpy treatment of ecocritical work outside the English-speaking world: 'As the movement continues to spread beyond its original Anglophone base, the problem of intercommunication between critical vocabularies becomes commensurably greater' (Buell 2011: 107). The global nature of the most burning environmental issues today brings language to the fore in a double sense.

In their essay 'The Anglophone Dilemma in the Environmental Humanities,' Daniel Finch-Race and Katie Ritson address the language issue at a more principal level, claiming that an 'English-speaking worldview entails a set of attitudes and beliefs that can end up overwriting cultural values in geographical contexts where expression comes in myriad languages and dialects' (Finch-Race and Ritson 2021). True, a lingua franca is necessary to deal with the global environmental crisis, but it may also limit both perception and communication. Language is power also with regards to theoretical overwriting. For example, Finch-Race and Ritson have observed 'ecocriticism's deep roots in English-language modes of "nature writing" [...] often eclipse related traditions in Romance, Germanic, Nordic, and Slavic literatures, as well as numerous smaller languages and dialects—most of which come under consideration only when translated into English.' Even though they realize that it can be difficult to get away from this limited perspective, they believe that many ecocritical scholars are 'in a strong position to take forward multilingual research and publications based on an expert appreciation of the power of words.'

I fully support this call for a stronger emphasis on language in the environmental humanities. I also believe that ecocritics trained as philologists, working with words on a daily basis, can develop hypersensitivity to certain forms of abstraction. Personally, I find concepts such as 'the Global North,' 'Western thought' and 'the Anthropocene' to be too abstract to have any explanatory force. Very often, I grope for the empirical basis for such terms, and a part of me is worried that we risk alienating people from important discussions by using obscure terms. For many people, eco-philosophy, ecocriticism and the environmental humanities at large are already experienced as some sort of intellectual colonization of nature (Furuseth 2020a), which at its worst may lead to the further polarization of already heated political debates on environmental and energy issues.

Between cultures

As Hannes Bergthaller and his co-authors put it in the manifesto essay 'Mapping Common Ground,' ecocritics and environmental historians have finally realized the need to reframe their work as part of the interdisciplinary enterprise of environmental humanities in order to 'acquire the critical mass and popular appeal it needs to have an impact in the public sphere' (Bergthaller et al. 2014: 263). In other words, the main reason for cooperating across disciplines is located outside rather than within the academy. In that perspective, interdisciplinary scholarship may function as a practicing ground for this larger mission of reaching out. Fortunately, the authors of 'Mapping Common Ground' do not propose academic rebranding or erase disciplinary borders, but they emphasize that in order to realize the promise of the environmental humanities, the work that will be needed 'is principally one of translation and transmission – between the disciplines that constitute it, but also, and perhaps more importantly, to a public whose existence we can no longer take for granted' (Bergthaller et al. 2014: 273). This is a crucial point. I would like to add that in order to be able to translate, we need knowledge about both the source language and target language as well as a metalanguage.

I believe my skills in translating between academic cultures emerged from my years at NTNU, and probably the most important years were those before I got a position there. As a student in Trondheim in the 1990s, I remember very well when I shared a flat with a musicology student and two petroleum engineering students. The musicologist and I envied the petroleum students for being treated to pizza and beer on a weekly basis by the big oil companies Statoil and Hydro. As humanists, we could only dream of such benefits. We took comfort in our arts, of course, reading and playing – building a different kind of capital, one might say. When the petroleum students fled to their Statoil evenings, we pretended to be sad and abandoned, but our envy was not particularly deep-seated. We had energetic discussions late into the night. In retrospect, I know that I learned a lot from the years when we – petroleum students and humanities students under the same roof – poked fun at each other. With the playfulness came curiosity, respect, annoyance and some sort of recoding of belief systems or at least an ability to see the world and the university from different perspectives. I hope it was mutual.

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Rural coal-fired brick factory in one of China's richest provinces. (Photo: © Mette Halskov Hansen)

Epilogue

Mette Halskov Hansen

In 2000, I was part of a team doing research in an area of Southwest China that had acquired the dubious reputation of hosting one of many 'cancer villages.' The rate of lung cancer and respiratory diseases was exceptionally high, and everybody we talked to in the small town had friends or family who were affected. The area was known for its abundance of coal mines, and there were large coal-fired power stations in the township. One day, on one of my walks on the outskirts of the town, I came across the unusual site of a village that seemed completely abandoned. It was beautifully located on a hill overlooking the town, but there were no signs of human life except for two run-down houses outside of which some men's laundry was hanging. Fields were fallow, trees and plants were in the process of taking over buildings, there were no farm animals in sight and the silence in the village was in striking contrast to the Chinese countryside I had otherwise come to know.

I set out to explore what had happened, and through many conversations, the puzzle started to come together. People in the village had been peasants for many generations. They were living off their small fields, benefitting from a mild climate and a river supplying them with plenty of water and fish. However, one relocated villager recalled, from the early 1970s onwards, more and more cows and pigs in the village fell ill. They seemed dizzy and eventually lost their ability to stand or walk properly. Nobody knew exactly what was going on and it all happened gradually. Villagers started to turn their suspicions toward a chemical factory established nearby due to the easy access to river water. Over the years, the river slowly changed color and an increasing number of animals fell ill or died. The villagers were convinced that the factory was releasing its waste chemicals directly into the river, and they started to protest against the local authorities – alas, to no avail.

To make a long story short, in 1979, desperate villagers transported a very sick cow on a long train trip to the provincial capital in order to stage a small protest in front of the government building. A long process of negotiations started. By the early 1990s, nearly ten years before our arrival, the whole village area and the surrounding fields were so polluted that the factory was finally closed. The water in the river could no longer be used, and all the villagers were relocated. Where did they move? They received compensation from the government and most of them were given housing in the township area very close to the coal-fired power stations. Some of the men became workers in the coal mining industry. Villagers had barely escaped one kind of life-destroying pollution only to move closer to another. But those I talked to were nevertheless grateful for their opportunity to move and the return of their incomes.

The story of this ghost village, while local and small in scale, epitomizes so many of the larger issues addressed in this book about the Anthropocene. No single academic discipline or individual scholar suffices to comprehend what happened in this small town in China over the last sixty or seventy years and why it constitutes such a compelling example of the complex challenges of our time. It makes no sense to separate the study of the chemical factory's ecological impact from the government policies, the social and economic lives of peasants or miners-to-be or the popular and scientific debates around 'cancer villages.' Complex realities require multiple research methods and close collaboration across academic disciplines. As the editors argue in the introduction to this book, humans and other living beings are increasingly faced with intertwined social, political, environmental and technological challenges. The very concept of the Anthropocene has made it clear how misleading it is to distinguish between the 'natural' and 'sociocultural' realms. The notion of the Anthropocene can, therefore, also help us open the doors between established academic disciplines and challenge the organizational structures of universities as well as the form and content of the studies we offer our students.

In 2022, UNESCO published a report with a clear message to leaders and actors within higher education institutions: Push for transformations that will equip your institutions to be catalysts of the urgently needed changes toward a more sustainable world. Facilitate interdisciplinary and transdisciplinary research and collaboration. Support epistemic dialogue and integrate diverse ways of knowing. Engage, too, in difficult forms of partnerships with societal actors outside academia (Parr et al. 2022). These are no minor tasks that are not without their dilemmas. Nevertheless, the climate and environmental crises, with all their social and economic implications and consequences, demand it. And time is short.

We are already seeing changes in the right direction, especially in the field of research, where both universities and larger funding schemes, including the European Research Council, have opened for more collaborative research across disciplines and sectors. From 2013, I was fortunate to be part of a team of scholars from the disciplines of chemistry, anthropology, China studies, political science, environmental engineering and media science based in Norway, China and the United States. We received support from the Norwegian Research Council and other funding institutions in China and Norway to carry out a long-term collaborative study of the human dimensions of air pollution in China. For me and most of the other participants from the humanities and social sciences, it was the first time we had collaborated with chemists and environmental engineers who were measuring and analyzing rural inhabitants' exposure to air pollutants. For the chemists, it was an equally new experience to have anthropologists following them around and engaging in longer conversations with villagers whose exposure to air pollution was being measured. The experience was eye-opening for all scholars involved, and it also triggered a slew of questions about how we teach and educate our students in universities in the United States, China and Norway.

We need to bring the UNESCO report's call for action – as well as the positive and negative experiences from radical interdisciplinary research and collaborations – into our university policies and practices of education. In experiencing and acknowledging the urgency of challenges in the Anthropocene, many scholars are developing new types of research questions in collaboration with each other and with partners from other sectors of society. Students should be part of this. New questions call for more experimental research methodologies, and changing research methodologies should consequently impact the form and content of our research-based education. Perhaps for universities, a simple guiding principle could be twofold: First, to take seriously our responsibility to develop scientific knowledge in close collaboration with others who can help promote the change and transition that is needed in the Anthropocene; and second, to simultaneously build education that fosters what Tim Ingold and others have termed *response-ability* – the capacity and readiness 'to go along with things and answer to them' (Ingold 2022). This is a different form of education than the traditional cultivation of reason. It is, as Ingold argues, an education that sharpens our attention to the world around us so that we can respond with skill and sensitivity to what is going on there. It develops in close collaboration between students and teachers.

The Oslo School of Environmental Humanities at the University of Oslo has come a long way in initiating such experimental forms of university education. The idea to develop a course that offers 'Anthropocene literacy' to students is both refreshing and efficient as a tool to build collaboration and understanding across fields of knowledge. The lecture series leading to the chapters in this book has been pioneering and exemplary in this respect. I hope it inspires many other new courses and initiatives that can help us all – students and scholars – to better understand, face and respond to the climate and environmental crisis, which remains the biggest long-term challenge of our time.

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