Producing Anti-Political Scientists?

An exploration of environmental science pedagogies at Utrecht University in the Anthropocene

Master thesis in Cultural Anthropology: Sustainable Citizenship

Utrecht University, 2021

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Word count: 21,944.

Universiteit Utrecht

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Abstract

Drawing on Foucauldian theories of governmentality and subjectivisation, previous applications of these concepts to the governance of nature, and ethnographies of science, this thesis examines the formation of certain types of scientists in the Anthropocene. Based on interviews and participant observation conducted among students studying environmental sciences at Utrecht University, I argue that teachers and course materials seek to shape students into anti-political scientists-in-the-making who reproduce renderings of the Anthropocene as a *technical* issue, rather than a *political and ethical* crisis. On the individual level, this is done by teaching students how to conduct themselves appropriately as either disengaged theorists or pragmatic solution-finders, depending on the programme they follow. However, subjects are also formed through the dissemination of certain discourses, which construct a regime of truth that presents science as the most authoritative method of knowing and governing nature and society. However, some students challenge these discourses: they engage with the responsibility of becoming a scientist in the Anthropocene, they oppose the commodification of nature, and they problematise their programmes' marginalisation of alternative forms of knowledge production about nature. I argue that the construction and circulation of these counter-discourses are attempts to re-politicise the Anthropocene and Anthropocenic subjects.

Acknowledgements

I would like to thank my supervisor, David, for his invaluable insights and advice. Thanks to Úna for the editing tips, and to everyone back home for all the support. Finally, and most importantly, thank you to all my participants for generously giving me your time and opinions.

List of Pseudonyms

In order to help the reader keep track of the participants I refer to in my thesis, I have included a list of the acronyms and pseudonyms I used below, along with the date I interviewed a participant or in which class I encountered them, and what they studied. To protect my participants' anonymity, I have tried to obscure identifying features throughout the text; however, I have kept these characteristics in mind when choosing pseudonyms in order to demonstrate the mix of genders and nationalities present in classes.

Interviews

Rory (Sustainable Development (SD): Earth System Governance track): interviewed on 10/02/21, personal communication on 22/07/21, 27/07/21, 28/07/21.

Francisco (Environmental Biology (EB): Behavioural Ecology track): interviewed on 10/02/21, follow-up interview on 13/04/21.

Jeb (SD: Earth System Governance): interviewed on 12/02/21.

Hella (SD: Environmental Change & Ecosystems): interviewed on 12/02/21.

Carlos (SD: Earth System Governance): interviewed on 15/02/21.

Vera (EB: Fungal Biology): interviewed on 17/02/21.

András (SD: Energy & Material Systems): interviewed on 18/02/21.

Thomas (Climate Physics (CP)): interviewed on 19/02/21.

Eline (SD: Energy & Material Systems): interviewed on 23/02/21, follow-up interview on 22/04/21.

Cato (CP): interviewed on 24/02/21.

Madhuri (SD: Earth System Governance): interviewed on 24/02/21.

Arnoud (EB: Fungal Biology): interviewed on 26/02/21.

Barend (CP): interviewed on 01/03/21, follow-up interview on 16/04/21.

Sanne (EB: Ecology & Natural Resources Management): interviewed on 03/03/21, follow-up interview on 30/03/21.

Aida (CP): interviewed on 04/03/21, follow-up interview on 21/04/21.

Madelief (CP): interviewed on 05/03/21, personal communication (email) on 19/07/21.

Christopher (CP): interviewed on 19/03/21.

Diederik (CP): interviewed on 06/04/21.

Participant Observation

I have only given the pseudonyms of the participants I quote or refer to by name.

Climate Physics (CP)

Dynamical Oceanography (DO): Pieter (professor)

Current Themes in Climate Change (CTCC): Job (professor), Wouter, Anya, Koen, Leonardo, Daphne, Floris, and Tess (students)

Climate Physicist-Activists (CPA)

Environmental Biology (EB)

Plant-Microbe Interactions (PMI): Aart and Elke (professors)

Sustainable Development (SD)

Bio-Based Economy (BBE): Bas (professor), Lukas (student)

Environmental Systems Analysis (ESA)

Introduction

At the tail end of a class on the vulnerability of marine ecosystems to the climate crisis, a student questioned whether current policies are enough to protect these ecosystems against human activities. In response, Wouter proposed establishing a Parliament of Things (Latour 1991) in an attempt to ensure that "not only the human perspective is represented in our democracy, but other perspectives". Christopher agreed that a different philosophical engagement with the world is needed; but that on a more practical level, it was obvious to him that present policies are not enough. Though he did not have an answer to this dilemma, he argued that "we can keep *asking* about what we need to do, but in the end we need to actually *do* something about it!". Barend then placed the blame on "developing countries" who "are getting their head around fertilizer use... in order to improve their futures... but they're actually destroying their ecosystems" due to runoff into rivers and oceans. The debate this question generated ran over the class's allotted time slot; but before Job ended the session, Anya reminded the rest of the class that a brainstorming session was being organised that night to discuss how to bridge the gap between what they were learning about the climate crisis, and the feeble policy responses of national governments. She invited any student who had been interested in the day's discussion to join them.[1]

At the prospective dawn of a new geological epoch, the "Anthropocene", I conducted fieldwork among master's students studying an environmental science at Utrecht University (UU) in order to investigate the formation of their subjectivities. The International Commission on Stratigraphy has not yet approved this term as a formal unit of geological time, partly due to debates as to when to date its origins (Chau & Fair 2019). Nevertheless, recognition of human culpability in vast planetary transformations is growing (Chakrabarty 2014; Chau & Fair 2019: Rudiak-Gould 2015). These changes include anthropogenic climate change, a sixth mass extinction, and the growing ubiquity of synthetic materials in the biosphere (Anthropocene Working Group 2019; Zalasiewicz et al. 2017). These potentially catastrophic consequences for humans and nonhumans has caused the concept to spread from the scientific realm to other academic disciplines, policy makers, and the public (Chakrabarty 2016; Gibson & Venkateswar 2015;

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[1] Field notes from CTCC Discussion 7 (25/03/21).

Moore 2015).[2] This sense of responsibility was clearly felt by the students I describe in the vignette above; what is also clear, however, is that there is no single Anthropocenic discourse that governs how responsibility for these changes is attributed, or how to react to them. Instead, a myriad of discourses circulate: from Wouter's ecocentrism, to the ethical imperative to act now forwarded by Christopher, to Barend's attribution of blame to the Global South. These discourses and others freely circulated and sparked debate in many of the classes I attended as part of my research. They were also reproduced outside of these classrooms, such as in the activist group established by Anya, and among the students I interviewed.

The attribution of blame and responsibility is an inherently moral action (Rudiak-Gould 2015). I was struck during fieldwork by how many students engage in deep reflection on what our political and ethical response to the Anthropocene should be, including in their own lives as scientists-in-the-making. However, because they are characterised as falling outside of the purview of Science,[3] these debates are circumscribed by the course materials of their programmes. In this thesis, I explore what motivated students to begin studying the environment; the meanings they ascribe to Nature, Science, and their own role in the Anthropocene; and the ways they have been changed (or not) by their studies. Drawing on Foucault's conceptualisation of subjectivisation and governmentality, I theorise that these students are being formed into particular types of scientists-in-the-making through the circulation of certain discourses on how scientists should behave, as well as how Science should relate to Nature and Society. I argue that UU disseminates a pedagogy which seeks to produce anti-political scientists who render the Anthropocene a technical issue, rather than a political crisis. However, some students contest this by constructing counter-discourses which attempt to re-politicise responses to the Anthropocene.

In the remainder of this chapter, I first situate my thesis within theoretical debates surrounding science and subject formation. I then describe where I conducted research, before reflecting on my methodology and ethics.

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[2] In this thesis, I use Anthropocene as an umbrella term to refer to the multiple and interlinked environmental crises that threaten our world, including the climate crisis and the homogenisation of the biosphere.
[3] I capitalise Science, Nature, and Society at certain points in this text to refer to and problematise representations of these entities as accurate reflections of a "true" reality, rather than human-made constructions.

<u>The production of Nature, Science, and scientists</u>

My thesis contributes to our understanding of processes of subject formation among science students at a time when the Anthropocene simultaneously strengthens and challenges scientific authority. My project is therefore part of the anthropology of science. In this section, I review anthropological engagements with how scientific knowledge is produced, and how the power relations that inform its production are then erased. I end by outlining the theoretical framework that undergirds my analysis of how scientists are produced at UU, based on Foucauldian conceptualisations of discourses, subject formation, and governmentality.

Constructing Nature

The anthropology of science draws on science and technology studies (STS) to argue that science and scientific facts are the products of their contexts. These scholars argue that what "what would later be packaged as a 'mind-independent fact'" is actually the result of "collective cultural assumptions, pragmatic negotiations between individuals, and the use of particular methods, tools and techniques rather than others" (Candea 2016, 4; see also Hine 2007). Thus, as some STS scholars focused on the natural sciences argue, objective science does not discover a pre-existing nature; by producing knowledge about nature, scientists actually produce "nature" itself (Foucault 1970; Haraway 1991; Latour 1987, 2005; Knorr-Cetina 1983). Like the ethnographers who follow them through the laboratory, scientists engage in *crafting* facts about nature, rather than *revealing* what nature is; both accounts are thus "no more *than fiction*" (Latour & Woolgar 1986, 257).

But as anthropologists of science, feminist theorists, and post-structural political ecologists have shown, these fictions wield vast political and material power because "science is a process of active world-making", which means that "actual humans [and nonhumans] will be shaped and transformed in important ways by these various offshoots of scientific understandings built in particular labs, and will in turn to live to confirm the value and reality of these understandings" (Candea 2016, 9). Drawing on Foucauldian notions of governmentality, biopower, and the Panopticon, scholars have argued that this form of knowledge production originated in the modern era, where Science constructed a Nature and a Society that were separate, but that nonetheless Nature could (and should) be managed for human benefit (Rutherford 2002). After

being exported all over the planet through colonialism and capitalism, this "regime of truth" (Foucault 1980) continues to wield enormous power (Chakrabarty 2009; Descola & Palsson 1996; Hastrup 2014). Moreover, this regime informs contemporary discourses on "sustainability", which represent Nature as fragile and limited, and thus construct a planet that "can be managed and manipulated, disciplined and governed, by politicians and economists, bureaucrats and bankers, *provided that they follow the directions provided by scientific investigation and analysis*" (Peace 2002, 530; emphasis mine; see also Luke 1999, Rutherford 2007). Thus, making nature manageable relies on producing as much (scientific) knowledge as possible about it; the work of environmental scientists is therefore deeply political (Gusterson 1998; Peace 2002; Rutherford 2002; Rutherford 2007).

The anti-politics of Anthropocenic environmental science

Scientific knowledge production has also been essential to the construction of the Anthropocene, which "has not been something for geologists to discover, but a product of human thought and contemplation" (Gibson & Venkateswar 2015, 8; see also Crist 2007; Singh 2015). The idea of the Anthropocene engenders and reproduces potent regimes of truth whose effects are as tangible as those of anthropogenic environmental change (Chau & Fair 2019; Moore 2015; Swyngedouw 2010). One such regime of truth is the erasure of the political aspects of the Anthropocene; as I outline in this section, the predominance of apocalyptic and eco-modernist discourses among many scientists renders the Anthropocene an urgent crisis that can only be tackled through techno-managerial, *anti-political* approaches.

The Anthropocene was first popularised by Paul Crutzen and Eugene Stoermer at the dawn of the twenty-first century (Crutzen & Stoermer 2000). Crutzen, in particular, argued that attempts to constrain fossil fuel use and its greenhouse gas emissions (GHGs) through policymaking have been so unsuccessful, and the potential consequences are so disastrous, that we must now seriously consider "climate engineering" instead, such as through a "stratospheric sulfur release experiment" that would artificially cool the planet (Crutzen 2006, 217; see also Crutzen 2002; Lövbrand et al. 2009; Steffen et al. 2011). Other scientists prominently associated with the epoch have proposed solutions which seem more benign than brute force geo-engineering; for instance, Will Steffen, co-creator of the concept of "planetary boundaries", has argued that humans must

become caring "stewards of the earth" (Steffen et al. 2011). However, these experts' representations of the Anthropocene reproduce the earth as something humanity should manage, as they constitute the planet as an entity that should "with loving supervision, intelligent crafting, big-data monitoring, and careful techno-natural nurturing and manicuring, be terraformed to whatever socio-ecological condition humans may desire" (Swyngedouw & Ernston 2018, 11). In fact, many of these eco-modernist representations construct a hopeful vision of the world in which the Anthropocene does not destroy humanity, but leads to the intensification of our control over the planet (Rothe 2020).

The Anthropocene as a concept quickly gained traction in the social sciences and humanities; there, however, an apocalyptic discourse predominated which envisioned the collapse of human and earth systems due to the strain humanity has placed on them (Ginn 2015; Rothe 2020; Swyngedouw 2010). This apocalypticism now suffuses many scientists' representations of the Anthropocene as well; they foresee the overshooting of "planetary boundaries" which irrevocably pushes the planet out of the Holocene, the geological epoch which functioned as a "safe operating space for humanity" for thousands of years (Rockström et al. 2009, 472). But though apocalyptic and eco-modernist discourses seem opposed, they function in similar ways in scientific discourses: they constrain the options we have to react to the Anthropocene by deeming some solutions (usually technical and technological) realistic answers to the urgency of the crisis (Crist 2007; Swyngedouw 2010).[4] Whether avoiding disaster is a matter of deploying geo-engineering projects on a planetary scale (Crutzen 2002, 2006), or of managing the earth as a set of "ecosystems services" (Steffen et al. 2011), solutions are judged solely on "wholly technocratic questions of efficiency and cost-benefit ratios from which political considerations and debates are largely effaced" (Fletcher 2014, 330).

Science therefore "renders technical" the Anthropocene, removing it from "the messiness of the social world" and erasing its root causes (Li 2007a, 265; see also Li 2007b, 2011). Ferguson's concept of the "anti-political machine" functions in a similar way. This machine is composed of experts who narrow possible solutions to technical interventions alone, instead of tackling the

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[4] See Latour et al. (2018) for an alternative understanding of "apocalypse": "an attitude which precisely takes out the poison of the accusation and the doom and the responsibility. It is a turn that seeks to take the poison out of catastrophism" (604; see also Ginn 2015). However, as I argue here, I characterise apocalyptic thinking as anti-political because, when coupled with techno-managerialism, it renders the Anthropocene a technical issue, rather than a political one.

power relations that underly the problem or reconsidering our current practices (Ferguson 1994; see also Nadasdy 2005). This enables the Anthropocene and its subjects to be governed through "post-politics", in which "ideological or dissensual contestation and struggles are replaced by techno-managerial planning, expert management and administration" (Swyngedouw 2010, 225). Under such a regime, responses to the Anthropocene focus on curbing excess carbon emissions "within the horizons of a capitalist order that is beyond dispute" (Swyngedouw 2010, 219; see also Crist 2007; Youdelis 2020). The dominant neoliberal order becomes the framework that determines what is considered a "sensible" concern (Rancière 2007); all else is rendered invisible (Kenis & Mathijs 2014), including alternative visions of the future (Veland et al. 2018; Yusoff 2016). Though this regime claims not to be, this is a deeply political project; nonetheless, I will refer to this dimension of Anthropocene discourses as *anti-political* or *technical* in the rest of my thesis.

However, the Anthropocene also seems to have triggered a shift in how even the 'hard' sciences relate to the natural world: the Cartesian Nature-Culture dichotomy has been destabilised, the agency of nonhuman actors is being debated, and the political ramifications of who is responsible for the Anthropocene are becoming matters of interest to scientists (Chakrabarty 2014; Latour 2017; Lövbrand et al. 2009). Thus, as Tsing argues, Science is a "unifying force pulling together all kinds of knowledge and creating a monolithic kind of knowledge" about Nature and the Anthropocene, while simultaneously "there has been lots of fragmented and multiple kinds of science-making… which undermine the promises of the modern project of progress and Man" (Tsing in Latour et al. 2018, 596), and may subvert attempts to render the Anthropocene technical. The Anthropocene is therefore "a storm in which ethics and science are entangled" (Schmidt et al. 2016, 193), and which is forming the subjectivities of the scientists-in-the-making I am interested in.

The formation of scientists in the Anthropocene
Alongside my analysis of the anti-politicisation of environmental science in the Anthropocene, I draw on Foucauldian theories of discourse, subjectivisation, and governmentality to explore the subjectivities emerging among students at UU. Foucault conceptualised discourses as the assemblages of beliefs, statements, and practices that shape how we think of reality, and

therefore produce it (1980). He theorised that the creation and circulation of some discourses over others create subjects who have internalised and naturalised certain ways of thinking about and being in the world (Foucault 1995; Li 2007a). These discourses therefore allow individuals to be formed into governable subjects through the "conduct of conduct", a process Foucault also called "governmentality" (2008). The processes through which *environmental* subjects are formed on the ground have also been ethnographically documented (in particular, see Agrawal 2005; Fletcher 2010). Rather than looking at subjectifying discourses in isolation, these scholars investigate the emergence of environmental subjectivities amidst a morass of conflicting and collaborating discourses, which operate through "a micro-politics of power, where self-construction becomes essential to the governing of environmental risk" (Rutherford 2007, 300).

Three ethnographies of science have been especially useful in my analysis of subject formation among environmental science students, and the mechanisms that shape and socialise them. Traweek (1988),[5] Gusterson (1998), and Johansson (2009) analyse the processes through which scientists and scientists-in-the-making internalise certain beliefs, language, and practices from textbooks, classes, and their fellow-students. These are continuously reproduced in daily life until students "become unselfconscious practitioners of the culture, feeling the appropriate desires and anxieties, thinking about the world in a characteristic way" (Traweek 1988, xi). This encompasses much more than just the information students learn, but can include the management of affect and exhibiting appropriate behaviour (Johansson 2009), or the telling of jokes (Gusterson 1998). Moreover, these ethnographers problematise their participants' representations of scientific expertise as a non-political truth about the world, rather than a "situated knowledge" (Haraway 1991) whose production and deployment has very real political and material consequences.

However, subject formation in the education system is not a top-down transfer of information and skills solely governed by teachers; students also have a hand in their own subjectivisation, such as through the internalisation and reproduction of values or norms (Foucault 1995). Some scholars have characterised this as "responsibilisation", which encourages its subjects "to take

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[5] Traweek is also interested in the effects of gender in/ on science, and analyses how scientists' conceptualisation of nature is shaped by social structures like gender in ways that are entirely invisible to them, but are inextricable from the knowledge they produce. However, as I return to in the conclusion, an analysis of the gender dynamics in the classrooms I joined is outside of the scope of this thesis.

upon themselves the responsibility for their own security and that of their families... [and] take an active role in securing themselves against all that could possibly threaten the[ir] security" (Rose 1996, 341; see also Lemke 2001; Rose & Miller 1992; Trnka & Trundle 2014). This is done through the application of technologies of the self, which according to Foucault "permit individuals to effect by their own means or with the help of others a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality" (1988, 18). Rutherford problematises how environmental technologies of the self are often focused on lifestyle changes and conscious consumerism, rather than collective action in the face of the capitalist structures that have caused the Anthropocene (2007).

I complicate this reading of why students become more environmentally conscious by drawing on the anthropology of ethics, a growing field which takes responsibility as one of its central themes.[6] They critique a tendency in the social sciences to erase how people's practices are always marked by self-critical reflection on how their actions affect others; thus, acting in the world is inextricable from ethics and feelings of responsibility (Laidlaw 2013; Lambek 2010). Following Foucault (1988), I refer to this dimension of subjectivisation as *ethical self-formation*. Governmentality and ethical self-formation work in tandem in the constitution of the self because "it is through technologies of the self that the subject thinks and acts upon and makes decisions about what sort of subject to be, how to fit the self around that objectifications that are confronted by the self" (Skinner 2012, 918; see also Lemke 2010). Thus, I think of pedagogy as a process of constant subject formation that operates in everyday life "as a dialogical and constructive engagement between people, and between people, things, and environment" (Marchand 2010, Siv).

Subjectivisation as an analytical lens focuses on how individuals experience discourses, revealing how subjects are produced by these discourses, but also (re)produce and sometimes change them in turn. According to Foucault (1980), this demonstrates that the creation of governable subjects is a process predicated on contingencies, rather than inevitabilities, and the ways in which supposedly hegemonic regimes of truth can rupture (see also Agrawal 2005, 228-

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[6] I use *environmentally conscious* to describe many of my participants because they were highly aware of their impact on the environment, and seek to limit this impact; however, they often balanced their concern with a recognition that their options to change are limited by larger structural forces.

30; Dupont & Pearce 2001; Li 2007b; McKee 2011; Rutherford 2007; Skinner 2012). One crucial rupture I found was a refusal among some of my participants to render the Anthropocene technical and construct themselves as anti-political scientists, thus challenging the anti-political pedagogy employed at UU. As I discuss in the following chapters, many students constructed a clear divide between what they considered scientific or objective, and political or subjective; but others argued that science should be used as a means of effecting societal change. Several more articulated an intensely moral view of the Anthropocene, centring their own responsibility. In the remainder of this thesis, I will therefore contrast *technical* fixes, *political* critiques of current ways of life, and *ethical* self-making when analysing this rupture.

Situating my research

I conducted research among students following a two-year master's programme in an environmental science at UU, guided by the following research question: *What kind of environmental scientists are being produced at Utrecht University?* I focused on three courses: Climate Physics (CP), Environmental Biology (EB), and Sustainable Development (SD). Each of these two-year courses address different facets of the environmental crisis and its management. CP, according to the UU's master's website, focuses "on the fundamental physical processes that make up the Earth's climate system", which "requires advanced mathematical skills" and "specialised theoretical, observational, and computational knowledge and skills relating to the atmosphere, meteorology, oceans, cryosphere (ice), and biosphere" (Utrecht University n.d.a). In comparison, EB begins on the ground, studying the "plants, animals and microbes [that] play key roles in the sustainability of life on Earth" (Utrecht University n.d.b). Students specialise in plant or fungal biology, the management of ecologies and natural resources, or the protection of animal habitats. Finally, SD aims to train students "who want to contribute to the design of the solutions needed to achieve an environmentally and socially accountable society" and become "the scientists of the future" (Utrecht University n.d.c). Its students are encouraged to specialise in the suitable use of energy and resources, the management of ecosystems, the governance of sustainable transitions, or sustainable development in the Global South. This programme is therefore the most explicitly focused on finding solutions to the environmental crisis *and* the most interdisciplinary, as the last two tracks incorporate thinking from both the social and natural

sciences. I refer to these programmes as part of the *environmental* sciences, rather than natural sciences, in an effort to capture their interdisciplinary nature.

I followed five courses in these programmes: Dynamical Oceanography (DO) and Current Themes in Climate Change (CTCC) from CP; Bio-Based Economy (BBE) and Environmental Systems Analysis (ESA) from SD; and Plant-Microbe Interactions (PMI) from EB. Alongside my interviews, I was therefore able to gather information on the subject matter of all three programmes, the content and form of almost all of their tracks, and how students and teachers interact with one another. Moreover, I joined the meetings of the group Anya established to discuss how to apply the knowledge they were learning in class to the climate crisis, a group I will refer to as the Climate Physicist-Activists (CPA). Until the last week of fieldwork, all lectures and meetings were conducted online over Microsoft Teams; therefore, I also paid attention to how teachers and students negotiated pedagogy in a digital space which often felt stilted and unnatural,[7] as well as students' opinions on how the pandemic may have changed how they construct a sense of community with their peers.

My fieldsite fell somewhere between the typical anthropological focus on a local community, and a multi-sited approach that analyses translocal connections and movements (Boellstorf et al. 2012; Candea 2007; Gupta & Ferguson 1997; Hine 2007; Marcus 1995). On the one hand, university students usually congregate in classrooms where they collectively engage in learning, thus making both a "field" and a shared "habitus of collectivity" (Amit 2000, 14). However, the pandemic rendered my participants more isolated from the campus community than they would normally be. Furthermore, many (if not most) of my participants are part of a wealthy and mobile global class. Moreover, as Marcus points out in the article in which he coined the term *multi-sited ethnography*, "[c]ultural logics… are always multiply produced, and any ethnographic account of these logics finds that they are at least partly constituted within sites of the so-called system (i.e. modern interlocking institutions of media, markets, states, industries, universities-the worlds of elites, experts, and middle classes)" (1995, 97). Therefore, the subjectifying discourses I am interested in link the class to the outside world; tracing the relations and

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[7] One example of how students had to adapt to online teaching was how to signal that they agreed or disagreed with what was being said in class. They usually did this by "applause-reacting" or "heart-reacting" digitally over Teams; in my descriptions of these interactions, however, I have left this as simply agreement or disagreement for the sake of readability.

interactions between both levels makes my research a form of what Marcus calls a "strategically situated (single-site) ethnography" (1995, 110). Such studies keep both their local subjects and the global system in mind and in relation to each other as co-producers, rather than conducting a "single-site ethnography that examines its local subjects' articulations primarily as subalterns to a dominating capitalist or colonial system" (110-111). By intentionally limiting myself to environmental science classes at UU, I constructed an "arbitrary location… whose messiness, contingency, and lack of an overarching coherence or meaning serve as a 'control' for a broader abstract object of study" (Candea 2007, 180; see also Falzon 2009; Hine 2007; Law 2004). This allowed me to compare the ideal type of the university as a total and subjectifying institution to the social relations that develop in particular classes.

Methodology

Due to the Covid-19 pandemic and the subsequent lockdown, my thesis is an online ethnography: I conducted participant observation in online classes, and I interviewed my research participants over Microsoft Teams. Participant observation in classes enabled me to see how the university, or the scientific discipline itself, seeks to socialise these students by disseminating certain knowledge and practices "through which people are culturally re-produced by institutions and social movements so that they find particular ideologies meaningful" (Gusterson 1998, 4). Many of the environmental discourses involved in the production of students' subjectivities circulate outside of the university. However, I was interested in how these discourses are brought together in the (online) classroom specifically, knotting together over the course of a two-hour-long lecture or tutorial in order to produce a certain type of scientist-in-the-making who carries those discourses with them when they leave. Between classes and CPA meetings, I conducted an average of ten hours of participant observation a week. By contrast, conducting interviews with students demonstrated how their subjectivities are being produced by, reproduce, and challenge these subjectifying discursive regimes. I conducted interviews with 20 students, which lasted between 45 minutes and two hours (see Appendix 4. for my topic guide). I then re-interviewed five of them in order to gain a deeper insight into their motivations, beliefs, practices, and relationship with their studies and the environment. Both

participant observation and interviews were essential to my insights into how courses attempt to render Science/ Nature technical, and students' subsequent attempts to re-politicise them.

As the internet has been mainstreamed since the mid-1990s, conducting ethnographic research online has become an accepted method in anthropology. The emergence of "Web 2.0", especially, has made studying social phenomena and relations in virtual spaces a necessity, as a steeply growing number of people all over the world engage with the internet as "a space where their own daily lives may be played out, both in moments of drama and crisis and in more mundane ongoing practice" (Snee et al. 2016, 3), particularly among young people (Livingstone 2002; Livingston et al. 2011). However, most online ethnographies stress the internet's connection to, and embeddedness in, offline life, rather than conceptualising it as a separate cultural space (Bond & Agnew 2016; Hine 2015; Kozinets 2009; Snee et al. 2016). Because "the Internet is increasingly entwined in peoples' lives… [as] both an imagined space and an architectural place" (boyd 2008, 26), the boundaries between the digital and physical worlds have become increasingly blurred (Hine 2015; Stirling 2016). While I had therefore initially hoped to conduct some participant observation offline, the pandemic made this impossible. Moreover, as I could not be physically present, my ability to build rapport with my participants through informal conversations on campus was reduced (O'Reilly 2012), potentially affecting the "thickness" of my data (Geertz 1973). Even online, however, I was still able to analyse how student-teacher interactions foster certain forms of subject formation, embedded in specific practices and discourses, and how students both reproduce and challenge these discourses.

Ethics and positionality

In general, I followed basic anthropological principles: I attempted to minimise any harm to my participants (including psychological harm as a result of discussing the environmental crisis); I obtained informed consent and continually re-checked it throughout fieldwork; and I guaranteed my participants' anonymity, using pseudonyms throughout my thesis (Boellstorf et al. 2012; Dutch Anthropological Association 2018; see Appendices 1. and 2. for information letters for participants regarding interviews and participant observation, and Appendix 3. for my informed consent form). I recorded interviews on Microsoft Teams, transcribed the audio, anonymised all data, and then deleted the recording. Because online teaching in the classes I joined relied so

heavily on the presentation of slideshows, my field notes from participant observation are full of screenshots; but those used in my thesis have been anonymised, and no identifying features can be seen. This information, including field notes and consent forms, is stored in a password-protected database; coding keys are securely stored offline. After finishing my thesis, I will store my data on the faculty's servers for at least 10 years, in accordance with VSNU's guidelines.

As with all knowledge production, my interpretation of my participants' subjectivities and lifeworlds is produced in relation to my own situated knowledge (Haraway 1991). It is impossible to ever produce knowledge based on "the view from above", which is universal and totalising; instead, knowledge is always based on a partial and embodied "view from somewhere" (Haraway 1991, 196; see also Latour & Woolgar 1986). A key aspect of my positionality that became relevant during fieldwork, and one that has remained a source of mild anxiety, is my lack of training in the environmental sciences. Latour and Woolgar liken their refusal to defer to the "apparent superiority of the members of our laboratory in technical matters" to "an anthropologist's refusal to bow before the knowledge of a primitive sorcerer" (1986, 29; see also Boellstorff et al. 2012, 65-66). The exotification of science in order to distance the reader from a quintessentially "western" or "modern" practice and belief system was common in early ethnographies of science (see Gusterson 1998; Latour & Woolgar 1986; Traweek 1988). However, I agree with Gusterson that "the objectifying, exoticizing language of anthropology is as objectionable at home as abroad" (1997, 117; see also Candea 2010, 2016). Even though I am not an environmental scientist myself, I have an ethical obligation to my participants to do my utmost "to grasp the native's point of view, his relation to life, to realize *his* vision of *his* world (Malinowski 1922, 25; emphasis in original). I have therefore reflected on my literature review, theoretical framework, methods, and positionality at all stages of this project in an attempt to produce valid knowledge that is as true to my participants' lifeworlds as possible.[8]

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[8] I have also striven to represent my participants' emic perspectives by drawing on their words as much as possible, and frequently quote from my interviews. The most glaring counter-example to this is my use of "Anthropocene"; as I outline in the third chapter, this concept was barely present in class. However, I find it useful as both a collective term for the interlinked environmental crises that are happening *and* as a signifier of how world-changing this epoch is. Furthermore, I depart from many of my participants' representation of science as a universally applicable and true form of knowledge production. I can only apologise if any of my participants resent my characterisation of science as a situated knowledge.

The remainder of this thesis consists of my findings and analysis, divided into three chapters, and a conclusion. In the next chapter, I describe how students are being formed through three processes: they are taught how "proper" scientists behave, they are trained in certain skills and tools, and they are integrated into the wider scientific community. However, this produces two different subjects: theorists who produce knowledge about nature, separate from society; and solution-finders who want to use science to construct a more sustainable society. In the second chapter, I identify and analyse the most dominant discourses present in classes, which concern the Anthropocene, science, nature, and the public; all seek to integrate these students in an anti-politics machine. As I argue in the third chapter, however, students' environmental subjectivities are not being formed by their studies alone; and perhaps because of this, some of my participants both reproduced these dominant discourses *and challenged them*. They engaged with the ethics of becoming a scientist in the Anthropocene; they questioned the commodification of nature; and they contested their programmes' marginalisation of non-western perspectives on sustainability. Thus, some students resist their programmes' attempts to incorporate them into an anti-political machine by re-politicising the Anthropocene. Finally, I conclude my thesis by summarising my argument, outlining my contributions to the field, and reflecting on my positionality in the research.

Chapter 1: Becoming Scientists

During one of the first student-led discussions of CTCC, Cristopher posed a question to the rest of the class about the role scientists should have in the climate crisis- should they be "finding and attempting to implement alternatives to our complete dependency on fossil fuels? Or is it really the scientist's job simply to report findings and leave the policy entirely to others?". This sparked a lively debate. While Koen argued that their role should be limited to assessing the state of the climate, others insisted that the urgency of the crisis means that scientists should have a larger role in the implementation of policies. Barend then disagreed; as he told me in our first interview, he believes that scientists can effect change more efficiently by working with industry, rather than governments. Several students agreed, before Koen broke in to disagree because "companies still have to abide by market forces... which can be the core of the problem". Christopher concurred, along with two other students in the Teams chat.[9]

Many discussions in CTCC revolved around scientists' responsibility in the Anthropocene, alongside debates as to who is to blame for the crisis. I discuss this in more detail in the following two chapters, but I now focus on what my participants themselves were debating in this class: what kind of scientists are they becoming? Several mechanisms were vital to shaping students' subjectivities as scientists-in-the-making, which I analyse below. Firstly, their teachers acted as role models for them to emulate, alongside teaching them certain knowledges and skills. I argue that the programmes I followed seek to produce two different subjects, both of which are anti-political: *disengaged theorists* who will continue to work as independent researchers; or *pragmatic solution-finders* who will act as sustainable policy advisors.[10] Secondly, these students were integrated into the broader scientific community. As Foucault found, technologies of the self are thus an essential part of pedagogy, as they represent "certain modes of training and modification of individuals, not only in the obvious sense of acquiring certain skills but also in

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[9] Field notes from CTCC Discussion 4 (04/03/21).

[10] My interviewees, and many teachers, used "scientist" and "researcher" interchangeably; in my analysis, I make the distinction between theorising about the world and acting in the world sharper. However, I continue to characterise the students that follow these programmes as "scientists-in-the-making" because their programmes underline the importance of *scientific* knowledge in order to combat the environmental crisis. Furthermore, as I discuss in the next chapter, these programmes disseminate similar discourses on Nature and Science, which are taught to theorists and solution-finders alike.

the sense of acquiring certain attitudes" (1988, 18). More than being "bound together by a way of thinking, about the world and about knowledge and about themselves" (Traweek 1988, xi), students' daily practices and conduct are being shaped by their classes. Thus, the pedagogical process is not just the imparting of information and skills, but involves alterations to students' subjectivities.[11]

Producing theorists and solution-finders

  1. *The disengaged theorist*

The CP programme, as advertised by UU to prospective students, "trains you to be a highly skilled researcher by focusing on the fundamental physical processes that make up the Earth's climate system... including the dynamics of the planet's atmosphere, ocean, and climate".[12] Similarly, all four EB tracks "prepare you to generate and disseminate knowledge in the ecological and environmental sciences",[13] through "practical research training and advanced theoretical education... [in order] to train you as an independent researcher".[14] PMI, as a class, exemplified this; over the course of two weeks, around twenty students experienced the peer review process under the guidance of three teachers. According to Aart, "this is a very important aspect of doing science" because "your research does not exist if you cannot publish it and share it with the scientific community and the public". Following Elke's tutelage, each student chose a scientific paper which they presented as one of its authors during the second meeting in a "simulat[ion of] a scientific conference". The others then questioned the presenters, as they were told that it is considered bad manners not to have questions at the end, which is part of the audience's duty. During the class's last meeting, two student reviewers gave feedback on the paper, which the original author (now acting as a journal's editor) then decided to reject or accept, with major or minor revisions.[15] These students were therefore being taught the

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[11] As Lave and Wenger argue, pedagogy is not a top-down transfer of knowledge but is "distributed among coparticipants", including teachers (1991, 15). However, I limit my analysis to the transformations undergone in students.

[12] UU Climate Physics master's website, programme description: https://www.uu.nl/masters/en/climate-physics/node/node/695 (accessed 14/07/21)

[13] UU Environmental Biology website, description of tracks: https://www.uu.nl/masters/en/environmental-biology/tracks (accessed 14/07/21).

[14] UU EB website, study programme description: https://www.uu.nl/masters/en/environmental-biology/study-programme (accessed 14/07/2021).

[15] Field notes from PMI meeting 1 (08/02/21), 2 (11/02/21), and 3 (18/02/21).

appropriate attitudes and behaviour, from how to critique a scientific paper to how to act politely, by embodying fully fledged scientists.

Many of my interviewees told me that the point of their programme is, in Vera's words, "to learn how to be a scientist; so how to carry out experiments, how to do that on your own, how to make your own hypotheses and conclusions... how to write, how to read an article, how to get the information you want from it". Much of this involved being actively taught how to assess, monitor, quantify, process, and analyse the natural world, such as by modelling environmental systems or constructing projections of the future, and how to write up and present these findings to other researchers. However, students also learned by mimicking their teachers' unconscious behaviour; as I discuss below, they absorbed both technical terms and the correct attitude through the language used, and jokes made, by their teachers. Furthermore, these students highlighted the importance of becoming a critical thinker, or "an independent person that is not reliant on the supervisor but has his own- his or her own- ideas, and can discuss these ideas with others".[16]

2. *The pragmatic solution-finder*

Like CP and EB students, SD students are trained to produce knowledge about nature and the environmental crisis; but they are also taught how to analyse, manage, and improve sustainable policymaking. According to UU, they are not just scientific knowledge producers separate from society, but are supposed to "contribute to the design of the solutions needed to achieve an environmentally and socially accountable society".[17] In BBE, for instance, this was through learning whether and in what ways to establish a biobased economy. Students were taught to think of themselves as potential advisors in the transition, as 50% of the course's final grade rested on the degree students embodied different societal stakeholders in the prospective Dutch

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[16] Quoting Sanne (follow-up interview: 30/03/21).
[17] UU Sustainable Development website, introduction to the course: https://www.uu.nl/masters/en/sustainable-development (accessed 14/07/21).

bioeconomy, rather than scientists.[18] Guest lectures given by representatives of these industries were also a large component of the course.

Most of the SD students I interviewed echoed their programme's focus on practical solution-finding and policymakers. Eline was an intriguing example of this. She told me that she has a philosophical interest in "how history has led certain human societies to consume the way we do, how we see materials, how we see ownership of materials, how we see our role as being the supreme species of the world, that the world is made for us and we can do whatever we want". Nevertheless, her classes seem to be redirecting that interest into technical fixes, such as "trying to spread renewable energy in a way that makes sense in a certain country" through seeing "opportunities of waste to generate value, the principle of the circular economy, how to generate value where there is none, especially in a context where there is limited financial capacity", and "how this can contribute to development" in the Global South.

This focus on the technical was reflected in the skills these solution-finders are learning. These include those of the disengaged theorist outlined above, such as statistics, modelling, projections, and programming. But in order to assess and analyse current and alternative modes of living, consuming, and producing, and their effects on the planet, these students also learn social science methodologies and epistemologies. As I will elaborate on in the next chapter, these solution-finders pay more attention to the social aspects of the Anthropocene than the disengaged theorists do.

Being integrated into a scientific community
When I asked Hella if she felt like part of a scientific community, she told me that because she is new to studying the environmental crisis from a natural science perspective, "I feel like an outsider, but I'm starting to feel like I somewhat belong to that bubble". This 'bubble' included sustainable development as a discipline, such as the assumptions and simplifications that come with doing research; but it also encompassed her peers and prospective colleagues, who share her desire to work towards mitigating the crisis. Many of my participants and their teachers

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[18] Field notes from Stakeholder Presentation 1 (10/03/21) and 2 (07/04/21); however, the description of the assignment in the course manual still stressed that students should base their proposals on what "the science" says about biomass potential.

characterised their respective communities similarly: as a larger institution or network of contacts they were working towards joining, *and* as a social ecology comprised of their fellow-students and the professors that teach in their classes. I address these dimensions separately below, but they are entangled in and inform one another.

The broader network

For all three programmes, UU prominently advertises the quality of its teaching, the international environment on campus, and networking opportunities with the broader scientific discipline. These are indicative of the institutional, formal, or hierarchical characteristics of the scientific community in which students are expected to integrate themselves. This process is eased on the individual level by their teachers. For instance, Pieter often gave the historical background of oceanographic concepts or theories, such as the observation of what would later be named the Ekman spiral by the famous polar explorer Fridtjof Nansen.[19] By linking present knowledge production to a prestigious lineage of "scientist-hero[es]", teachers both represent Science as continuously unfolding towards greater knowledge (see Chapter 2) *and* show students what they should be striving for (Traweek 1988, 81). Teachers also reveal the current state of the discipline by sharing what research problems are being worked on at the moment, or by sharing what they or former students have researched. Both give students examples of the individual trajectories of scientists or scientists-in-the-making for them to emulate.

Some students told me that they felt connected to this broader network because of a shared interest or commitment to sustainability. However, others seemed to feel some anxiety about their prospects of being accepted by the broader community. Francisco, for example, worried that he is "a completely unknown person to the other members of the scientific community", and will only be recognised as one of them after years of publishing and specialised experience. These students have already begun to internalise the anxiety that is part of a scientist's subjectivity, according to Traweek, as they are constantly "afraid that they will not continue making significant contributions, that they and their work will become obsolete" (1988, 76).

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[19] Field notes from DO Lecture 5 (09/03/21).

The smaller social ecology

Overall (and unsurprisingly), students seem closer to their peers than to their discipline as a whole, forming a more intimate and informal community I refer to as a social ecology. András, for example, told me that he feels much closer to others in his master's programme than he did during his bachelor "because we're closer to the teachers [and] get more insight into the research", but also because "the number of people in my class is much less... it's almost like a family environment". This ecology gives students a personal support network, and is drawn on for companionship or help studying, as Johansson finds of Swedish undergraduate students (2009). As I discuss in the third chapter, this ecology may also be a source of environmental ethics as students absorb environmentally conscious beliefs and habits from each other. However, all classes were conducted online for at least half a year due to the Covid-19 pandemic. As a result, most interviewees struggled to build a sense of community with other students, and they felt that "there is literally and metaphorically lots more distance between people... people socially feel a bit more shy or holding back a bit",[20] which "creates a bit of detachment" from other students and teachers.[21]

But though many students struggled to form relationships face-to-face with their peers this year, they continued to learn the appropriate disciplinary language, and especially the relevant scientific terms; according to Aida, "people throw around these terms without even realising it because they're so involved in the research that they don't bother to define these terms", which is "nice that they're sort of indoctrinating us into that". Humour is also a crucial part of pedagogy. In a BBE guest lecture given by a former student, he laughingly told the class that when he had joined BBE three years ago, he had been so ignorant that he had questioned the logic of burning trees for biomass; now he works for a company that provides the shipping industry with biofuel.[22] Both Gusterson (1998) and Johansson (2009) emphasise that learning this new language is essential to becoming a scientist, because it "make[s] communication with laypersons harder, constructing a wall between those who are initiated and those who are not"

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[20] Quoting Arnoud (interview: 26/02/21).
[21] Quoting Eline (1st interview: 23/02/21).
[22] Field notes from BBE Lecture 16 (31/03/21).

(Johansson 2009, 4). Jokes function in a similar way, creating boundaries between those understood by the community to be full members, and thus proper scientists, and those who are not (Gusterson 1998; Traweek 1988). In the case of the BBE guest lecturer above, his joke fit a larger pattern of dismissing opinions that challenged the course's utilitarian view of nature (see Chapter 2), and thus attempting to exclude them from the classroom.

Like Johansson's nano-scientists (2009), several of my participants identified *not being a layperson* (anymore) as an important part of becoming a scientist. Christopher was initially ambiguous as to whether he feels like a part of the scientific discipline because he does not think he will pursue a doctorate degree. Nevertheless, he eventually told me that he feels like part of the community because he is becoming "someone who understands science at least, and can operate on a scientific basis" - in other words, acceptance into the scientific discipline is predicated on no longer being a layperson. Gusterson (1998) argues that the construction of this barrier between the inside and the outside of the laboratory makes it a modest form of a total institution (Goffman 1961), which has "a powerful ability to 'deself' people: to alter their positions in a field of social relationships and thus to peel away their old identities and create new ones" (Gusterson 1998, 81). This echoes Foucault's "disciplinary institution" (1995), which he argued is the principle that underlies modern schools. Learning a new mode of communication at university, therefore, is a way of separating my participants from previous social relations (and the subjectivities they fostered) in order to entangle them in new ones.

Constructing anti-political scientists

Many students, particularly those being formed into disengaged theorists, told me that teachers try not to share their opinions in class in an effort to remain "impartial"[23] and "objective".[24] As Madelief laughingly told me, she does not think that they are "trying to make us all vegetarians or something"; nor do they "go in emotional rants how we as students should save the planet before it's too late... the teachers just stick to the physics and you almost never hear their opinion".[25] This may have been reinforced by the pandemic, as several of my interviewees

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[23] Quoting Francisco (1st interview: 10/02/21).
[24] Quoting András (interview: 18/02/21).
[25] Quoting Diederik (interview: 06/04/21); I also noticed this when conducting participant observation in class; for instance, a BBE guest lecturer claimed that "you can see more and more people with a strong ecologist leaning who

mentioned that teachers have been more reluctant to initiate discussions online, even though discussion points from previous years remain on their slides. Some of the students I talked to reproduced their teachers' representation of science as objective, and praised teachers who kept their opinions to themselves. They advocated for keeping discussions to "just the science" because ethics were considered too subjective; thus, while in ethics "there is no right or wrong, there's so many things in between", science has objective answers.[26]

By representing science as objective, scientific expertise is rendered "to a terrain beyond dispute, to one that does not permit dissensus or disagreement" (Swyngedouw 2010, 217). This is a way of producing consensus around disputed societal issues that is profoundly anti-political because it evacuates policymaking of any political disputes (Ferguson 1994; Rancière 2001; Swyngedouw 2010). I will analyse in the next chapter how this erasure of ethical and political contestation enables the construction of an anti-politics machine that seeks to manage the Anthropocene technocratically. On the individual level, however, I argue that this depoliticization manifests as a disciplinary norm circulating among teachers to teach "objective facts" about the crisis, rather than sharing their own subjective opinions, and which some students seem to have internalised. Thus, the anti-political subjectivity that these programmes seek to construct among students is just as ideological and laden with power relations as subjectivities that explicitly claim to be political.

Depoliticising science, according to Swyngedouw (2010), also leads to the restriction of solutions posed to the Anthropocene to the technical or technological alone. The production of solution-finders at UU follows this pattern. Eline is an example of this: I quoted her above on her philosophical interest in the Anthropocene, and how this interest has been channelled into technical tinkering with our current ways of living, rather than envisioning fundamental transformations. She identifies deeper causes for the Anthropocene, such as how societies envision their relationship with nature, and thus advocates for investing in education to change this. But the material she is learning seems to restrict her proposed solutions *in the short-term* to

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argue that we shouldn't use the forest at all, and the discussion is going more and more out of hand, but anyway *that's just my opinion"*, almost disowning her own statement because it was "just" her opinion, rather than a statement of scientific truth (field notes from BBE Lecture 3, 22/02/21).

[26] Quoting Arnoud (interview: 26/02/21); this is also visible in András' ambiguity about Greta Thunberg's Stop Fake Renewables campaign because science shows that wood *is* a renewable resource, according to the "objective" definition of the word (interview: 18/02/21).

adaptation and mitigation technology, particularly in vulnerable areas, because it is "easier, in my opinion, than trying to change structures that have been there for centuries". As I discuss in the next chapter, many teachers and students forwarded similar arguments that the urgency of the crisis makes these technologies the most practical approach. Interestingly, this perspective was shared by both solution-finders and theorists; among several CP students, geo-engineering on a global scale was proposed as a potential solution.[27]

BBE epitomised the restriction of solutions to the technical and technological. Rather than rethinking societal structures, it taught students how best to replace one form of extractivism (the oil economy) with another (the bioeconomy) in order to offset our climate impact. This transition was tied to technological innovation. One guest lecturer, for instance, argued that "responsible innovation" is an essential part of producing products that seem inherently sustainable, such as coffee cups made of bio-plastic. However, because not all bio-plastics are biodegradable, "not even" researchers in her department knew which bin in the UU canteen to throw their cups into. During a discussion at the end of the class, a student shared that he has been working with a firm that embeds small dots in plastic that reflect UV light at a specific wavelength, which tells the disposal system whether the plastic is biodegradable or recyclable. The guest lecture replied approvingly that "there are so many innovation[s], or technological approaches to this problem"[28]- rather than questioning whether we need single-use coffee cups, or reflecting on the ways in which they are embedded in and reproduce unsustainable and unjust systems of production and consumption.

Conclusion

For the sake of my analysis, I have operationalised my findings into two types of scientists-in-the-making, both of which are anti-political: *disengaged theorists* and *pragmatic solution-finders*. However, these categories were not as clear cut in reality, as many of my participants did not conform to these types. Barend, for instance, told me that Leonardo was one of the most passionate in CTCC about the ideal of science for science's sake, an observation that matched the opinions he expressed in class. This would make him a perfect example of a disengaged

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[27] Field notes from CTCC Discussion 4 (04/03/21) and CTCC Discussion 7 (25/03/21).
[28] Field notes from BBE Lecture 11 (17/03/21).

theorist- except that over the course of the group's first meeting, he became one of the most committed members of the CPA and a dedicated advocate for sharing information with the public in order to effect change.[29]

Nonetheless, I argue that the CP and EB programmes attempt to shape their students into scientific researchers concerned chiefly with theorising and producing knowledge about nature. The primary skills I identified with these *disengaged theorists* were critical thinking, self-reliance and confidence, the ability to write up and present their findings, and a range of technical methods for monitoring, quantifying, and analysing nature. While these theorists view scientific knowledge production as the ultimate goal, for SD's *pragmatic solution-finders*, science is a means of effecting societal change. They also produce knowledge about the world, but they are more concerned with creating ways to adapt, mitigate, and reduce our impact on nature, particularly through advising policymakers. They therefore supplement some of the natural science skills the theorists learn (especially statistics, modelling, and programming) with an awareness of the social world. I found that students following the ESG and ID tracks, especially, are taught social scientific epistemologies and methodologies.

However, both types of scientists-in-the-making conceptualise the scientific community they are being integrated into in similar ways. Most of the students I interviewed expressed a desire to belong to the broader discipline, but some expressed anxiety over whether they would be accepted into what I have called the broader scientific *network*. On the other hand, many have already become a part of a close-knit community of their peers and teachers. Students rely on this *social ecology* for help in navigating the process of becoming a scientist and as a source of ethical practices, even though the pandemic has made creating a sense of community more difficult. Both aspects of the scientific community, the network and the social ecology, are essential aspects of teaching these students how to behave appropriately. As Johansson says, becoming a scientist-in-the-making (whether a prospective theorist or a solution-finder), "signifies much more than just taking academic courses. A shared set of meanings emerge through the practice of everyday experience... the inclusion process, in contrast, involves

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[29] Field notes from CPA meeting 1 (25/03/21).

learning how to cooperate, how to behave properly in the university environment, and how to think scientifically" (2009, 46).

I have also argued in this chapter that, though solution-finders want to use science to facilitate the transition to sustainability, both kinds of scientist-in-the-making are anti-political subjects. Firstly, a disciplinary norm to prioritise "objective facts" over subjective opinions (and ideally, not to share their opinion at all) circulates among many of those I have identified as theorisers. This erases the ways in which Science is always already implicated in political and ethical debates, instead reifying it as a consensual regime of expertise (Ferguson 1994; Rancière 2001; Swyngedouw 2010). Furthermore, the construction of this regime restricts the ways forward envisioned by the solution-finder to the technical and technological alone, short-circuiting any discussion of the deeper causes of the Anthropocene. In the next chapter, I will analyse the Anthropocenic discourses which circulate in classes, and how they reinforce this anti-politicisation.

Chapter 2: Dominant Environmental Discourses in Class

"… you're not going to become a teacher of environmental science if you don't have a certain perspective, and the same goes for the literature… most of them agree that there is a problem that should be addressed" (interview with Jeb, 12/02/21).

In this chapter, I focus on the perspectives on the Anthropocene fostered by teachers and course material in classes, and how these are reflected in the students themselves. Counter to my expectations that different environmental discourses would circulate in the three programmes I joined (CP, EB, and SD), I found that they represented Nature, Science, and the Anthropocene in similar ways, constructing certain 'regimes of truth' (Foucault 1980). I first describe and analyse how the Anthropocene is presented as a matter of great urgency in classes in order to make some futures and solutions the only option. I then elaborate on how classes connect nature and science in order to represent Science as the best way of knowing and managing both Nature *and* Society. I argue that these discourses seek to render technical their subjects' visions of, and responses to, the Anthropocene. These anti-political discourses are reproduced by most students, shaping how they think of themselves and their roles as scientists-in-the-making. Therefore, I argue that the Anthropocenic discourses forwarded by teachers have become a form of governmentality that seeks to shape their students into anti-political subjects. However, this governmentality is also contested; throughout the chapter, I point out disjunctions between students and teachers, while I address the active construction of counter-discourses among students in the next chapter.

The Anthropocene: a crisis in need of scientific intervention

Throughout my fieldwork period, the Anthropocene was referred to by name only once in class, during a student-led presentation in CTCC focused on carbon emissions and other GHGs.[30] My interviewees only used it if I asked them directly about the Anthropocene, though most knew what it meant. However, the environmental crisis was very present in class. In all courses but PMI, the crisis and how to best measure, adapt, or mitigate it was understood to be one of the most important reasons that students had chosen this master's programme. Overall, the

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[30] Field notes from CTCC Presentation 4 (01/03/21).

Anthropocene was most often represented in classes as the climate and biodiversity crises, though deforestation and ocean acidification were also sometimes mentioned. This was echoed in my interviews with students; however, in sharp contrast to the clinical tone often taken by their teachers, my participants expressed much more worry and regret about biodiversity loss, extreme weather or climatic events, and pollution. Human impact on ecosystems was a particularly common source of grief; as Christopher told me, "animal conservation things, and trying to preserve habitats and biodiversity and things is one of the things that I'm most excited about when I see them going well, and then most upset by when they're not going well".

Furthermore, many of the students I interviewed articulated much more concern for the social causes and consequences of the Anthropocene than their programmes seemed to. While many SD courses covered the social side, CP and EB were more concerned with how the crisis affects the natural world. CTCC was the exception to this, as student-led discussions often debated how to limit human impact- but as Thomas told me, "it's also mainly focused on the science". This focus on "the science" may stem from the structure of the course, as the class is focused on the parts of the IPCC's Fifth Assessment Report (AR5) written by Working Group 1 (*The Physical Science Basis*), rather than Working Groups 2 (*Impacts, Adaptation and Vulnerability*) and 3 (*Mitigation of Climate Change*).[31] Moreover, students themselves reproduced this divide between the natural and the social in the structure they instituted for Thursday's discussion sessions. The first half usually consisted of a Q&A focused on the technical details of scientific facts and methods, while the second half often debated appropriate political and ethical responses. In sharp contrast, students tended to be much more focused on the social, political, and economic elements of the Anthropocene in our interviews, alongside its ecological and climatic aspects. Many of them identified consumer society, alongside governmental inaction on industrial emissions, as the primary cause of the Anthropocene.

Visually, the crisis was generally represented in class through "hockey stick" graphs (Krauss 2009), which plot rising emissions, temperatures, ocean acidification, and other effects of human activity on nature since industrialisation (see figure 1).

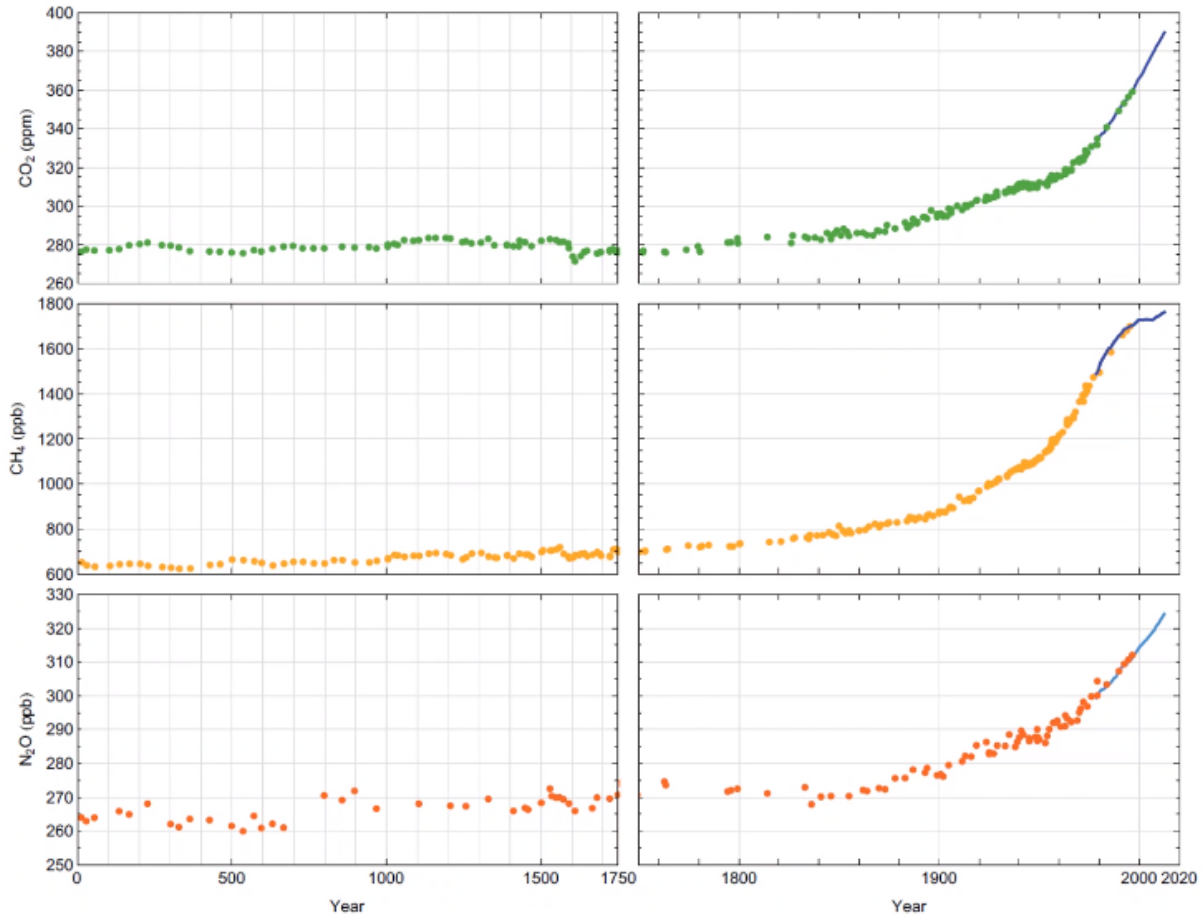[31] Field notes from CTCC Presentation 1 (11/02/21).

Figure 1: screenshot from CTCC Presentation 4 (01/03/21); dots show concentrations of three GHGs (atmospheric carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O)) found in ice cores, while lines are measurements from the atmosphere; the hockey stick shape is clearly visible, especially since newer measurements show that the apparent drop in methane in the fourth graph is misleading and has actually continued to rise.

Apocalypticism and eco-modernism: rendering certain Anthropocenic futures inevitable

As I outlined in the introductory chapter, scientific representations of the Anthropocene are often marked by apocalyptic and eco-modernist imagery; these discourses are also present in the classrooms I joined. Both constructed certain visions of the future. I argue that the hockey stick figures that were common in classes echo eco-modernism in that they imagine humanity's future will continue on the same trajectory as before, without any fundamental changes. This vision was particularly prominent in BBE, which often assumed human resource exploitation to be inevitable. In the second lecture, for instance, the guest lecturer presented one of the visions of

the future foreseen by the Integrated Model to Assess the Global Environment (IMAGE), based on an Integrated Assessment Model (IAM) that "simulates the global consequences of human activities" on nature from 2050-2100.[32] This vision, SSP2, rests on assumptions that current population trends will continue, leading to an increase in the amount of energy generated from fossil fuels and a corresponding growth in GHG emissions. He then outlined a "realistic" mitigation scenario (SSP2-450), based on the application of a carbon price as a proxy for the climate policies that will have to be instituted. He explained that this is projected to lead to an increase in the cost of fossil fuels and a preference for "clean" energy (such as wind, solar, biomass, and nuclear power), investment in energy saving technologies, and behaviour change among individuals.[33] These futures rely on technical methods of making human consumption and production patterns "sustainable" without questioning the ways in which our current socio-political and economic systems are inherently unsustainable, or reconsidering the necessity of human resource exploitation. Our current ways of living are thus projected into the future, with no radical breaks from the present- in the Global North, at least (Crist 2007, 2013; Rothe 2020; Swyngedouw 2010).

The second trope that structured visions of the future in class was apocalyptic imagery; this was often deployed in DO and CTCC, and was usually linked to the *climate* crisis specifically. A guest lecture in DO centred on the potential slowing of the Atlantic Meridional Overturning Circulation (AMOC), which might in turn slow down the Gulf Stream, without which "it would be around five to ten degrees colder than current temperatures" in Europe. In the event of reaching such a catastrophic tipping point, according to the guest lecturer, our planet could someday soon resemble the science fiction disaster film *The Day After Tomorrow*, with its iconic image of the Statue of Liberty buried in ice.[34] His use of such alarming imagery reflects the prevalence of apocalyptic discourses both in and outside of the scientific community, and also emphasises the grave threat the climate crisis poses to humanity's future.

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[32] IAMs are models that link the main elements of human and natural systems, such as the effect of economic growth on the biosphere, on a global scale; they are based on "scenarios", or storylines, which describe plausible trends in the evolution of societies and ecosystems over the long term (quote and description of IAMs based on field notes from BBE Lecture 2, 15/02/21).
[33] Field notes from BBE Lecture 2, 15/02/21.
[34] Field notes from DO Lecture 10 (04/05/21).

Though what I call hockey stick futures and apocalyptic futures seem diametrically opposed, I draw on my literature review to argue that they both deem only *some* options to be realistic and timely responses to the Anthropocene, while others are dismissed as too time-consuming or impractical. In BBE, arguments in favour of transitioning to a bioeconomy often rested entirely on the urgency of the climate crisis, as using biomass is considered crucial in order to limit GHG emissions; therefore, according to one guest lecturer, "we shouldn't be waiting for the perfect solution because we don't have the time for that" (see figure 2).[35] These are restricted to technological and technical innovations that amount to attempts at a "global-warming techno-fix" focused on curbing excess carbon emissions, according to Crist, rather than the crisis's root cause: "destructive patterns of production, trade, extraction, land-use, waste proliferation, and consumption" (2007, 34; see also Swyngedouw 2010). Furthermore, this urgency means that geo-engineering on a planetary scale may be necessary in order to avoid or mitigate catastrophe; as Job told his pupils, geo-engineering "might be necessary in order to buy time" and avoid the disastrous short-term consequences of the climate crisis.[36]

Figure 2: screenshot of slide from BBE Guest Lecture 13 (24/03/21).

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[35] Quoting guest lecturer from BBE Lecture 13 (24/03/21). Interestingly, the last guest lecturer also began her presentation by emphasising the urgency of the climate crisis, but argued that this means that "burning biomass is getting harder to justify" because of the GHG emissions and land use change associated with it (field notes from BBE Lecture 19, 12/04/21).

[36] Field notes from CTCC Discussion 7 (25/03/21).

Just as these representations of the Anthropocene construct visions of the future which demand certain solutions in order to avoid disaster, I argue that they render alternative futures and solutions unimaginable and impossible to bring into being (Veland et al. 2018; Yusoff 2016). One of last BBE lectures included a particularly obvious example of how this disciplines scientists' imaginations; according to Bas, the only adaptation and mitigation options IAMs are currently programmed to model are afforestation and bioenergy with carbon capture and storage (BECCS).[37] So even though it has not yet been proven that these technologies will actually work, BECCS is presented as one of the only rational options for dealing with the climate crisis because it is impossible for the model to envision alternatives.[38]

The majority of the students I interviewed echoed the apocalyptic imagery that suffuses many of their classes, envisioning catastrophe or human adaptation in a vastly changed world. They foresaw futures rent by extreme weather events, mass extinction and ecosystem collapses, and rapid rises in temperatures and sea levels. Like their teachers, some told me that this makes the need for large-scale changes urgent. Others, however, argued that "if you hear predictions about we only have nine years left and then major changes will happen... I can imagine these kinds of solutions are actually needed" but "those massive grand-scale projects [like geo-engineering] are often bringing side effects that... will be a problem in the future".[39]

The Anthropocene demands scientific intervention
Whether presented as more-of-the-same or as an oncoming cataclysm, the Anthropocene was represented as a crisis in need of solving; classes usually represented scientific knowledge production as essential to this intervention, and as the most authoritative voice in the Anthropocene. Though most students thought their teachers tried not to share their opinions in class, as I discussed in the previous chapter, some noticed that teachers "actively try to educate

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[37] BECCS is a method of capturing and storing the carbon released when biomass is burned for bioenergy, thus removing excess CO2 from the atmosphere.

[38] Field notes from BBE Lecture 19 (12/04/21).

[39] Interview with Sanne (follow-up interview: 30/03/21); in the same interview, however, she seemed to accept that the destructive effects of biomass production on ecosystems may be a sacrifice that needs to be made to combat the crisis.

us into wanting to contribute to solving the environmental crisis" by becoming environmental scientists or policy advisors.[40]

Perhaps unsurprisingly, given what these students had chosen to study, most believed that the environmental sciences have played, and will continue to play, a positive role in the Anthropocene. As I will expand on below, students praised science for revealing the existence of the crisis, and for providing guidance to policymakers and the public. Some interviewees also felt that science can potentially create useful adaptation and mitigation techniques; but perhaps because of their interest in the social aspects of the crisis, most students identified over-reliance on technology as a way of treating the *symptoms* of the Anthropocene, rather than its causes. Overall, however, almost all students seemed convinced of the importance of science, and of the need to contribute to solving the crisis by dedicating their future careers to it as scientists-in-the-making. Most would seem to agree with Madelief, who told me that the environmental crisis is "really something that I'm very worried about. That's why I started studying... environmental science in the first place… I want to dedicate my life, actually, to improving this, and contributing to fixing the climate crisis. And I think being a climate scientist is for me the best way to do that".

Throughout this section, I have highlighted the ways in which students' statements on the Anthropocene resemble those of their teachers. Though I cannot be sure that these discourses can be traced directly back to what students are learning in class, some of my interviewees themselves made this link. Eline, for instance, told me that her view of the crisis had changed because of what she has been learning in the last year. While she had felt driven to solve the crisis during her bachelor, being exposed to policy documents and reports of missed climate targets constantly has led her to feel "doomed" because "unless things really change- if things keep going on at this pace then we're definitely not going to make the changes that we need in the time that we can actually mitigate the chaos that might happen afterwards". Hella, in comparison, told me that joining the master had made her feel more hopeful because she is now "surrounded by people who care a lot, are educated in this field... and that want to change and

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[40] Quoting Jeb (interview: 12/02/21).

come up with great ideas and innovations to... adapt and mitigate this crisis somehow". While Eline has accepted and begun to reproduce the dominant tropes of apocalypticism and urgency forwarded by her teachers, Hella resists them; but the subjectivities of both are being shaped by the governing discourses they encounter in class, and thus by the scientific field they are entering. In the next chapter, I discuss in more detail the ways in which some students resist dominant discourses by attempting to construct counter-discourses; but in the remainder of this chapter, I will analyse the entwined discourses that construct Science, Nature, and Society that circulate in classes, and how they seek to shape students into particular kinds of subjects.

Science is the best way of knowing and managing Nature and Society

In the second half of this chapter, I analyse the dominant representations of nature, the environmental sciences, and the public that circulate in classes. I identified two dominant and interlinked discourses on Nature-Science in teachers' statements, which some students seem to internalise and reproduce. Firstly, when nature was characterised as complex and difficult to predict, science produced ever-more accurate models and information on the basis of increasingly intensive surveillance of the planet. And secondly, when nature was presented as a provider of resources or services to humans, science's role was to measure and maintain these resources. I argue that these representations of Nature render it knowable and manageable by Science. Furthermore, because science was considered the most authoritative form of knowledge production about nature and its crisis, it was also represented as the best guide for policymakers and individual citizens- including the students of themselves, most of whom strive to incorporate scientifically-backed environmental practices into their personal lives.

Nature is complex and difficult to predict, but Science continually progresses towards ever-more accurate understanding

Models of the planet or of ecosystems often appeared in class, though teachers were careful to stress that they are not true representations of reality. Pieter began the very first DO lecture by showing his pupils an old NASA computer simulation of ocean currents, demonstrating the tropical circulation and eddies of the surface, which he described as an "idealised version" of the ocean's movements (see figure 3).
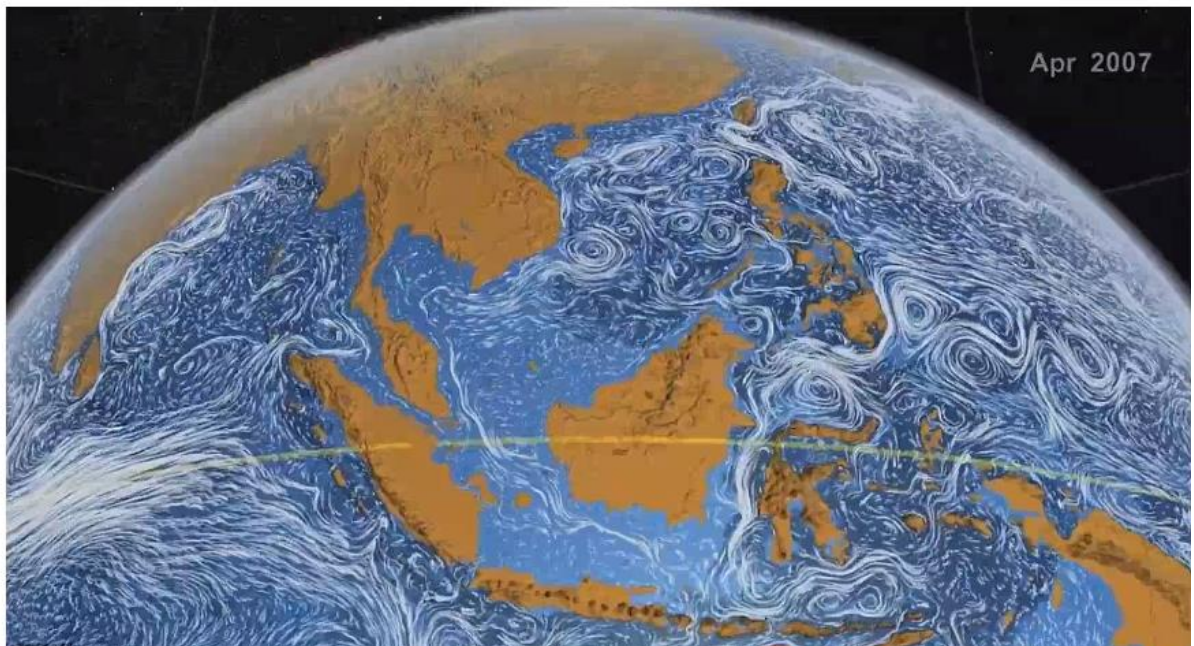
Modelling the ocean

Figure 3: screenshot of slide showing a NASA animation that simulates the ocean's surface movements (field notes from DO Lecture 7, 23/03/21).

He then compared this simulation to the much less intricate depictions that oceanographers typically produce (see figure 4).
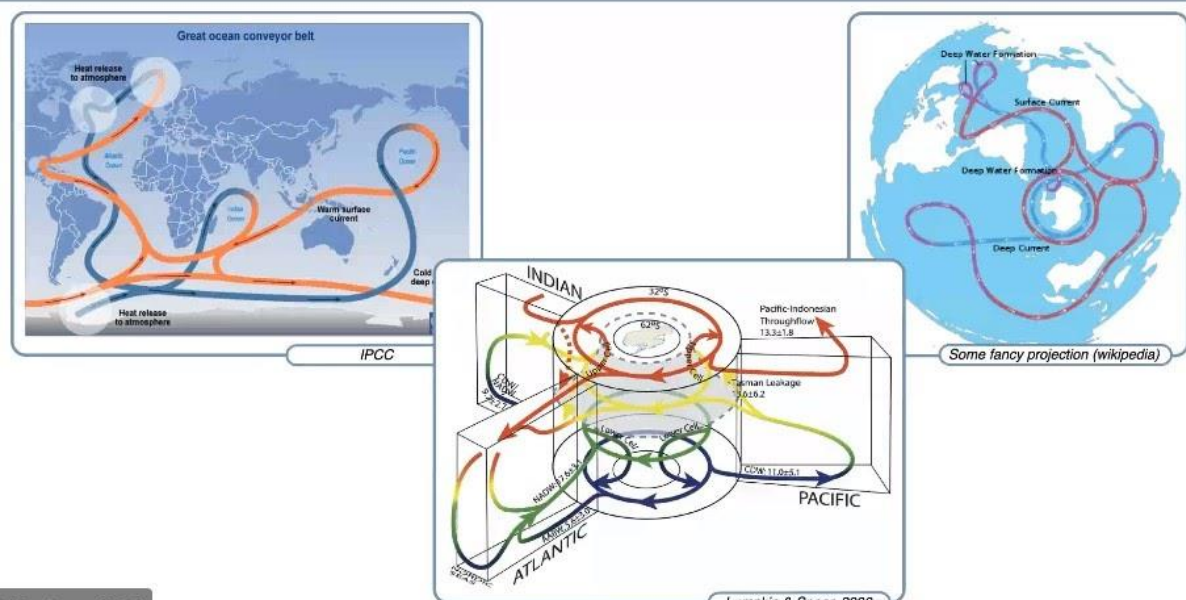
Figure 4: screenshot of slide with examples of how oceanographers typically represent the movement of the surface ocean, such as the thermohaline circulation as a conveyor belt (field notes from DO Lecture 1, 09/02/21).

However, Pieter went on to argue that both the cartoons and the simulation are too simple in comparison to "the real circulation of the surface ocean" (see figure 5).
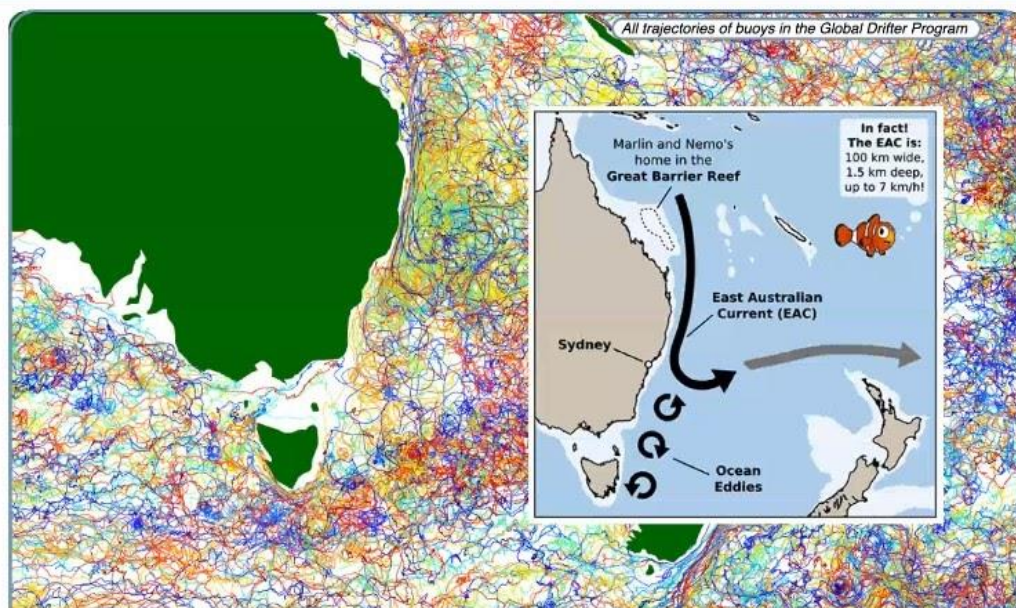
Figure 5: screenshot of slide demonstrating the surface ocean's movements around Australia based on the movement of buoys, or drifters, fitted with GPS that report their locations every hour (field notes from DO Lecture 1, 09/02/21).

This circulation can be observed through the deployment of "drifters" which periodically report their location and enable oceanographers to track where the surface currents have taken them. During the Australasia Antarctic Expedition Pieter worked on years ago, two drifters were thrown overboard at the same moment on opposite sides of the stern, 10m apart; eventually, they ended up hundreds of kilometres apart, having followed a random pathway away from each other. Pieter described this as "a hallmark of chaos" that also occurs in the atmosphere, and

which means "we can predict [ocean movements on] the large scale, but not the small scale".[41] Thus, Nature was represented in this class (and in many others across the programmes) as complex, unpredictable, and difficult to model.

However, this complexity was circumscribed by representations of Science as a continuous project towards ever-more accurate and detailed understanding of all aspects of the planet on the basis of increasing observation. This discourse was disseminated by almost every course, and was often bolstered by teachers' account of their discipline's genealogy (see Chapter 1). In another DO lecture, for instance, Pieter described the controversy that erupted amongst oceanographers in 2005 with the publishing of a paper revealing the apparent slowing down of the AMOC, which could slow down the Gulf Stream and lead to plummeting temperatures in Europe. This convinced the American and British governments to construct the RAPID/MOCHA array, a set of moorings that spans the Atlantic and constantly monitors the Gulf Stream. However, this array found that the speed of the AMOC is so varied that what the original scientists saw was a random set of points that happened to show a negative trend. The array will need to function for 70 years more to gather enough data to make sense of such a fluctuating pattern. Nonetheless, it continues to operate, and is now being joined by a new construction, OSNAP, to measure the AMOC further north- "so we have it now and we *are* collecting more data!".[42] Therefore, though Science may occasionally face a stumbling block, it continues to collect more and better data about Nature.

So though all the lectures I attended in which modelling was discussed included a disclaimer that all models are simplified or abstract representation of reality, and which some of my interviewees also emphasised, modelling was nevertheless presented as part of Science's project to construct an omniscient "view from above" (Haraway 1991, 95) based on increasing surveillance of the earth. This surveillance relies primarily on satellite information, particularly in Climate Physics, where "modern techniques from satellites have increased our understanding" to such an extent that "the top of the atmosphere is now better understood than the bottom".[43] Therefore, though the rise of general circulation models of the atmosphere was an essential factor in the production of an environment beset by crises, and in raising public awareness of

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[41] Quoting Pieter, field notes from DO Lecture 1 (09/02/21).
[42] Quoting Pieter, field notes from DO Lecture 9 (06/04/21).
[43] Quoting Floris, field notes from CTCC Presentation 2 (15/02/21).

these crises (Rutherford 2002), satellite data and the models they inform are also essential to the *management* of such crises. As Peace argues, this satellite technology is "the late twentieth century equivalent of Bentham's Panopticon... [which] render[s] entirely credible the notion of government at any distance, whether spatial or conceptual" (2002, 536-37). Moreover, these satellites are joined by a wide range of proxies and data sources, including ice core records from millennia ago,[44] buoys in the ocean,[45] tree rings,[46] and phytoplankton abundance.[47] The intensification of planetary surveillance enables Science to tame Nature's unpredictability. By collecting data from the atomic level to the planetary, Science represents its knowledge as almost omniscient and incredibly detailed (Peace 2002). This constructs a regime of truth that reifies Science as the most authoritative voice in unravelling Nature's mysteries.

As the Anthropocene magnifies the threat Nature poses to human societies, I argue that this form of scientific knowledge production (rendering Nature knowable) is becoming increasingly important. It is therefore unsurprising that most students reproduce this discourse. Many of my interviewees emphasised that science's most important role in the Anthropocene is that it reveals the crisis's existence in the first place; in Eline's words, "natural science... shows the fact that the climate crisis is here, *factually*, and shows what needs to be done, what the potential losses could be, how to adapt; so science is proof that change is necessary... it's proof of the necessity of sustainable development and of changing our patterns'.

Nature is a set of resources and services for human use, and Science's role is to measure and preserve that function

In the second week of BBE, the class played *Fields of Fuel*, an online game that simulates sustainable biomass production and which is "designed to educate players about the economic and environmental trade-offs associated with biomass".[48] Students embodied virtual farmers in the American Corn Belt growing energy crops while earning an income and improving ecosystem services. Thus, students were expected to learn how to balance biomass' price against

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[44] Field notes from CTCC Presentation 4 (01/03/21), CTCC Presentation 6 (15/03/21), and DO Lecture 10 (04/05/21).
[45] Field notes from DO Lecture 1 (09/02/21).
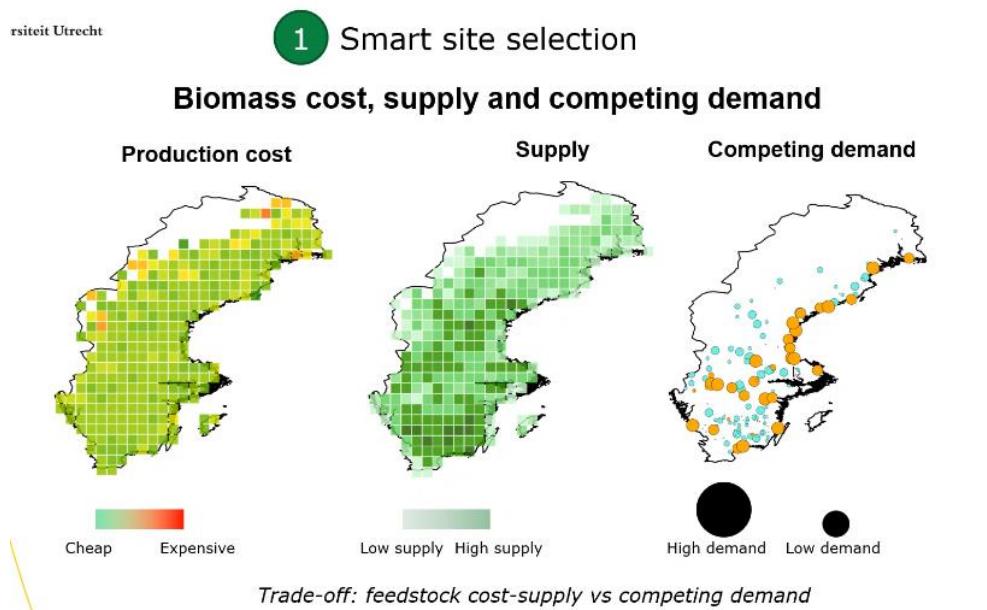[46] Field notes from CTCC Discussion 6 (18/03/21).
[47] Field notes from DO Lecture 5 (09/03/21)/
[48] Quoting slide, field notes from BBE Lecture 2 (15/02/21).

its impact on soil fertility, water quality, GHG emissions, and other ecological aspects. This assignment demonstrates many strands of the discourse I discuss in this section, and which was particularly evident in BBE: nature was categorised according to its use for humans, and therefore considered a provider of goods and services. Science was represented as the best way of managing nature more efficiently, while simultaneously mitigating the damage caused by irresponsible exploitation. I argue that this discourse avoids any deep reflection on our way of life in favour of continuing to assume that we need to manage nature-as-a-resource better.

BBE constantly categorised Nature according to the use it could be put to for humans. Different types of biomass were distinguished from each other, such as lignocellulosic energy crops like short rotation coppice, or advanced forms, like algae. Trees and their combined "forest biomass potential" were divided into their different uses: harvested logs for furniture production, in comparison to twigs burnt as biomass residue. Finally, land was usually identified as either productive farmland, which should continue to be used to produce food, or marginal land, which is only suitable for growing biomass.[49] Figure 6 below exemplifies this representation, as the guest lecturer literally pixelated nature from above in order to reveal where it is most cost-effective to extract resources from it.

rsiteit Utrecht

1 Smart site selection

Biomass cost, supply and competing demand

Production cost   **Supply**   **Competing demand**

Cheap   Expensive   Low supply   High supply   High demand   Low demand

Trade-off: feedstock cost-supply vs competing demand

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[49] Field notes from BBE Lecture 2 (15/02/21) and BBE Lecture 3 (22/02/21).

Figure 6: screenshot from a BBE guest lecture on how to construct a biomass feedstock supply chain by finding the best balance between biomass cost, supply, and competing demand (field notes from BBE Lecture 10, 15/03/21).

However, a third category of Nature was so-called "virginal lands": areas shielded from human exploitation, such as for food or biomass production, in order to protect their biodiversity and ecosystem services.[50] This representation emphasised nature's fragility, and was often reproduced by students. During their presentations, for instance, most students represented nature as either a previously pristine land that had been decimated by irresponsible biomass production (see figure 7), or as a lush and well-managed paradise (see figure 8).

Figure 7: screenshot of a student presentation representing the Dutch farming sector (field notes from BBE Final Presentations, 07/04/21).

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[50] Quoting guest lecturer, field notes from BBE Lecture 2 (15/02/21); a similar sentiment was expressed in ESA Lecture 5 (09/03/21).

Figure 8: screenshot of a student presentation representing the Port of Rotterdam (field notes from BBE First Presentations, 07/04/21).

Representing Nature as a resource to be utilised or protected means the role of Science is to determine which use it should be put to. From quantifying and modelling how much of the EU's land can be used to produce biomass,[51] to designing and administering biomass feedstock supply chains,[52] scientists are crucial to the management of nature. They therefore do not merely produce more and better knowledge about Nature, as I argued above; they also act, in Carlos' words, as "stewards": "I like [UU's] perspective on governance and as society as stewardship for nature... the sort of idea behind governance is that we are just animals, but because we can communicate, think, and be so critical, as other animals cannot be, that we should use these skills- this *gift*- to protect nature, not to dominate nature". Similarly, Sanne lamented her peers' lack of appreciation for Dutch ecosystems and their need for restoration, because we need to "think about what we do with dunes, do we want to let them become forests, which happens with succession? Or do we want to maintain the dune landscape?".

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[51] Field notes from BBE Lecture 3 (22/02/21).
[52] Field notes from BBE Lecture 10 (15/03/21).

Though this care for nature seems benign, I argue that representing nature as a provider of goods and services to humans leads to "environmental problems ceas[ing] to be discussed in moral terms and are now addressed as issues that require cost-benefit analyses" (Oels 2005, 196; see also Fletcher 2010). In BBE, this manifested in talk of "trade-offs" between biodiversity and energy, but also in the course's focus on EU policy makers and the micro-economics of bioenergy. In order to advise policymakers on how to manage nature better, students were therefore being taught the technological and economic aspects of the bioeconomy, alongside the ecological. This was sometimes done by demonstrating how nature should *not* be managed, as in the case study of Greek forestry presented by the second guest lecturer in BBE. She claimed that, though Greek forests are relatively large, forestry only accounts for 0.3% of the nation's Gross Domestic Product (GDP) because "these state-owned forests, they just have not been managed properly" in comparison to privately owned forests, leading to the state "losing the opportunity to *use their forests properly*".[53] Even the last guest lecturer, who was asked to speak because she is a critic of biomass use, viewed nature as a resource to be managed better in the pursuit of a "climate-neutral, competitive economy of empowered consumers" through a "cost-effective transition to climate neutrality".[54]

Thus, students were being taught how to adjust our *existing* systems, technologies, and ways of relating to nature in order to reduce our impact on the planet, primarily by substituting fossil fuels with renewable alternatives. Many of them reproduced this dominant discourse in turn, characterising Nature as a set of resources and Science as its steward, rather than challenging or re-imagining our current economic and social systems or lifeworlds.

To illustrate the two discourses I analyse above, I have taken DO as a typical example of *Nature as a mystery for Science to unravel*, and BBE for *Nature as resources for Science to manage*. This division parallels the *disengaged theorist/ pragmatic solution-finder* dichotomy I constructed in the previous chapter. However, both of these discourses circulated across the programmes I examined and the classes I joined. I therefore argue that, instead of producing two different subjects, these discourses work in tandem to make Science an anti-political regime of

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[53] Quoting guest lecturer (emphasis mine), field notes from BBE Lecture 3 (22/02/21).
[54] Quoting slide from BBE Lecture 19 (12/04/21).

expertise (Swyngedouw 2010). As I outlined in the first chapter, governmentality scholars have argued that dominant sustainability discourses render the earth fragile and in need of efficient and benevolent stewardship (Luke 1999; Peace 2002; Rutherford 2002; Rutherford 2007), as prominent scientists have done (Crutzen 2006; Steffen et al. 2011). Producing more knowledge of a Nature beset by Anthropocenic crises means that it must be protected through intensified management. Through scientific knowledge production about nature, therefore, "what was unknown has become fully knowable; what was mysterious is now readily imaginable; and the whole [planet] has become eminently governable" (Peace 2002, 536-37). As I discuss in the next section, this has made science the most authoritative guide to acting in the Anthropocene, from global policy circles to personal lives, which is supported by the representations of the Public that circulate in the classes I joined.

Science is the best guide to behaving in the Anthropocene
At the end of the seventh CTCC Presentation, Daphne invited her fellow-students to join the group that would become the Climate Physicist-Activists (CPA).[55] In the group's first meeting, conducted over Teams, a clear divide emerged between participants like Daphne, who wanted the group to act as a bridge between the scientists who know how dire the crisis is and the people in power who can facilitate change; and participants like Leonardo, who was highly sceptical of the public's ability to force policymakers to change. However, by the end of the meeting, most of the group had been convinced that they could "construct a really clear and understandable story about the importance of climate change".[56] They decided to share their knowledge directly with the public by producing a podcast, believing that revealing the facts about the crisis to citizens would persuade them to effect change.

In this section, I outline and discuss the last dominant discourse I found circulating in classes: Science should act as a guide the Public in the Anthropocene. As the vignette above illustrates, many students thought it was crucial to reveal the reality of the environmental crisis to the public by sharing their scientific knowledge with them, because they believed that this will convince ordinary people to change their behaviour. Though some of the classes I joined and the students I

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[55] Field notes from CTCC Lecture 7 (22/03/21).
[56] Quoting Wouter, field notes from CPA meeting 1 (25/03/21).

talked to envisioned a more equal relationship between the public and scientists, it was much more common to see the relationship as that of a teacher and student, with varying levels of assumptions about the public's ignorance. For instance, in one of the first guest lectures of BBE, the guest lecturer told the class that she is "more tempted to look at what the European environmental agency says and to be science-driven," rather than follow the "worried and ignorant" public who oppose biomass production and consumption.[57] Many students reproduced this division between Science and the Public, which was also often divided in two: policymakers and individuals. I first focus on how policymakers were expected to follow scientific evidence, while science itself is still considered non-political; I then discuss how individual citizens are expected to behave- including the expectations the students placed on themselves.

1. Science as a guide to policymakers

According to many of my interviewees, SD courses teach students how to advise policymakers. CP, on the other hand, is more focused on teaching students how to become climate scientists than guiders of policy; as Cato told me, "it is really focused on understanding the processes- so people sometimes say, oh so you are going to solve the climate crisis, well no, we're just focusing on understanding it and seeing what happens, so it's mainly about the physics and the dynamics". Moreover, though CTCC was the most focused of the CP classes on how to fix the crisis, course materials still prioritised understanding and evaluating the IPCC's research over the appropriate policy responses. Interestingly, however, many of the *student*-led discussions in CTCC revolved around how to convince political leaders to listen to climate scientists and institute environmental policies. Furthermore, many interviewees identified consumer society (alongside governmental inaction on industrial emissions) as the primary cause of the Anthropocene; thus, policymaking was considered a necessary way of dealing with the public's ignorance of the damage their activity causes to nature. For instance, in response to a question on whether polar tourism should be prohibited, most agreed it should be banned, potentially along with cargo traffic around the Arctic. In fact, Floris argued that tourism should be minimised to keep the area as "untouched" by humans as possible in order "to let nature do its thing, and maybe *just let researchers in*".[58] Thus, students reproduced the division between science and

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[57] Quoting guest lecturer, field notes from BBE Lecture 3 (22/02/21).
[58] Emphasis mine; field notes from CTCC Discussion 8 (01/04/21).

society, and the authority science should have in the public sphere, that characterises the dominant discourse.

But while most classes and students emphasised that politicians should be guided by science, this was paired with a conviction that science itself is not political. Though some teachers represented science as conflicting interpretations of one true data set, or reality, most classes focused on how much is known and agreed upon about the environmental crisis.[59] Teachers, alongside many of their students, seemed to wish to keep conflicting interpretations out of the public eye out of fear that these conflicts would undermine their authority and grant climate sceptics leverage.[60] Deploying scientific expertise in this way evacuates policymaking of political contestation in favour of producing consensus to a limited set of technical fixes (Ferguson 1994; Li 2007a; Nadasdy 2005; Swyngedouw 2010). This makes science a technical, rather than political, means of intervening in society. This regime of truth restricts our imaginations, dissuading us from envisioning any project more ambitious or revolutionary than a planet dominated by technocratic, capitalistic expertise and management (Crist 2007; Swyngedouw 2010).

2. Science as a guide to individual citizens

Teachers and students also argued that science should guide ordinary individuals' behaviour; therefore, scientists have a duty to communicate the urgency of the crisis to the public and tell them how to act. Many of my interviewees considered raising awareness of the environmental crisis an essential part off science. Cato, for instance, insisted that science has played a positive role in the Anthropocene because "generations now, they already grow up knowing that there is climate change... I think you will find fewer climate deniers among younger generations because it is so out there, it's so well known. For them, it's not an uncomfortable truth that they have to adjust to at some point in their life, but they already know it from a young age, and I think the enormous scientific evidence does help for that".

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[59] Sanne (1st interview: 03/03/21) and Eline (follow-up interview: 22/04/21) confirmed this to me; however, Francisco told me that contested science *is* part of class discussions (follow-up interview: 13/04/21), which Barend confirmed (personal communication: 20/07/21).
[60] Field notes from CTCC Discussion 3 (25/02/21).

This focus on individual behaviour extended to students' own lives. My interviewees overwhelmingly reported feeling responsible in the fight against the crisis, which they linked to their personal lives, studies, and future careers. Though students clashed over how much responsibility it is fair or sensible for them to take on, almost all of those I interviewed told me that they still found it important to do their best to live sustainably, and no one refused to share their environmental practices with me even though I stressed that they had the right to do so. In the next chapter, I will discuss further whether this is a form of disciplinary responsibilisation or of ethical self-formation; for now, however, I wish to highlight the students' focus on whether or not their chosen lifestyles are supported by scientific evidence. This was most evident in regard to dietary choices, which was a highly contested subject. Many of my interviewees differed on whether science confirms or denies that reducing the consumption of meat and other animal products is environmentally conscious. Francisco, for example, was in favour of reducing meat consumption rather than eliminating it entirely "because animal production in some regions has an important ecological role", while Madelief has been almost entirely vegan for years. However, all of them based their contrasting opinions on "the science", which they seemed to believe had settled this dispute beyond a doubt.

I argue that this focus on scientific evidence parallels Foucault's governmentality "in accordance with the order of things", where power is exercised "in terms of the truth… of religious texts, of revelation, and of *the order of the world*" (2008, 311; emphasis mine). I take "the order of the world" here to mean what Science tells us about Nature and the Anthropocene, and which functions as the highest form of truth in modern life (Rose 1990; Barry 2001). Thus, Science is again reified as the most authoritative form of knowledge production about Nature and its crisis, because it acts as a revelation to the public, politicians, and scientists-in-the-making themselves.

Conclusion

 I have argued in this chapter that classes represent Nature, Science, and the Anthropocene in interlinked ways which construct certain "regimes of truth" (Foucault 1980). These discourses ultimately construct Science as the most valid and authoritative way of knowing and managing Nature and the Public, particularly as we enter the Anthropocene, and solidify scientists' positions as governors of both. I have characterised this as a form of anti-political governance

because it relies on producing consensus to scientific expertise alone, rather than allowing contesting interpretations of science and solutions to thrive. Students reproduce this anti-politicisation; the responses to the Anthropocene they forward focus on either technical tinkering, or educating people on the impacts of their lifestyles in order to foster changes in individual ethics and behaviour, as well as in the policymaking sphere. Furthermore, these discourses have extended into their personal lives, shaping them into disciplined environmental subjects who rely on scientific evidence to tell them how to act. However, teachers and students are not merely subjectified by these discourses, whether they circulate on the global, institutional, or inter-personal level; they actively co-produce *and challenge them*, as will be the subject of the next chapter.

"... the more I got into sustainable development, it also made it harder for me to justify doing things I *knew* were bad for the environment. And I've also had discussions with someone from the course about how much someone studying sustainable development's lifestyle should reflect what they're studying... we have to hold each other accountable... we need to fundamentally change the way we act and behave. So if we're not thinking about that for ourselves, how can we expect other people who aren't studying what we're studying, to do the same..." (Interview with Eline, 23/02/21).

Early in my fieldwork period, I was alerted to the ways in which some students do not reproduce the governing discourses that circulate in classrooms, but challenge them. As I outline below, this may be because their master's programme is not the only source of information they have on Nature, Science, and the Anthropocene; they are also being subjectified by discourses originating outside of the classroom. I label the narratives these students constructed *counter-discourses* in order to emphasise that, though they did not appear often, students seem to purposefully spread them in classrooms in order to influence their peers. They are therefore different to the ruptures in dominant discourses I identified in the last chapter, where teachers' and students' discourses do not fully align but there is no effort made to actively construct a counter-discourse to what is being taught. I discuss three counter-discourses I identified below, all of which in some way challenge the dominant representation of Science as the most authoritative and objective way of knowing and managing Nature-as-resources, and attempt to re-politicise the Anthropocene. I argue that this is an example of what Rutherford describes as "the ways in which governing is always becoming, necessarily uneven, [and] often contested" (2007, 292), and therefore illustrates how governmentality never fully succeeds in moulding subjects entirely to its liking.

Outside influences: sources of subjectifying discourses beyond UU

Most of the students I interviewed told me that their master's programmes had taught them more about the Anthropocene and its potential consequences, and a majority also reported changes in their environmental beliefs or practices as a result. An SD class on different kinds of food production and their effect on land use change emissions seems to have been particularly

influential; András, Eline, and Rory said this class was a key factor in convincing them to reduce their meat consumption. As András told me, "an example from my studies that actually changed me was an assignment where we had to calculate the land requirement for different types of food products... and different diets [meat, vegetarian, vegan]... you do the calculation yourself, so it can be difficult to start buying meat again". However, five of these students told me that the changes in their opinions and habits originated in the student community, rather than in the material they are studying. Vera, for instance, said that her environmental practices are "not really something I learned at university- but... I think you do influence each other, I think the environment around university does influence students". In her case, she learned about the destructive amounts of GHGs emitted by airplanes from friends, rather than her textbooks, which convinced her to reduce the amount she flies.

Furthermore, a substantial portion of my interviewees said that joining their programme had *not* resulted in major changes because they already considered themselves environmentally conscious. According to many students, they had absorbed such beliefs and practices from their families, friends, and previous experiences in formal education. Thus, their attempts to be environmentally conscious preceded their enrolment in their master's degree, and was often the reason they chose the programme in the first place. Rather than awakening them to the reality of the Anthropocene, therefore, most students hoped that their programmes will provide them with the skills and networking opportunities they need to contribute to combating the crisis (see Chapter 1). These previous experiences may have played a role in shaping them into subjects that resist the discourses circulating in class, constructing the counter-discourses I discuss below. Thus, students identified certain spaces *outside* of the classroom, where critical ideas about Nature, Science, and the Anthropocene originate, as crucial sites of subject formation. I argue that these critiques foster the construction of counter-discourses, but are *also* modes of subjectivisation in themselves, with their attendant power relations. Therefore, though my ethnography focuses on the classrooms of UU, the university's anti-political pedagogy is not the only one affecting the formation of these scientists-in-the-making.

<u>Students' counter-discourses</u>

I identified three counter-discourses emerging among some students, which I describe and analyse below according to which was most to least prevalent in classes and interviews. The first challenged representations of Science as objective and value-neutral; in comparison, students were much more focused on the political and ethical dimensions of becoming a scientist in the Anthropocene, both in their academic and their personal lives. In contrast to dominant representations of Nature as a set of resources or services, the second discourse characterised this as the cause of the Anthropocene, and instead articulated a more eco-centric perspective. Finally, the third and least widespread discourse critiqued conceptualisations of Science as a "view from above", and instead characterised it as a situated knowledge informed by colonial histories (Haraway 1991). Interestingly, these counter-discourses seem to circulate among students regardless of the type of scientist-in-the-making their programmes wish to shape them into; thus, they cut through the disengaged theorist/ pragmatic solution-finder dichotomy I constructed in the second chapter. These counter-discourses demonstrate that governmentality and its discourses is never "a completed project, simply applied to a passive populace" (Rutherford 2007, 292; see also Skinner 2012). Nevertheless, as I reflect on in this chapter's conclusion, students continue to reproduce certain aspects of these dominant discourses, even as they challenge other parts of them.

1. *Science is political and ethical*

Teachers and course materials presented the Anthropocene as a set of agreed-upon and depoliticised facts, constructing a consensus which restricts solutions to a set of technical fixes (see Chapter 2). However, some students challenged these attempts to render the crisis technical by questioning the objectivity and value-neutrality of Science. I argue that students' assessments of the causes of the Anthropocene are much more political, and that this means a more fundamental transformation is necessary. Furthermore, students were more focused on the personal ethics of becoming scientists in the Anthropocene, and on how to keep themselves and others accountable for their environmental impact. This focus on the ethical may be because some students do not seem to have been disciplined into repressing their subjective opinions, as their peers and teachers have (see Chapter 1). Moreover, it may be related to the amount of

discussion possible between students in and outside of the classroom, particularly when the COVID-19 pandemic restricted almost all interactions between these students to online platforms.

As I discussed in the previous chapter, most teachers and students unconsciously characterised scientific knowledge production about nature as "the view from above, from nowhere" (Haraway 1991, 195), leading them to "speak as if they had knowledge while other people have ideology- as if they could speak from outside politics" (Gusterson 1998, 223). By contrast, several of my interviewees recognised that what they are learning is actually a form of situated knowledge (Haraway 1991). Sanne, for example, told me that her teachers taught a certain *version* of reality backed by some scientific evidence, but evidence also exists for other perspectives.[61] They therefore acknowledge that all knowledge is the product of its situation, critiquing the objectivity and universalism associated with Science (Candea 2016; Haraway 1991; Rutherford 2002).

These students were also aware of the ways in which scientific knowledge production is always informed by values and political judgements; that "far from standing outside politics, experts are inextricably enmeshed within it, their knowledge and authority being vital in the construction and maintenance of regimes of truth" (Gusterson 1998, 223). In particular, these students argued in favour of purposefully using science as a tool to intervene in society and human behaviour in the pursuit of certain political or ethical goals. For instance, in response to proposals to deploy technical and technological approaches such as geo-engineering, some students argued that this method is neither feasible on a global scale with current technology, nor is it an ethical response to the crisis. Students worried about its side-effects, such as the potential depletion of the ozone layer if aerosols are sprayed into the atmosphere in an attempt to reduce global temperatures.[62] Moreover, this approach means that "we do not look to change our destructive behaviours, we

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[61] Interview with Sanne (1st interview: 03/02/21); in both our conversations, she also challenged the hierarchy of knowledge assumed by Science, under which the environmental sciences are considered more valid forms of knowledge about nature than those of local communities or non-scientists.

[62] Interview with Aida (04/03/21); interestingly, Aida worried that many students do not think enough of the consequences of geo-engineering, which I also found in one of the first CTCC discussions; when a geo-engineering method was first brought up, the discussion centred on its technical feasibility until Christopher asked about its side effects, which generated an unplanned (and unresearched) discussion of how it might lead to ecosystem collapses and a dependency on this method (field notes CTCC Discussion 4, 01/03/21). Thereafter, geo-engineering was subjected to much more critical discussion in this class, particularly during CTCC Discussion 7 (25/03/21).

just solve their impacts with technology".[63] Instead of allowing our business-as-usual model to continue, fortified by planetary projects that modify the climate further, students argued for a more fundamental shift away from a culture that considers itself to be "superior, and therefore with the right to dominate its surroundings- not just the environment, but all that can be dominated".[64] Thus, these scientists-in-the-making are actively questioning the "project of colonising the Earth" that Crist attributes to Anthropocenic scientists (2007, 50).

Furthermore, in contrast to their teachers' seeming reluctance to share their opinions or impart certain moral values, students constantly discussed the personal ethics of becoming a scientist in the Anthropocene. Many want to dedicate their professional careers or lives to combating the environmental crisis, and shared the personal sacrifices they have been making (or think they should be making), as I discussed in the previous chapter. The notion of *responsibility* was therefore a particularly prominent theme, as exemplified by the quote I opened this chapter with. Conversations with my interviewees and in some classes often revolved around who is to blame for the Anthropocene and who should take the lead in combating it; and on their own responsibility as future scientists to the natural world and future generations to mitigate the crisis.[65] There was no consensus among my interviewees as to how much responsibility individuals should take on; some argued that everyone must reduce their impact as much as possible "because even though it's not enough, it's still steps in the right direction",[66] while others pointed out that this expectation was an incredibly taxing emotional burden that "would just drive me crazy",[67] or distracts people from the crisis's true cause: large-scale industrial emissions and the structural conditions that enable them. However, almost all of the students I

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[63] Quoting Francisco (follow-up interview: 13/04/21); Christopher and Anya made the same argument in CTCC Discussion 7 (field notes, 25/03/21).

[64] Quoting Carlos (15/02/21); Francisco made similar statements (interview, 10/02/21).

[65] In our conversations, Sanne often highlighted her responsibility as a future biologist to efforts to conserve nature; however, she also pointed to a potential source of tension between contributing as a *scientist* and as a *responsible citizen*: "I think the main reason for students who don't undertake these personal changes themselves is that they see that you as an individual [can make sacrifices]… but if other people are still flying for their master or their internship, or if many people in their environment are still eating meat, they have the idea like, *I* am sacrificing things, but it doesn't really help in the bigger picture because I don't get the same job as a person who has experience in different countries, like the US or Australia, in real wild situations, because I make the choice not to fly there…. most people are still in that mindset, I am a biologist so I have the right... to go there because is part of my education and that is where I will work later and if I want to make a change then I have to do these kinds of things so that I can in the future help solving these problems" (follow-up interview: 30/03/21).

[66] Quoting Eline (1st interview: 23/02/21).

[67] Quoting András (interview: 18/02/21).

talked to thought of *their own* actions in terms of sacrifices they are morally obligated to perform. Many have cut down on unsustainable consumption by buying second-hand clothes; by reducing the amount of food wrapped in plastic, imported, or available out of season they buy; and reducing or eliminating meat from their diets entirely to become vegetarians or vegans. Others have reduced the amount of unsustainable transport they take in airplanes and cars, or are conscientious recyclers. Many also report trying to influence their friends and families into changing their own habits.[68]

I argue that their focus on their own actions is the product of a disciplinary environmentality, which is "intended to inculcate an environmental ethic by means of which people will self-regulate their behaviour in conservation friendly ways" (Fletcher 2010, 175). Thus, these students have disciplined *themselves* into becoming more environmentally conscious subjects by deploying environmental technologies of the self (Foucault 1988) focused on conscious consumerism. Though many of those I interviewed recognised that the Anthropocene "may have less to do with the individual (and how she shops!) and more to do with sanctioned actions of governments and industrial polluters" (Rutherford 2007, 299), they simultaneously responsibilize themselves (Rose 1990) to such an extent that they prioritise personal change over challenging "the neoliberal order which contributes to environmental problems" (Rutherford 2007, 299).

However, I argue that making themselves responsible for combating the Anthropocene is both a problematic norm students have internalised, *and* a way of engaging in ethical self-formation (Foucault 1988). Students consider attributing responsibility to themselves and holding themselves accountable essential in order to become ethical subjects. Thus, these students are not merely being disciplined and shaped by governing discourses; they also *shape themselves* in a reciprocal double movement, "injecting an element of contingency to everyday encounters and alleviating the determinist effect that technologies of power would have otherwise" (Skinner 2012, 918).

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[68] Interestingly, only one or two interviewees seemed to have considered participating in *collective* environmental action: Vera, who "flirted" with joining Extinction Rebellion (quoting from interview on 17/02/21), and Eline, who was part of a student action group during her bachelor studies (1st interview: 23/02/21). This focus on individual actions was exemplified by Arnoud, who considered himself an environmentally conscious person because even though he is "not extremely activistic", he is "very conscious about the current crisis and ways to do very small things to help and to sort of improve myself as an individual" (quoting from interview on 18/02/21).

2. Nature is not a resource

During the second BBE lecture I attended, a guest lecture on the amount of biomass EU policymakers could realistically expect the land to produce, the guest lecturer characterised Greek forests (and by implication, all forests) in terms of their "forest biomass potential" which "have not been managed properly". At the end of her presentation, a student challenged this representation of nature and argued that to categorise forests as simply stocks of potential energy for human use, rather than an ecosystem, is a "very weird" perspective on sustainability because it ignores the importance of biodiversity. In turn, the guest lecturer explained that because no wilderness remains in Europe and all remaining ecosystems are at most semi-natural, it is now up to humans to decide "what biodiversity do we want, what human uses do we want in these situations, and what is optimal in terms of the ecosystem services that we want to link to these areas". Lukas replied that research has revealed precipitous declines in Europe's biodiversity as a result of our agricultural practices; so he did not understand why "we shouldn't go back to that old state of having untouched forests" in Europe again, rather than continuing to exploit nature as efficiently as possible for human gain.[69]

As I outlined in the previous chapter, many of the classes I observed characterised nature as a set of resources or services, and science as its governor. But I began to wonder early on in my fieldwork what it meant that some of my interviewees, and even their teachers at times, also critiqued ideas of sustainable development and eternal economic growth. In the interaction I describe above, Lukas epitomised some of the ways students challenged dominant representations of Nature-as-resources. These students recognised that, far from being a non-political or "natural" way of thinking about the planet, this discourse stems from and reinforces the economic model and mindset that is causing the Anthropocene. However, even the most ardent opposition to Nature-as-resource still envisioned a nature in need of scientific

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[69] Quoting discussion between the guest lecturer and Lukas, field notes form BBE Lecture 3 (22/02/21); Lukas reiterated his opinion weeks later during a lecture on forest carbon accounting, arguing that "natural forests are not only valuable for carbon storage" but also for the biodiversity they foster (quoting from Teams chat, field notes from BBE Lecture 12, 24/03/21).

management; but in a way that would prioritise the health of ecosystems, rather than the services they provide to humanity.

Lukas' viewpoint was shared by many of my interviewees, who believe that it was the rise of representations of Nature as resources for humans to exploit that had led to the environmental crisis. They argued that capitalism, neoliberalism, or consumer society all rely on and perpetuate the exploitation of the planet and each other. Hella, for instance, told me that she and many of her fellow-students believe that "obviously *the* one solution would be to completely change the system that we live in... [because] capitalism and wealth accumulation are not in any way compatible with creating a fair and sustainable world". This counter-discourse, according to Hella, was sometimes reproduced by her teachers too, as "within the teaching there is a lot of criticism in general of capitalism and the neoliberal market ideal, and I think there is a lot of concern that this could never really be in line with something sustainable". Nevertheless, most classes represented Nature as a resource for Science to govern (see Chapter 2).

Interestingly, however, even Lukas saw a need for science to manage nature. When the guest lecturer critiqued Greek forests for being so badly managed that forest fires are common, he argued that forest fires are one of the ways these ecosystems regulate their undergrowth. However, the guest lecturer explained that this is not the case for man-made forests, where "there is a tremendous growth of shrubs, the forest becomes completely [overgrown]... so you have a huge amount of biomass that burns very easily. That is not a natural state either"- as has become the case for almost all European ecosystems, whether forested or agricultural. Lukas responded by arguing that "if that's not really a healthy state for Europe's ecology to be in, should we not turn it around a little bit" by creating and managing "untouched forests" in a way that prioritises biodiversity.[70] Therefore, the apparent dichotomy between the "ecologist perspective" and the "climate change perspective" is resolved in their shared understanding that nature needs to be managed in a better way than is being done now.[71]

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[70] Quoting discussion between the guest lecturer and Lukas, field notes from BBE Lecture 3 (24/03/21).
[71] Quoting Bas, field notes from BBE Lecture 3 (24/03/21).

3. Science is not universal

The final counter-discourse I identified was most clearly articulated by two interviewees, Eline and Madhuri,[72] and their critiques may therefore only apply to the SD programme they both follow. They challenged environmental sciences' self-representation as a universally applicable mode of knowledge production, and argued that this actively erases "non-western" or alternative perspectives on sustainability. In this section, I first outline their critique, relying mostly on Eline's account, before describing how other students articulated similar sentiments. However, most of the students and teachers I observed reproduced the erasure of alternative perspective by elevating the Global North as the centre of authoritative knowledge production about nature and the Anthropocene. Thus, in comparison to Eline and Madhuri's argument that the knowledge they are learning to produce is informed by the imperialist histories of the Global North, rather than an expression of a "Universal Science" (Blaser 2016), most teachers and students unconsciously characterised their perspective as "the view from above, from nowhere" (Haraway 1991, 195).

In both of my conversations with Eline, she highlighted the western-centrism of academia and the resulting marginalisation of non-western perspectives on sustainability. In conjunction with broader discourses that represent "Africa and quote-unquote developing countries... in a way that's lesser", she said that the SD programme presents these countries "as a monolith without so much complexity to them".[73] She told me that in the course Perspectives on Sustainable Development, only a single lecture "skidded over four or five different alternatives" originating in the non-west. However, simply including more perspectives is not enough, because it is also a question of "how you name your courses to begin with. If you name your courses Perspectives on Sustainable Development but then 99% of the perspectives are still western... you imply almost that these theories that are being talked about in this course are the only ones that exist, but then that excludes the rest of the world, which is huge and there's vast amounts of knowledge there". She argued that SD is therefore complicit in reifying the west as the most authoritative, or

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[72] Neither interviewee fit the typical UU student profile (white and/ or European); however, instead of linking their articulation of this counter-discourse to the ways they may have been racialised or othered in some way, I analyse it as an expression of their situated knowledges *as they themselves did*.

[73] A note on my usage of non-west/ Global South/ "developing countries": as far as possible, I have used Eline's words ("non-west"/ "alternative"), and then "Global South" or more specific when applicable, as this is what she considers best practice.

even only, knowledge producer about sustainability.[74] This is both a legacy of, and perpetuates, colonial power relations, as "the idea that western perspectives are universally applicable comes from the same place that justified colonisation to begin with… the west is the one that knows, and whether it needs to go save, or has the right to extract and destroy and all of these things-that just comes from the perspective of the dominance and the greatness of the west". Eline argued that the similarities between how non-western knowledges were treated under colonial rule and how they are treated now by academia means that addressing this "is a question of decolonising the university, and quote-unquote science".[75] This entails decolonising syllabi by including more alternative perspectives and situating pre-existing knowledge in their histories; but also by challenging the prejudice among professors and curriculum writers against these forms of knowledge production.

Not only is the SD programme coming from "a Global North, western European, American perspective a little bit, because the frameworks and everything are from there", according to Madhuri, but both students told me that most of their peers and teachers are white, Dutch or western European, and middle- to upper-class. This dominant perspective is not only reflected in the curriculum, as described above, but also in the lack of awareness of how marginal perspectives are erased. Though Eline has discussed this with other students, "it's not something that's very evident in the first place, and even less so when most of the students are also from this context... if you're born in the west and raised in the west and you have this education that never questions the fact that it's supposedly universally applicable, than it makes complete sense that even as an adult you don't think about it, you know, why would you think otherwise if

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[74] Furthermore, as Madhuri also pointed out to me, the erasure of alternative perspectives produces faulty knowledge and failed projects because "contexts are just different... there are so many, soooo many examples of development projects that have failed miserably and continue to because there just isn't a consideration of the context and the sources that are actually there, but it's rather imported perspectives". Alongside a philosophical consideration of the consequences of knowledge hierarchies, therefore, these interviewees also had a more practical approach; however, it lies outside of the scope of this chapter to analyse how this relates to their programme's attempts to form them into pragmatic solution-finders.

[75] However, Eline did not see the need for decolonising the more quantitative or technical aspects of her course (at least, not yet) because "you don't necessarily need another perspective on the Law of Thermodynamics because… it's a law of physics that's been applied for centuries and centuries" (22/04/21). Furthermore, though she critiqued assumptions that development projects should always follow western trajectories, she did not seem to question the visions of progress and modernity that underly them. This belief echoes Chakrabarty's argument that mid-century anti-colonial movements in Asia and Africa (and their resulting governments) were driven by anti-imperial *and anti-poverty* impulses; but by taking "modernity and the modernization of the world for granted", he argues that such movements continue to envision the need for economic development without considering how it has led to and perpetuates the Anthropocene (Latour & Chakrabarty 2020, 452).

everything you've been taught is a certain way?". Thus, the fact that knowledge is situated in specific contexts and histories may not be obvious to most scientists-in-the-making, or their teachers.

Nonetheless, other students *did* challenge certain facets of the dominant discourse that Science is universal, especially its accompanying assumption that the Global South needs advice from the Global North in order to reach global sustainability targets. For instance, in a CTCC discussion about the feasibility of imposing sanctions on nations who do not protect their ecosystems, Tess argued that "developing countries" are the biggest offenders of this because they are more reliant on emissions-heavy industries, and that "developed countries" should provide them with the help they need to reach "the standard that we in the Global North want". However, this was immediately challenged by Thomas, who pointed out that it is the developed countries with the largest economies that have the biggest impact on the environment. Christopher agreed, and asked what right the North has to condemn the South now when we destroyed our ecosystems decades or centuries ago, as in the case of his home country.[76] Moreover, Rory told me that a significant proportion of first year SD students sent an open letter to the course administration which "flagged the predominance of western rationalist ideas in the course content, and asked the administrators to make changes to include more diverse concepts of sustainability" (see Appendix 5). Their critique of the erasure of alternative knowledges, and how this process is fed by and reproduces colonial power relations, signals that that this counter-discourse may growing.

Some scientists-in-the-making were clearly resisting a more dominant discourse that the Global South is lagging behind the North in terms of environmental protection. However, most students and teachers reproduced the erasure of alternative sciences, and argued that the South needs the North's help in order to catch up. For instance, in one BBE lecture, Bas began by looking at the traditional use of biomass in South Asia and Sub-Saharan Africa as domestic fuel, which contributes to deforestation. Bas told the class that UU has partnered with the Fair Climate Fund to encourage locals to transition to more advanced cooking stoves, which the Fund "hand[s] to people in developing countries… for free" in exchange for ownership of the resulting carbon

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[76] Field notes from CTCC Discussion 7 (25/03/21). Tess's focus on the emissions of the South in the present day, while ignoring the North's historical (and current) culpability, echoes what Mirzoeff (2014) calls "imperial aesthetics" (220); as he argues, "imperial smoke is a positive sign of the energy and vitality of the modern metropole, whereas the smogs of developing world capitals are miasmas, threatening to health and vitality" (226).

credits. They then sell these credits to institutions such as the UU to compensate for the carbon emitted when they fly, which Bas presented as "a means to modernise developing countries".[77] This incident was representative of many others in classes I attended, which reproduced broader discourses that present the Global South as riddled with weak governance, corruption, inefficiency, and in need of assistance in order to protect their Nature (Comaroff & Comaroff 2012; Leach & Mearns 1996).

Conclusion: attempting to render Science political?

During my fieldwork, I identified three discourses that circulate among *some* scientists-in-the-making that are in opposition to those of their classes. Firstly, students challenged the supposed objectivity or value-neutrality of science, and articulated a much more explicit engagement with their own responsibility as citizens and scientists-in-the-making. Secondly, they resisted representations of Nature as a set of resources or services for humans to manage and exploit. Lastly, they characterised Science as a situated knowledge informed by colonial histories, rather than a Universal Science. Thus, even though students are being integrated into a discipline that wields vast discursive power in the Global North (Gusterson 1998), let alone within the scientific community itself, there remains the possibility of resisting or changing subjectivising discourses (Rutherford 2007; Skinner 2012).

These counter-discourses were only shared by a minority of the student population I observed, and I saw some evidence that they were actively rejected by those who subscribe to the dominant discourse. For instance, Lukas's problematisation of Nature-as-resources was dismissed by both the guest lecturer and several of his peers.[78] Similarly, Madhuri told me that she sometimes censors herself in order to get along with her classmates in group projects. However, characterisations of Science as an ethical and political discipline were widespread among students; in fact, comparing my experiences of CTCC and BBE leads me to believe that these discussions of political and ethical issues arise naturally in these classes once students have digested the scientific facts, *if a space is made for these discussions*. CTCC held student-led discussions almost every week, which usually centred on the consequences of certain scientific

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[77] Quoting Bas, field notes from BBE Lecture 15 (29/03/21).
[78] Field notes from BBE Lectures 3 (22/02/21) and 12 (24/03/21).

or societal interventions; in sharp contrast, almost no discussions were held in BBE, except for questions asked of lecturers at the end of the class, which often focused on the technical details of their presentations.[79]

Therefore, to differing degrees and in differing ways, some scientists-in-the-making *do* disseminate counter-discourses which resist dominant representations of Science as the most authoritative and objective way of knowing and managing Nature-as-resources. This may signal a growing commitment to political engagement that the Anthropocene is fostering among environmental scientists (Latour 2017; Swanson et al. 2015). Furthermore, they challenge attempts to render the Anthropocene technical. I argue that by articulating an engagement with the Anthropocene, Nature, Science, and themselves (as scientists-in-the-making) as *ethical* and *political* entities, these students challenge representations of anti-political governance as "sensible" (Rancière, 2007). They potentially open up a space in which "future alternative imaginaries" can develop (Kenis & Mathijs 2014, 153), allowing "great new fictions that create real possibilities for constructing different socio-environmental futures" to come into being (Swyngedouw 2010, 228; see also Rancière, 1998). Thus, I hope that the circulation of these counter-discourses among environmental science students signals the emergence of articulable alternatives to the apocalyptic and eco-modernist discourses that support the intensification of our exploitation of the earth (Crist 2007, 2013; Swyngedouw 2010; Swyngedouw & Ernston, 2018).

However, these counter-discourses have not been constructed in isolation from governing discourses (Rutherford 2007), and thus echo and reflect certain aspects of each other. I focus here on the capacity of the first two counter-discourses (*Science is political and ethical* and *Nature is not a resource*) to construct a "common world" (Latour 2004, 2018) in which nature is fragile and in need of protection.[80] Many of the students I interviewed worried that the

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[79] The online nature of learning during the pandemic may have also limited the amount of ethical discussion that was possible. As Eline told me, "it's kind of difficult to hold each other accountable when we're not in a classroom context where we really interact with each other so much right now" (follow-up interview: 22/04/21). BBE was also a much larger class than CTCC, and students almost always turned their cameras off, creating an anonymous atmosphere that may not be conducive to debates on ethical responsibility. However, the amount of discussion I observed was also determined by where and how much participant observation I conducted e.g. in BBE *lectures*, rather than in group projects.

[80] See Stengers (2005) and Blaser (2014, 2016) for a critique of attempts to compose a common world, particularly in conjunction with, or by deploying, Universal Science.

Anthropocene as a term may reify human dominance over the natural world; as Eline told me, "I think that [the Anthropocene idea] is also attached to this obsession that we have with ourselves as humans, as being the centre of the universe... [which] is part of the problem that we have". They are therefore wary of what Crist calls the Anthropocene's power to "*act upon* the very reality it purports to merely describe: reinforcing it, sharpening its contours, and, through the extraordinary power of language to mold the world into experience and meaning, ultimately legitimizing… human interference with, and use of, every natural system on the planet" (2007, 52-53). However, their own focus on human culpability for the crisis and nature's fragility shares many of the same assumptions as what Rutherford calls the "one-world discourse" (2007, 295), which constructs a "dominant storyline of the 'fragile earth' under stress from human action and in need of care and protection from an imagined global community" (Macnaghten 2003, 65). In other words, this discourse reproduces Nature as an entity in need of governance (Luke 1999; Peace 2002; Rutherford 2002; Rutherford 2007). Tracks and programmes that take a social science perspective, rather than that of the natural sciences, also reproduced this discourse, creating a shared approach to sustainability on the basis that "the facts that [are] presented these days about our current situation... are impossible to deny".[81] Thus, though their methodologies and epistemologies may differ, the ontology that programmes, teachers, and students share remains the same; Nature is fragile and in need of protection from the Public through the intervention of Science.

Furthermore, these counter-discourses represented humanity as faced with the choice to continue destroying the planet or restricting themselves. In Cato's words, "I don't think [the environmental crisis] has a direct effect on us as humans, but it makes me very sad that we as one species are determining the course of the entire planet". Some interviewees even argued that human overpopulation has disturbed the natural equilibrium of local ecosystems or the planet as a whole, skirting worryingly close to advocating for population control. Vera, for instance, compared humanity's ability *as a species* to adapt to the Anthropocene to that of a "disease that finds a way even if there are vaccines". This discourse echoes colonial and post-colonial justifications for the control of marginalised populations, particularly in Africa (Leach & Mearns 1996), while erasing the impact of the wealthy of the Global North (Rutherford 2007).

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[81] Quoting Arnoud (interview: 26/02/21).

Furthermore, these counter-discourses may reify all humans as equally responsible for the Anthropocene, thus presenting humanity as a homogeneously all-powerful entity, erasing the differentiated responsibilities of certain societies and communities, and reproducing the very anti-politicisation it seems to challenge (Chakrabarty 2009, 2012, 2014; Davis & Todd 2017; Malm & Hornborg 2014; Swyngedouw 2010).

Conclusion

By "studying up" among scientists-in-the-making, I have revealed the entangled and conflicting discourses that are affecting the production of subjects that may someday play a crucial role in our response to the Anthropocene. I have therefore studied "the culture of power rather than the culture of the powerless" (Nader 1972, 289), but also the power relations they are embroiled in, reproduce, and contest. I have argued in this thesis that the three programmes I followed at UU (Climate Physics, Environmental Biology, and Sustainable Development) seek to produce anti-political scientists-in-the-making. Teachers and course materials overwhelmingly present the Anthropocene as an issue that must be tackled in order to avoid apocalypse, but only through methods considered "sensible", and which continue to manage nature for human benefit. Science is naturalised as a non-political way of governing Nature and Society "in accordance with the order of things" (Foucault 2008, 311). This reifies scientists as the ultimate knowledge producers about, and stewards of, Nature-as-resources; and represents Society as in need of scientific governance in order to limit human impact on the environment. Thus, classes construct environmental science as an anti-political machine (Ferguson 1994) that erases the political causes that underly the Anthropocene in order to deploy technical fixes (Li 2007a, 2007b, 2011). This fosters an anti-political response to the Anthropocene, where contests over diverging futures and the ideologies that inform them are replaced by the production of consensus to expert techno-managerialism (Rancière 2007; Swyngedouw 2010; Youdelis 2020). Ways forward seem to be limited to the deployment of "sustainable" technology or vast geo-engineering projects, while alternative futures are rendered invisible and inarticulable (Veland et al. 2018; Yusoff 2016).

The construction of this anti-political machine is bolstered by the production of anti-political subjects on the individual level. These programmes seek to shape students into two types of scientists-in-the-making: disengaged theorists who analyse the world rather than intervene in it; and pragmatic solution-finders who prioritise technical policymaking and technological fixes over deeper questioning of our current ways of being. Furthermore, a disciplinary norm circulates among all programmes that diminishes subjective opinions in favour of "objective fact". This bolsters the production of Science as a consensual, non-political, and indisputable

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regime of truth (Swyngedouw 2010). Many students reproduce this regime of truth, particularly in their reliance on science to determine which environmental practices to incorporate into their daily lives. Thus, even when some teachers argue in favour of reducing carbon emissions rather than deploying geo-engineering methods, as Madelief told me, this is internalised by most students as the responsibility of individuals alone, rather than a call to collective action.

However, in comparison to the Panoptical sites of education where a younger Foucault argued governmentality had unbridled power to produce "docile bodies" (1995), I have found that some students contest these dominant discourses and re-politicise the Anthropocene. Their exposure to discourses outside of their programmes leads them to question Science as the objective and non-political governor of Nature-as-resources. Furthermore, contra dominant representations of scientists as value-neutral and removed from society, many of them articulate a deep sense of responsibility that informs their everyday practices and envisioned futures. These students actively share these counter-discourses with their peers. Nevertheless, I have highlighted and problematised how representations of Nature as fragile and in need of protection from humans may compose a "common world" (Latour 2004, 2018) in which humanity is considered either the planet's steward or its destruction, and the differentiated responsibility of different communities for the Anthropocene is erased (Chakrabarty 2009, 2012, 2014; Davis & Todd 2017; Malm & Hornborg 2014). However, the composition of a common world may be interrupted by the third counter-discourse, as it problematises Science's representation of the Global South as a place in need of governance, rather than a source of learning.

The qualitative, bottom-up approach I have taken to governmentality centralises subject formation among individuals, and thus the ways in which governmentality is never completely successful, but is adapted and disrupted by its subjects (Agrawal 2005; Dupont & Pearce 2001; McKee 2009, 2011; Rutherford 2007; Skinner 2012). The contingency of these emergent subjectivities was made clear to me by how specific my findings are to both a certain place (environmental science classes being taught at UU) and a certain *time*; not only are these scientists-in-the-making being formed in the midst of the Anthropocene, but also during the COVID-19 pandemic. This was reflected in the online nature of learning during fieldwork, and in the frequent mentions of the virus among my participants. Furthermore, I have attempted to avoid characterisations of students as either a subject *or* a challenger of governing discourses in

order to show that governmentality does not construct a single subjectivity. At certain times and in certain spaces, some students articulated dominant discourses; and in others, they articulated its counter. Thus, their subjectivities are constantly emergent and shifting. As in all ethnographies, the people I talked to and observed escaped both subjectivisation by governmentality and easy categorisation by the anthropological gaze (Rutherford 2007).

However, I also acknowledge that my research is marked by certain limitations; most glaringly, my inattention to gender, racialisation, and other modes of marginalisation. Though I am aware that "[not] all bodies are incorporated into systems of rule in the same ways" (Rutherford 2007, 292), a thorough analysis of this lies outside of the scope of my thesis. Furthermore, while I initially intended to compare my findings to how the environmental sciences have been taught before the Anthropocene became a "matter of concern" (Latour 2004), I struggled to gain access to the teachers and old course material that would have allowed me to do so. Because the pandemic made it difficult to build rapport with these teachers, I have also overlooked the position of these educators in pedagogy, particularly their own ethical and political engagements with the Anthropocene. Moreover, as I became more interested in the discourses that circulate inside the university's *classrooms* specifically, I decided to limit my research to interactions between students and teachers alone, rather than following the movement of these discourses outside of the classroom. All of these represent promising avenues for future research.

The pandemic also made it difficult to analyse offline spaces in conjunction with the online sphere, which is essential when conducting ethnography digitally (Bond & Agnew 2016; boyd 2008; Hine 2015; Kozinets 2009; Snee et al. 2016; Stirling 2016). Furthermore, I have struggled to create a sense of the online classroom as an ethnographic space because of the ways in which it limited interactions between students; in fact, even teachers seemed to find it difficult to create a space for discussion online. I have tried to address this sense of detachment by foregrounding students' voices as much as possible, drawing primarily on their own words.

I have also had to reckon with my own positionality in the research. Just as scientists and scientists-in-the-making construct "facts" about nature, I am constructing "facts" about *them* (Latour & Woolgar 1986). This is inextricable from my own subjectivity and situated knowledges as a white, middle class, western European student, and a part of the western academy that has erased other ways of seeing the world (Davis & Todd 2017). In an effort to

keep myself accountable, I sent my participants a draft of this thesis before I submitted it. I hoped that seeking feedback from students would enable them to resist my attempts to construct them into certain kinds of subjects, or would at the least open up a space for further dialogue between us. I found this process incredibly valuable; though only seven interviewees responded to me, they added nuance to my arguments (particularly regarding the rendering technical of the Anthropocene) while agreeing with many of my findings.

However, asking my participants for feedback was also a source of trepidation, and echoed some of the issues that troubled me throughout my time in the field. I struggled to balance my worry that I was influencing participants into becoming more political against my deeply held beliefs about how we should act in response to the Anthropocene. Comments from students like Madelief, who joked that "maybe it's time for me to join an anti-capitalist action group" in her feedback to me, did nothing to assuage this fear. Nonetheless, I have been inspired and heartened by the attempts of some of my participants to re-politicise Science and the Anthropocene, and I hope that their efforts foster the creation of "great new fictions" (Swyngedouw 2010, 228) that trouble the extractivist, techno-managerial governmentalities that now reign.[82] As Jeb told me in one of the first interviews I conducted: "it's always weird in climate science that they talk about the need for systemic change, and then I wonder, systemic change for what? You need systemic change to keep the world the way it is? Or do you need systemic change to change how the world really *is*? And those are two very different things". I can only hope that the scientists-in-the-making I met, the university, and my own research contributes to a true transformation in how we inhabit and create knowledge about this new Anthropocenic world.

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[82] Though Rory informed me of it as I was finalising this thesis, and a full analysis therefore lies outside of the scope of my study, I want to highlight here an open letter sent by SD students to the faculty critiquing the programme's erasure of alternative knowledges of, and responses to, the Anthropocene (see Appendix 5). I see it as a sign that the counter-discourses I identified may be growing in influence; not only does the letter forward an anti-colonial and anti-capitalist perspective, but it also directly engages with their own responsibility as scientists-in-the-making, as well as how the hierarchisation or erasure of knowledges restricts how we envision the future.

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Appendices

Subject formation among environmental science students in the Anthropocene.

January 11, 2021; Utrecht.

To whom it may concern,

Through this letter I would like to ask your permission to participate in the research "Subject formation among environmental science students in the Anthropocene". The purpose of the research is to investigate the effects discourses of environmental crisis are having on the subjectivities of students in order to answer the research question "How are the subjectivities of Utrecht University students being affected by their study of environmental sciences?". I am especially interested in why students decided to study environmental science, and how the discourses they encounter in class are shaping their environmental subjectivities and practices, creating certain visions of the crisis: who is to blame, how should it be managed, and what will the future be like. This research is part of my master in Cultural Anthropology: Sustainable Citizenship at Utrecht University, and will lead to a research thesis which will be published internally.

What is expected of you as a participant?

I would like to interview you as part of this research. This will comprise of a 45 minute- to an hour-long semi-structured interview about why you chose to study an environmental science, and the experiences and knowledge of the environmental crisis you have gained in and outside of education. If you would be interested in discussing this further, I would like to create several life histories of students willing to be interviewed multiple times over the next few months. I also

plan to interview students at the end of Period 3 in order to make comparisons between their statements at the beginning and end of a class. If you are interested in either of these, please let me know.

However, the gravity of the environmental crisis may mean that discussing it will have a negative impact on your mental health. As I will remind you below, you are under no obligation to continue with the interview if you feel troubled or overwhelmed.

Furthermore, I cannot offer any compensation for your time other than sharing my research and its findings with you, if you are interested in them. If you would also like to be credited by name in my thesis, either in the acknowledgements or if you are quoted, please let me know. Otherwise, I will anonymise all the data in order to make it impossible to identify you as a research participant.

Confidentiality of data processing

This research requires me to collect your personal data, along with recording the interview. I need this information to be able to answer the research question properly, or to be able to approach you for follow-up research. The personal data is stored on a different computer than the research data itself (the so-called raw data). The computer on which the personal data is stored is secured to the highest standards and only involved researchers have access to this data. The data itself is also secured by means of a security code.

Your data will be stored for at least 10 years. This is in accordance with the appropriate VSNU guidelines. You can read more information about privacy on the website of the Personal Data Authority:

https://autoriteitpersoonsgegevens.nl/nl/onderwerpen/avg-europese-privacywetgeving

Voluntary participation

Participation in this study is voluntary. You can discontinue the interview at any time, without giving a reason and without any adverse consequences for you. Only the data collected up to

then will be used for the research, unless you explicitly indicate that you do not want this. Furthermore, if the conditions of the interview change, you will have the opportunity to review and renegotiate your consent.

Independent contact person and complaints officer

If you have questions or comments about the study, you can contact my project supervisor, David Henig, at d.henig@uu.nl. If you have an official complaint about the investigation, please send an email to the Complaints Officer at klachtenfunctionaris-fetcsocwet@uu.nl or contact the UU Data Protection Officer at privacy@uu.nl.

If, after reading this information letter, you decide to take part in the investigation, please sign the enclosed reply strip and hand it to the investigator.

Kind regards,

Aoife Mac Donnchadha.

Appendix 2. Information Letter for Participant Observation

Subject formation among environmental science students in the Anthropocene.

January 11, 2021; Utrecht.

To whom it may concern,

Through this letter I would like to ask your permission to participate in the research "Subject formation among environmental science students in the Anthropocene". The purpose of the research is to investigate the effects discourses of environmental crisis are having on the subjectivities of students in order to answer the research question "How are the subjectivities of Utrecht University students being affected by their study of environmental sciences?". I am especially interested in why students decided to study environmental science, and how the discourses they encounter in class are shaping their environmental subjectivities and practices, creating certain visions of the crisis: who is to blame, how should it be managed, and what will the future be like. This research is part of my master in Cultural Anthropology: Sustainable Citizenship at Utrecht University, and will lead to a research thesis which will be published internally.

To do so, I would like to conduct participant observation in class. This means that I will join classes in order to investigate how students interact with each other, with their professors, and with the material they are learning.

I cannot offer any compensation for your time other than sharing my research and its findings with you, if you are interested in them. If you would also like to be credited by name in my thesis, either in the acknowledgements or if you are quoted, please let me know. Otherwise, I will anonymise all the data in order to make it impossible to identify you as a research participant.

Confidentiality of data processing

This research requires me to collect your personal data. Furthermore, I may take screenshots in the case of online participant observation (with permission from those involved). I need this information to be able to answer the research question properly, or to be able to approach you for follow-up research. The personal data is stored on a different computer than the research data itself (the so-called raw data). The computer on which the personal data is stored is secured to the highest standards and only involved researchers have access to this data. The data itself is also secured by means of a security code.

Your data will be stored for at least 10 years. This is in accordance with the appropriate VSNU guidelines. You can read more information about privacy on the website of the Personal Data Authority:

https://autoriteitpersoonsgegevens.nl/nl/onderwerpen/avg-europese-privacywetgeving

Voluntary participation

Participation in this study is voluntary. You can revoke your consent to be observed at any time, without giving a reason and without any adverse consequences for you. Only the data collected up to then will be used for the research, unless you explicitly indicate that you do not want this. Furthermore, if the conditions under which participant observation is being conducted change, you will have the opportunity to review and renegotiate your consent.

If you are interested in participating more and discussing your own views in a one-to-one setting, I am also looking for interviewees for 45 minute- to an hour-long semi-structured interviews. So if you would like to talk about why you chose to study an environmental science, and your experiences and knowledge of the environmental crisis, please let me know.

Independent contact person and complaints officer

If you have questions or comments about the study, you can contact my project supervisor, David Henig, at d.henig@uu.nl. If you have an official complaint about the investigation, please

send an email to the Complaints Officer at klachtenfunctionaris-fetcsocwet@uu.nl or contact the UU Data Protection Officer at privacy@uu.nl.

If, after reading this information letter, you decide to take part in the study, please sign the enclosed reply strip and hand it to the investigator.

Kind regards,

Aoife Mac Donnchadha.

Appendix 3. Statement of Informed Consent

I herewith declare to have read the information letter concerning research on 'Subject formation among environmental science students in the Anthropocene' and to agree to participate in the research.

Name

Date

Both the first set and the follow-up interviews consisted of semi-structured, open-ended questions, which allowed me to adapt my questions throughout the interview and the fieldwork period. For the follow-up interviews, I tailored questions specifically to each interviewee, rather than creating a more general topic guide; thus, I have only included the first topic guide I created here.

Introduction

- Introduce self, outline research topic, background information on purpose of the study, check for informed consent

Opening Topic

- Participant's age, gender, nationality, how long they have studied science and when they began to specialise in the topic they are currently studying

Discussion

- Motivation for studying science; motivation for following their current master's programme
  - Linked to an interest in the environmental crisis/ protecting nature…?
- Origins of interest in science
  - From education system/ family/ friends/ particular media…?
- Their place in the scientific community
  - Do they feel welcome in their discipline?
    - Role of gender, race, class, religion, ability, sexuality; I will ask whether they feel that some aspect of their identity marks them off from rest of the discipline, but I will let them choose which markers to share
  - Do they feel like part of a local/ national/ international/ global community of scientists?

- Connection to Utrecht/ the Netherlands; are they interested in embedding themselves in the Netherlands, or anticipating moving away?
- Description of what/ how they are learning in their master's programme
  - Do they think their course material/ teachers are fostering a certain viewpoint? Do they agree/ disagree with this viewpoint? What do they think of their classmates' views?
- Their opinion on the role of science in the environmental crisis/ the Anthropocene
  - Opinion on the environmental crisis
    - How do they think of the environmental crisis/ the Anthropocene?
    - Emotional reaction => why do they feel that way?
    - Do they separate their emotional reaction from a more 'rational'/ scientific view?
    - Do they base a more 'rational' view on what they are learning in class?
    - Have the ways in which they think/ feel about the environmental crisis changed since they began studying science? Since they started this master's programme?
  - How do they view the future? Hopeful/ pessimistic? Do they have particular visions, or are they uncertain? Why?
  - What do they think of as possible solutions to the environmental crisis/ the Anthropocene?
    - Do they think science will play a role? What about their discipline?
      - Do they categorise science as a positive or negative in dealing with the environmental crisis? Why?
- Their own place as a scientist-in-the-making in the Anthropocene
  - Do they feel responsible for producing scientific knowledge in order to discover more about/ manage/ protect nature/ humans?
  - Do they link their studies to (learning more about/ tackling) the Anthropocene?
- Environmental practices and beliefs beyond their studies
  - Do they engage in environmental practices? What kind? Why?
    - Lifestyle changes e.g. 'going green': diet change, carbon-neutral transport, recycling, change in consumer habits, awareness of carbon footprint.

- Collective action e.g. strikes and marches, petitions, online activism, contacting/ voting for political representative etc.
    o Do they feel they do enough?
    o Has the amount they do changed since they began their master's course? Why?

Winding Down

- Anything participant wants to add?
- Positive note:
    o Point out avenues to join local green organisations e.g. Green Office UU

After the Session

- Explain how the information will be used and stored
- Thank them for their contribution
- Wait in case of doorstep data

(reproduced with the permission of the signatories; thank you to Rory in particular for alerting me to its existence)

As students of the Sustainable Development Master program of Utrecht University, we believe that the curriculum needs to be updated to account for two crucial components of sustainability that can easily be considered absent in the program:

1. A critical understanding of the colonial aspects of mainstream research, and its critique within anti-colonial approaches
2. A general inclusion/integration of alternative (namely, non-European) perspectives to the concept of sustainable development.

How the course frames SD

The master's programme Sustainable Development is "aimed at students who want to contribute to the design of the solutions needed to achieve an environmentally and socially accountable society".

This goal is said to be achieved through an education in "how to analyze the processes associated with change and will consider the short- and long-term management of these processes on local and global levels." This description of the course is presented as achievable through a directed focus on the understanding and management of global systems at a variety of spatial scales, capable of challenging damaging socio-environmental processes.

Our courses regularly emphasise that sustainable development issues need to be understood from a systems perspective; it logically follows that the global social systems and structures which relate to the subjects we study should therefore be included. The consumption and production systems, humans' relationships with nature, societies' impacts on the natural environment, as well as governance frameworks that surround this, do not exist in regional vacuums. However, despite some discussion on the global interconnectivity of these systems, the implications of these relationships are lost and reduced to generalisations. This initial observation is addressed throughout the letter and framed around the fundamental questions we seek to discuss: whose knowledge is actually being prioritised in this programme, and how is this distributed across the course content? We believe a failure to include a range of perspectives, namely non-Western and

anti-colonial, risks the exclusion of other more marginalised forms of knowledge, essential for a holistic understanding of environmental change.

Background on the importance on different perspectives

Development is a naturally occurring process - plants, animals, and humans develop1. It is also a cyclical process in nature. However, when applied in the last 70 years to our economic system, it has become a linear and unlimited process based on economic growth. In summary, we started considering industrialisation and capitalism as a synonym for development, and equally as a synonym for well-being. Our argument sides with many critical scholars2 3 4 5that the concept of sustainable development can be considered antagonistic to the concept of socio-environmental justice. Therefore, socio-environmental justice should also be a holistic concept to be presented and debated in our masters. This view still accepts and engages with diverse and sometimes opposing views on environmental matters - adaptation versus mitigation, different conceptualisations of justice, reparation, aid, etc., presenting a rounded understanding of issues.

The industrialisation of the Global North, however, is already proven to have been based on the extraction of natural resources and appropriation of materials, and labor from the Global South6 7 8. The Great acceleration perspective9 also showed that high-income countries are responsible for 10 excess global resource use and are therefore the main drivers of ecological breakdown. Scholars previously mentioned in the citations argue such processes still largely exist in the colonial structures and relationships that provided the means for the European development through the Industrial Revolution. Moreover, it is something that needs to be addressed but is largely absent in our curriculum. The fact that "sustainable development" has arguably never happened outside of colonial structures, and even then only continues to do so in a post-fossil-fuel-technology society11 is barely touched upon in class debates brought up by professors and lecturers.

Some students in the course are aware of the efforts made by employees of the Copernicus Institute to address the issues regarding colonial structures and sustainable development. We also appreciate the opportunity to talk about these concepts and alternative solutions and we have been self-organising to fill the gaps from the program12. However, these employees and students

and their initiatives are not visible to all master students. Also, individual employees or specific students should not have to be the sole supplier of alternative knowledge to students, but the programme, in a structured way.

The amount of scientific evidence piling up against taking capitalism for granted13 or against the oxymoronic idea of sustainable growth is too substantial to be disregarded in a master's of socio-environmental science, aiming to prepare the future leaders of a sustainability transition.

The decision to only focus on one avenue of research on environmental and social change risks the exclusion of already-marginalised knowledge, and the furthering of silo thinking which fails to critique SD as a concept. Therefore, presenting a hierarchisation of knowledge and limited variety in the types of action capable of addressing current socio-environmental crises, risks the perpetuation of exploitative and damaging colonial systems of mainstream development.

Programme specificities: solutions as only Western in origin

This programme calls on us to seek a broadened and critical view of environmental systems, paving the way for new environmental futures. However, in the introductory courses, we only have one lecture on these approaches, all compiled into one thirty-minute slot. Additionally, there are no other modules or tutorial opportunities, for those inspired by this lecture to further advance in this debate. This presents clear oversight and disregard for the importance placed on these alternative and critical forms of knowledge. By choosing what to focus on and what not to present, a clear decision is made on what knowledge is more valuable. Moreover, alternative approaches are rarely, if ever, presented (as viable) within the lectures of other modules and courses undertaken during this first year of the programme. **The ability to also recognise the validity of these alternatives within discussions presents an open-minded and critical approach, which is crucial in academic debate**.

Despite the evidence piling up on the damages of green growth around the world14 15, students of this programme remain blind to, and excluded from, capabilities to challenge this. One poignant example of this is the new lithium technology of electric cars, plundered from Indigenous regions of South America.16 A classical SD approach praises the beneficial growth

of electric vehicles, without a global understanding of the implications of such a development. This knowledge therefore proves valuable, not only for those undertaking social science tracks, but also those within Energy and Materials and Environmental Change and Ecosystems courses. This is just one example, out of many others, for the types of arguments that should be presented from decolonial approaches. The ability to understand these other arguments is therefore invaluable in being able to fruitfully understand the global systems, drivers and complexities of environmental destruction **globally**.

What is the ultimate goal of SD and who is it for?

The education provided to students in a master programme such as this, should ultimately provide society with a selection of actors, capable of challenging damaging societal practices and seeking change. If this is the goal of the programme, what change does this programme actually envision, and who do they see as beneficiaries? If the knowledge prioritised fails to expand all possible thoughts and movements of change globally, this master will always be limited in what it actually wants to achieve.

Exposure to, and *integration* of alternative perspectives, from societies or groups or schools of thought born from different frameworks of reality, histories, ways of organising, etc., opens our boundaries of thinking and provides many more possibilities/tools to help formulate and implement solutions for a more sustainable society. Does SD see a sustainable 'society' only in the context of the Global North? Then this should be made clear, both to students, in the description of this programme, and more generally. Students should be aware that this programme is choosing not to give emphasis to the global structures and processes, historically and contemporarily, which have contributed to development, and associated environmental destruction, as we see today. More specifically, it should be clear that socio-environmental change and the presented solutions are based on a biased and predefined Western frame, one which cements predefined ways of life, relationships between humans/nature, and one legitimate pathway of development. To achieve a more sustainable society, both regionally and globally, we need to address all parts of the system that are unsustainable, a central part of which are the problematic (neo)colonial relationships today that govern, overtly or covertly, directly or indirectly, many political and economic interactions, particularly in the context of development

'solutions'. Thus, our position presents the demand for a programme in which we feel like we have all the possible tools at our disposal to seek meaningful change. The decision to include certain knowledge, at the expense of others, is a decision to state what is more *valuable*. We hope this letter, together with a small selection of recommendations, presents insight into the issues we have had thus far, and the hope we have for the rest of our master course, and those undertaking it in the future.

Suggested action points:

Short term:

- Expanded reading lists - including degrowth, non-Western scholars across all modules
- Guest lectures and tutorials available on these subjects across the tracks starting as soon as possible
- Resources on these perspectives should be provided in all (relevant) courses, so that students are free to pursue these in their assignments and are provided with the knowledge to do so (even when these topics are not yet explicitly addressed in the course). This also relates to sharing talks, conferences, academic blogs, and other sources aside from articles, that could benefit accessing this knowledge outside of lectures (as is done with dominant SD resources).
- Debates on the underlying power structures and responsibilities in the creation, analysis and dissemination of knowledge and action in lectures completely dedicated to these issues, as well as in those lectures where dominant SD knowledge is the focus.
- The development of a temporary committee for integrating these perspectives, including faculty and student representatives, to further plan the specificities of changes.

Long term:

- Creation of modules focused on decolonial and critical theories and debates

- Department commitments to inclusion of non-Western (and) de-colonial or critical approaches
- Long-term strategy for the redesign of the SD programme with these considerations in mind

Respectfully,

The signatories