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Conflicting Temporalities and the Ecomodernist Vision of Rewilding

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Conflicting Temporalities and the Ecomodernist Vision of Rewilding

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Abstract Ecomodernism offers a progressive and humanist vision of the Anthropocene, one in which publicly funded innovation has made possible both universal prosperity and planetary-scale rewilding. However, given the present primitive state of technology, ecomodernism is surely guilty of fabulism as its realisation would depend on technologies that may not be available for many decades. Despite this, ecomodernists argue that there is an overriding moral imperative to accelerate the transition to a fully integrated high-energy planet even if this accentuates the short-term need for solar radiation management. The aim of this chapter is to review the debate between ecomodernists and traditional environmentalists in relation to these conflicting temporalities. It is suggested that science may be of surprisingly little help in settling the underlying macro-political disputes.

1 Introduction

Considering how far we have come as a species over the last two or three hundred years, it would be very sad if the journey would end here. Or if the rest of the journey would be only for the few, leaving behind a planet that has been made largely unrecognisable and uninhabitable. It is thus not surprising that the natural impulse is one of scaling back (Crist, 2018), to think that there is a way of unmaking modernity and harmonising society with non-human nature. According to ecomodernism (Asafu-Adjaye *et al.*, 2015), that impulse however is fundamentally misguided. As a progressive and humanist vision of the future, ecomodernism instead suggests that only by doubling down on an Enlightenment trajectory of democratically guided scientific progress will it be possible to meet global human needs while restoring an ecologically vibrant planet (Symons, 2019).

Essentially, the ecomodernist vision is about reaffirming pluralism, about envisioning an open-ended future where some can be punk rockers and others stockbrokers, where people can live different lives and where the human condition can remain as contradictory and confusing as ever. Whereas traditional environmentalism seeks to impose a singular ethic of sustainability (Curren & Metzger, 2017), ecomodernism is cautioned by historical attempts to ensure ethical homogeneity and social purity. Rather than to fundamentally remake or rewire humanity, the ecomodernist vision seeks to reconcile the broad emancipatory forces of the last centuries with the natural environment through publicly funded breakthrough innovation. Yet, given the current primitive state of technology, ecomodernism is here surely guilty of fabulism and its optimism about the future may appear "not just self-delusional but outright dangerous" (Arias-Maldonado, 2018:139).

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To make any sense, ecomodernist optimism has to be looked upon from the vantage point of the deep future, when technology exists to freely manipulate matter at the molecular level (Umbrello & Baum, 2018), rendering both the production and transportation of material goods unnecessary and when abundant energy has not only overcome practically all forms of environmental determinism but also made possible climate restoration (Dorr, 2016). Fantastic or even unrealistic as such a future may seem, ecomodernism is premised on the view that the *relative* distance from where we are today to that future is far shorter than the distance to anything remotely resembling "sustainability" as conceived by traditional environmentalism. In this, ecomodernism is in fact founded on a grim reading of current environmental trends which fully acknowledges the risk of catastrophic climate change (Pereira & Viola, 2018). If long-term sustainability could be achieved by, say, a twenty or thirty per cent reduction in economic activity, then "degrowth" would be the obvious and preferable response (Kallis *et al.*, 2018). Yet, in a world of almost eight billion people, the level of depopulation and economic contraction needed is so great that it would be politically and socially unfathomable, especially in the light of competing national interests and widely shared material aspirations.

As such, rather than seeing a more integrated world as a threat to sustainability (Myers & Kent, 2003) and erecting new barriers to migration (Cafaro & Staples, 2009), ecomodernism takes the opposite view, that only in an open world of equal opportunities will it be possible to summon the political momentum necessary for effective environmental action and avoid the kind of costly distractions over migration policy that have nearly derailed liberal democracy itself in recent years. Captured in the metaphor of the "high-energy planet" (Karlsson, 2018), ecomodernism seeks to fully eschew Malthusian reductionism and its polarising demand-side framing of environmental problems and replace it with a unifying commitment to a supply-side energy revolution (Shellenberger *et al.*, 2008). Yet, it is clear from the onset that there is a considerable temporal distance between the present and the hypothetical fruits of that revolution. In the meantime, any attempt to take global development seriously would lead to further emissions overshoot and accentuate the need for controversial forms of climate engineering.

The aim of this contribution is to problematise these conflicting temporalities and, in particular, their implications for non-human nature. However, prior to that, the terms of the debate between ecomodernists and traditional environmentalists is reviewed with an emphasis on the controversy surrounding nuclear energy. On this basis, it is then argued that science is of surprisingly little help when it comes to settling these macro-political disputes or for determining what should count as empirical evidence of failure and success respectively. The chapter concludes by suggesting that, as the environmental crisis worsens, the stakes in these debates are likely to rise further yet, with both nuclear energy and proposals for climate engineering taking centre stage.

2 The terms of the debate

With regards to non-human nature, ecomodernism[2] represents a philosophical shift from the *management* of nature to the *liberation* of nature (Symons & Karlsson, 2018). In the very long run, ecomodernism envisions a comprehensive decoupling of the economy from the environment, either through atomically precise manufacturing or large-scale space colonisation. In the meantime, ecomodernists propose a gradual substitution of natural products with synthetic ones and the use of

[2] For the purpose of this chapter, I have used *The Ecomodernist Manifesto* from 2015 as the primary source of what ecomodernism entails (Asafu-Adjaye *et al.*, 2015). The manifesto was an effort to forge a consensus position among 18 leading ecomodernist thinkers. This means that I do not specifically engage with post-ecological perspectives but rather build on the seminal work of Martin Lewis (1992) with regards to the politics of non-human nature.

agricultural intensification in order to spare marginal lands. In essence, while traditional environmentalism seeks to re-embed society in nature, ecomodernism advocates *greater separation* as a pathway to planetary-scale rewilding.[3] Among its critics, this idea has been misunderstood as some kind of opposition to family farms or wilderness hikes whereas it is only about minimising large-scale interventions in nature, such as those caused by mining, forestry or energy production. Similarly, other critics have suggested that ecomodernists "celebrate the end of nature" (Fremaux & Barry, 2019:10) when a more open-minded reading of ecomodernist texts would make it clear that what is driving the ecomodernist project in the first place is precisely a moral concern for non-human nature and a desire to end human domination.

Beyond such elementary misunderstandings, ecomodernists diverge from traditional environmentalists in how they understand the broader cosmic setting of the human enterprise. Early pioneers of what is today known as ecomodernism, such as the 2019 recipient of the "Breakthrough Paradigm Award"[4] Stewart Brand, expressed a keen interest in space colonisation (Brand, 1977; McCray, 1993), a prospect that fundamentally alters the ethical context in which the ecological crisis is to be understood (Gott, 1993:319). Rather than accepting the subtractionist understanding of traditional environmental ethics in which the best would be for humanity not to exist, the possibility of humanity becoming a multi-planetary species and thereby securing not only its own long-term survival but that of life more generally, profoundly recasts the terms of the debate. Similarly, when taking an astrobiological perspective (Frank & Sullivan, 2014), today's changes in atmospheric chemistry become less of a final verdict on the moral failures of humanity and more of fairly predictable stumbling blocks on the road towards becoming a technologically mature civilisation.

Introducing such alternative end-points also makes it far more difficult to determine what is actually promoting versus impeding sustainability in the present. For instance, "luxury" emissions from aviation may turn out to be essential for driving aerospace innovation while demand for "unnecessary" consumer electronics may lay the foundation for the next revolution in electronics. All this brings back the argument over the *relative* distance towards a long-term sustainable socio-ecological regime, especially in the context of world politics with its deeply fractured epistemologies. Whereas a traditional vision of sustainability would always remain threatened by re-emerging unsustainable practices and its regime of ecological austerity would have to be policed indefinitely, the ecomodernist vision is about finding long-term solutions that are inherently compatible with the "broken timber of humanity" to speak with Immanuel Kant. Instead of rationing the consumption of individual natural resources at the local level, ecomodernism sees the wise use of resources as a stepping stone to a global post-scarcity future in which resource extraction has either become unnecessary due to atomically precise manufacturing or can take place outside the biosphere. While probably not entirely historically accurate (York, 2017), ecomodernists often use the example of whale oil to illustrate this point about the transformative role of technology and how, instead of politically determining what would be a sustainable rate of whaling or trying to "correctly" price the ecological services provided by whales as suggested by neoliberal conservationism (Büscher *et al.*, 2014), technological innovation ultimately rendered whale oil obsolete as a fuel. According to ecomodernists, the example of whale oil fits into a larger narrative which suggests that humans primarily spare nature for which they have little practical use (Blomqvist, Nordhaus and Shellenberger, 2015) and, as such, the path to ecological flourishing does not go through better valuing nature in monetary terms but instead through

[3] For ecomodernists, rewilding is a future-oriented process by which land is returned to nature and the degree of human intervention and management is reduced. For a broader conceptual discussion, see Gammon (2018).
[4] The Breakthrough Paradigm Award is an annual prize offered by the Oakland-based ecomodernist think tank *The Breakthrough Institute*.

technological innovation that makes nature economically *less* valuable. Ecomodernists also note that, as societies become more affluent, post-materialist values tend to become more pronounced and the ability to set aside land for conservation purposes increases.

Ecomodernist criticism of traditional environmentalism often comes down to debates over scale. For instance, while residential photovoltaics may be sufficient for powering household appliances or charging personal electronics and thus give an optical illusion of decarbonisation, that says very little about the energy needed to build the house in the first place or the energy embodied in the different consumer products. This is why the concept of "Energy Return on Investment" or EROI has become crucial for ecomodernist thinking as it engages with the question of what technologies could facilitate a rapid global decarbonisation (Karlsson & Symons, 2015). Reviewing historical emission trends and to what extent alternative energy sources have actually succeeded in displacing fossil fuels (Cao *et al.*, 2016; Loftus *et al.*, 2015; York, 2012), it is worth noting that sustained reductions that would be proportionally commensurate with the targets of the Paris Agreement have so far only come from two sources, either from economic contraction or the deployment of nuclear energy. Calculations suggest that if the rest of the world would be able to replicate the build-out of nuclear energy in Sweden and other leading countries in the 1970's, fossil-fuel electricity worldwide could be displaced within a couple of decades (Qvist & Brook, 2015). In contrast, and despite a much publicised effort, the German "Energiewende" based on renewable energy has not led to any significant decarbonisation as emissions have stayed roughly flat since its inception in 2011, prompting the German government to admit that it will miss its 2020 climate target. The intermittent nature of renewable energy sources mean that they depend on fossil fuels for load-balancing while their low EROI (which becomes even lower in case batteries are used for load-balancing) make them incapable of doing the heavy lifting needed to decarbonise the global economy as a whole (Moriarty & Honnery, 2016). Often discussions over these issues tend to get stuck over particular technical details or price estimations that are taken out of context. For instance, it is not uncommon for authors who advocate a post-capitalist future to dismiss nuclear energy on the basis that it is "too expensive" (Nisbet, 2014) which, after all, is a rather odd concern if the alternative is an end to the economy altogether. Important as these controversies may be, they ultimately reflect different orientations towards the Enlightenment and debates that go back all the way to the making of modernity (McMahon, 2001).

For ecomodernists, access to clean and abundant energy is essential to eradicate poverty through transformative social change and comprehensive modernisation (Bazilian & Pielke, 2013). With regards to nature, a high-energy future is seen as equally crucial for protecting biodiversity and avoiding the kind of energy sprawl associated with renewable energy sources (Trainor, McDonald, & Fargione, 2016). More specifically, ecomodernists point to how mass desalination of sea water for agriculture can spare natural aquifers and how direct air capture of carbon dioxide can restore atmospheric concentrations to pre-industrial levels (Keith, Ha-Duong & Stolaroff, 2006). On their end, traditional environmentalists believe that the planet cannot sustain such energy levels (Moriarty & Honnery, 2009) and that there is an urgent ethical need for an "energy descent" in order to "unlearn abundance" (Alexander & Gleeson, 2019). Again, these are not so much technical debates as they are conflicts between different worldviews and ways of understanding the human condition.

Whereas traditional environmentalists often believe that the future will be marked by crisis and energy scarcity (Friedrichs, 2013), and that community resilience can be strengthened by relocalising the economy and adopting "low-tech" options (Alexander & Yacoumis, 2018), ecomodernists fear that such an outlook may quickly become self-fulfilling. Instead of retreating from the global, ecomodernists see international trade as instrumental for overcoming local scarcity and ensuring food security in times of extreme weather events (Karlsson, 2017). In this, ecomodernists point to the need

for a progressive and coherent theory of globalisation, one that can equalise opportunity and, to quote the mission statement of the Breakthrough Institute, "accelerate the transition to a future where all the world's inhabitants can enjoy secure, free, prosperous, and fulfilling lives". More than anything, it is this commitment to global equality of opportunity that sets ecomodernism apart from existing theories of sustainable development but also mainstream political debate which often rests on the silent assumption that universal prosperity is ecologically impossible. Historically, the construction of modern welfare states has depended on the creation of high-productive off-farm jobs and rapidly rising energy consumption. Ecomodernists see no compelling reason why the developing world should not be allowed to follow a similar trajectory and that, rather than making climate mitigation contingent on the poor never "catching up", ecomodernists argue that global economic convergence should be the natural starting point for all climate mitigation strategies.

One of the most tired tropes of ecological economics is that "infinite growth is not possible on a finite planet". Obviously, in an open universe, that truism becomes slightly less convincing (Bostrom, 2003). The problem however is how to make the transition from where we are today to a prosperous, post-scarcity future in which technology has advanced sufficiently to overcome environmental determinism. Beyond the fictional accounts of *StarTrek*, few attempts have been made to articulate what such a future would even look like.[5] In a post-utopian political landscape deprived of political imagination, visions of a bright planetary future are readily dismissed as hopelessly naïve or hubristic. Part of this dismissal has to do with declining trust in our capacity for collective action. Whereas the same lack of purpose and direction has clearly not befallen the enemies of the Enlightenment (Lilla, 2016), the political Left has long abandoned the Promethean imagination that used to be one of its defining characteristics (Meyer, 2016).

How can the temporal gulf that separates a worsening ecological crisis in the present from a future of ecological restoration and rewilding be bridged? Ecomodernists generally agree that the state is the only actor with both the political legitimacy and institutional capacity to facility the necessary acceleration of science and technology (Symons, 2019). However, in the present, there is no constituency that demands such innovation efforts. Instead, much of the climate debate remains trapped around personal emissions reductions and the relative morality of this or that lifestyle. Similarly, as witnessed most recently at COP24 in Katowice, there is no serious discussion about the energy needs of a universally developed world (Arto *et al.*, 2016) or to what extent the actions undertaken by the most ambitious countries are actually possible for others to replicate (or if their perceived success depends on the offshoring of energy-intensive industries to developing countries). In fact, even accounts that specifically engage with the offshoring of emissions through trade tend to remain focused on how to reduce *consumption* in the rich countries rather than how to make *production* less polluting everywhere. For lack of a better description, the inability to take global scalability issues seriously represents a form of "climate nationalism" that ecomodernists believe distorts the standards by which progress towards the goal of climate stabilisation is measured (Karlsson & Symons, 2015). One flashpoint in this debate has to do with the use of energy forestry which, although perhaps useful for reducing emissions in rich and sparsely populated countries in the Global North, would have far-reaching consequences for biodiversity and food production if used in the tropics (Pimentel *et al.*, 2009). A similar argument can be made surrounding the use of large-scale hydropower which depends on the existence of a finite number of dammable rivers. As such, even if countries like Iceland or Costa Rica may appear to be "climate leaders" with nearly 100% of their electricity supply coming from low carbon sources, that leadership is dependent on unique

[5] For a recent such attempt which, if nothing else, has received considerable traction in social media, see Bastani (2019).

geographical features that other countries do not possess. This helps to explain why ecomodernists so wholeheartedly have come to see breakthrough innovation as the only way that the bourgeoning energy demand of the developing world can be reconciled with the need for effective climate action (Green, 2017). However, the necessary innovation efforts will not happen as long as it is commonly believed that existing renewable energy sources are sufficient to fight climate change or if the richest and most motivated countries were to succeed in partially decarbonising their economies using non-scalable technologies. It is thus not surprising that one of the most heated exchanges between ecomodernists and traditional environmentalists has concerned precisely the feasibility of a 100% renewable energy future (Clack *et al.*, 2017) and the question of what technological pathways that are most suitable for facilitating a deep decarbonisation (Jenkins, Luke & Thernstrom, 2018).

3 Love your monsters

Writing in *Breakthrough Journal*, the French sociologist Bruno Latour argued that rather than running away in panic from the world that it has created, humanity needs to learn to "love its monsters":

> *"But our sin is not that we created technologies but that we failed to love and care for them. It is as if we decided that we were unable to follow through with the education of our children … The dream of emancipation has not turned into a nightmare. It was simply too limited: it excluded nonhumans. It did not care about unexpected consequences; it was unable to follow through with its responsibilities; it entertained a wholly unrealistic notion of what science and technology had to offer." (Latour, 2011:22, 28)*

No monster is more emblematic of modernity than nuclear energy. Despite that civilian nuclear power has historically saved close to two million lives and prevented 60 gigatonnes of carbon emissions (Kharecha & Hansen, 2013), traditional environmentalists typically see it as an undemocratic and ungovernable "mega-technology" (Barry, 2016) which only serves to reinforce the hubristic separation from non-human nature that they believe is the root cause of the ecological crisis (Princen, 2010:82). In contrast, ecomodernists point to the experience of Sweden in particular to show that not only is a high-nuclear pathway eminently compatible with democracy but also capable of producing unparalleled ecological benefits (Goldstein & Qvist, 2019; Pierrehumbert, 2016). Turning the separation argument around, ecomodernists see the relative "disembeddedness" of nuclear energy as one of its principal merits as its high density allows for the production of massive amounts of clean and dispatchable electricity without the need for the kind of large-scale interventions in nature associated with biomass and renewable energy sources.[6] For these reasons, nuclear energy has become increasingly central to the ecomodernist agenda as a way of ending human domination and making room for rewilding, especially in a future with greater global equality.

While there may be some truth to the suggestion that if nuclear energy was discovered today, it would immediately be recognized as *the* solution to climate change, existing nuclear technologies come with the long shadow of the Cold War and are held to standards that are very different from those of fossil or renewable energy sources. While next generation nuclear technologies capable of safely recycling existing nuclear waste and eliminating the need for further uranium mining may assuage some of those concerns (Brook *et al*., 2015), nuclear energy still has a profound *cultural* problem as embracing it also means making peace with the masculinity, artificiality and hyper-rationalism associated with the

[6] The surface footprint of nuclear power is around 2 km^2/GWe compared to 50 km^2/GWe for photovoltaics, 300 km^2/GWe for wind turbines and 2500 km^2/GWe for biomass (Berger *et* al., 2017:65). Note that the footprint of wind and solar is even higher if intermittency is accounted for.

Enlightenment. It is important to recognize how secondary "hard" scientific data is to such cultural concerns. Just as the suburban university professor who takes her Mini Cooper to the Farmers' Market and Instagrams organic produce is seen as a trailblazer of sustainability while the effective altruist in his high-rise eating Soylent is seen as hopelessly estranged from nature, the perceived *unnaturalness* of nuclear energy puts it at odds with prevailing cultural logics and risk perceptions. Similarly, while few people would probably give much thought about biking, many people have intense anxieties about flying even as all "scientific" risk assessments show that flying is infinitely safer.

The democratic use of nuclear energy depends on the existence of a high-trust society and strong professional ethics among those set to regulate it. As such, it is not particularly surprising that small-scale renewable energy sources, even if dependent on the mining of rare earth minerals and a large component of natural gas in order to provide energy when the wind does not blow or the sun does not shine, are seen as a safer bet, especially as overall trust in public institutions is declining. However, in the same way that meaningful social resilience does not come from encouraging individuals to become "preppers" but from strengthening our collective institutions in order to prevent collapse in the first place, ecomodernists see a high-energy future as a way of going all in with regard to globalisation and ensuring that people everywhere have the clean energy needed for comprehensive modernisation. By making fossil and renewable energy sources uncompetitive, ecomodernists also hope that climate risks can be reduced while non-human nature and habitats can be spared. Yet, for many people in the OECD, the vision of an ecomodernist high-energy future does not resonate with everyday experiences. By most standards, a rich country like Norway is already fairly "sustainable" with a stable baseload supply from hydropower. The problem only arises once we imagine that everyone in a world of 8-10 billion people has a right to live in a similar fashion. While the answer from traditional environmentalism has been that this is simply not ecologically possible and that people in the rich countries have to dramatically reduce their energy consumption in order to accommodate developing world growth, ecomodernists believe that proposing such reductions would trigger a strong populist response and that they, more importantly, would end up foreclosing humanity's long-term possibilities as a species (Karlsson, 2016). Essentially, ecomodernists suggest that effective climate policies need to work with, rather than against, the transformative forces of the last centuries in order to lessen international inequalities and reduce the risk that developing countries become trapped in a state of premature deindustrialisation due to the lack of reliable energy (Rodrik, 2016).

Meanwhile, traditional environmentalists have spared no energy in stoking polarisation and attacking what they consider to be a malign global elite (Klein, 2014). In their view, climate change is a moral issue akin to apartheid and their tactics of visual boycotts and divestment protests also reflect this analysis (Mann & Wainwright, 2017:173). Yet, as long as human development remains closely linked to rising carbon emissions, it seems reasonable to doubt the possible success of such tactics. Ecomodernists on their behalf believe that it is crucial to instead restore elite interest in public affairs and reduce overall political polarisation. The Breakthrough Institute in particular has sought to invite conservatives to its dialogue events in the hope of overcoming some of the deadlock surrounding climate policy in the United States. Still, ecomodernist insistence on the role of government in driving innovation inevitably puts it at odds with the dismantling and paralysation of the state that has followed in the wake of Trump presidency.

Given its progressive and cosmopolitan orientation, ecomodernism is naturally opposed to ethno-nationalist populism but also postliberal visions of ecological austerity. Yet, in order to offer a coherent alternative to both these ascending forces, ecomodernism in its turn becomes dependent on an emancipatory or even utopian imagination whose realism can only be evaluated *ex-post*. Far from being some passive belief in capitalism's capacity to deliver a "techno-fix", ecomodernism argues that

a politics of radical engagement and broad social investments are necessary to facilitate a sufficient advancement of science and technology. While some comfort can be found in how unrealistic many of our everyday technologies (from jet planes to microwave ovens) would have seen from the vantage point of the 17th century, that is obviously no guarantee that the same holds true for the technologies needed to make an ecomodernist future possible. Still, when considering the possibilities that could be unlocked by intelligent machine labour (Dorr, 2016:639) or universal access to higher education in a fully globalised knowledge economy, it seems premature to rule out the possibility of an ecomodernist future.

4 Learning in the Anthropocene

All of this again brings to the fore the temporal disconnect between the ecological stress generated by accelerated economic convergence in the present and the possibilities of ecological redemption in the future. To some extent, this disconnect echoes the older debate surrounding the existence of an Environmental Kuznets Curve (Dinda, 2004). Yet, its scope is no longer confined to specific pollutants but pertains to the sustainability of the human enterprise written large.

Considering the current rate of habitat destruction, and rising greenhouse gas emissions, there is little empirical support for the ecomodernist belief in a decoupling of economic growth from environmental impacts. While it is true that demand for a range of natural resources seems to have peaked, and that a *relative* decoupling is occurring across numerous indicators, the *absolute* numbers are not encouraging (Wiedmann *et al*., 2015). Not only does global energy growth continue to outpace decarbonisation (Jackson *et al.*, 2018), but as the oceans fill up with plastics, corals bleach and unprecedented wildfires take their toll, talk of a "Good Anthropocene" may come across as utterly misleading.

Nevertheless, what is under debate is not whether humanity has historically been destructive to its natural environment (it has!) but what long-term planetary trajectory that has the greatest chance of ultimately bringing about sustainability. Here, traditional environmentalism has an obvious advantage in that people can easily imagine that their environmental footprint would be smaller if they somehow "harmonised" with non-human nature (or, better yet, if they stopped existing). Yet, while the Na'vi in *Avatar* may make for excellent science fiction, the political pursuit of such a totalising vision of *Ecotopia* is unlikely to command broad democratic support any time soon. In a world as populous as ours, it is also worth noting that a disorderly "energy descent" would utterly destroy the biosphere as untrained people would go out in nature in search of food and fuel. Thus, it is not surprising that many environmentalists stop far short of deep ecology, arguing that all that is needed is that we all tread a little bit lighter on a planet. However, science lends little support for such an optimistic belief. According to the latest *Emissions Gap Report*, global net emissions would have to fall back to the levels of the mid-1970's (around 25 $GtCO_2e$ per year) to make possible even a 1.5°C pathway (UNEP, 2018), that is to a time when the global population stood at a mere four billion and neither China nor India was industrialised. Yet, by the same token, there is little hope of climate stabilisation even if policies slightly more aligned with the ecomodernist vision were to be pursued by a handful of countries.

Again, the problem is one of scale but also what visions that realistically can inspire decisive global action. According to ecomodernism, it is ethically unacceptable to try to solve the ecological crisis on the backs of the poor by denying them the right to a modern life. Instead humanity must finally make good on the original promise of the Enlightenment and its universal humanism even if this requires a large amount of proactionary risk-taking and temporarily escalating measures of unsustainability. In order to not only trigger ecological mayhem, such an acceleration would have to be matched by determined political action that would in turn require strong civil society advocacy. While some

scholars are beginning to accept the ecomodernist view that small-scale renewable energy is insufficient in the fight against climate change, that does not necessarily translate into support for high-energy innovation but rather even more radical calls for degrowth and a future "defined primarily in terms of frugality, micro-scale localism [and] subsistence" (Trainer, 2012:594). What, if anything, in terms of empirical evidence and feedback would be sufficient to break this impasse?

For long, traditional environmentalists have entertained the belief that humanity would somehow be "saved by disaster" and that, as the material effects of climate change would be felt, support for radical ecologism would grow. Yet, just as the financial crisis of 2008 did not lead to demise of neoclassical economics but rather its entrenchment in the form of public austerity, it is equally possible that people will react to the threat of worsening storms by buying sturdier pickups or voting for politicians who promise to keep climate refugees out. Nevertheless, the same problem of political mobilisation applies with equal force to ecomodernism. Of particular concern to ecomodernism is the risk that piecemeal improvements in energy efficiency, especially in combination with overall deindustrialisation, will further diminish rich countries' interest in financing breakthrough supply-side innovation. As rich countries continue to pick the low-hanging fruit of energy efficiency improvements, it is possible that they will experience sustained emissions reductions for many years, at least relative to GDP growth, and that this will obscure the fact that the core of their economies remains carbon based. Similarly, if ecomodernists are correct that renewable energy is essentially a cul-de-sac with regard to climate change mitigation (Brook *et al*., 2018), it may still take decades to bring about a sufficient policy re-orientation given how invested many governments and NGOs have become in their support for renewable energy and how insensitive they seem to be to evidence of policy failure (Germany here being a case in point).

Even if only one single death has been attributed to the radiation released after the Fukushima accident while millions die from the burning of fossil fuels every year (Landrigan *et al*., 2018), public opinion turned strongly against the use nuclear energy following the accident (Kim *et al*., 2013). This underscores the fragility of a nuclear-centred ecomodernist project. It is likely that a rushed build-out of nuclear energy in response to climate change would lead to accidents and possibly even fatalities. Even if a utilitarian calculation could be used to show how insignificant such local losses would be compared to the devastating global effects of unmitigated climate change, this presents a profound pedagogical problem (not unlike how the focus on counter terrorism operations has come to crowd out efforts to reduce far more realistic causes of preventable death).

The underlying cause of many of these difficulties is the lack of feedback across scale levels which makes learning in the Anthropocene, which is already inherently difficult due to cultural factors and ideologically motivated cognition (Kahan, 2013), even more challenging. Stephen Gardiner famously talked about how the spatial and temporal dispersion of causes and effects invites moral corruption, prompting him to describe climate change as a "perfect moral storm" (Gardiner, 2006). This obviously has profound implications for the prospects of an ideal or optimal response to climate change. One does not have to be a cynic to suspect that neither *Ecotopia* nor *StarTrek* is forthcoming any time soon (Karlsson, 2013). If the time-scales were more compressed, the sense of urgency would presumably be greater. In his "Vulnerable World Hypothesis", the philosopher Nick Bostrom explores a scenario in which the threat of climate change would be even more catastrophic than it actually is. In this scenario, a doubling of atmospheric CO_2 would lead to rapid warming in the range of 15°C to 20°C rather than 3°C (Bostrom, 2018:13). In such a "vulnerable world", there would probably be much less hesitation about a war-time mobilisation to quickly build thousands of nuclear reactors in order to fully decarbonise the economy and capture CO_2 from ambient air. Yet, even in our world, it is still reasonable

to expect that increasingly radical policy options will become more salient in the public debate as the environmental crisis gradually worsens.

A common criticism of ecomodernism is that it is hubristic to believe that humanity can somehow detach itself from the natural world. That argument however rests on the unexamined premise that it is *not* hubristic to believe that humanity can remain entangled in fragile ecosystems that we have long outgrown, both in our numbers and resource use. As the seminal ecomodernist thinker Martin Lewis put it in his 1993 article: "when one considers concrete issues regarding the provisioning of our basic material needs, the separation of the human economy from natural systems turns out to offer profound environmental benefits, while the continued immersion of our apparatus of production into the intricate webs of nature is itself highly threatening to the natural world of non-human species" (Lewis 1993:779). In contrast, belief in traditional environmentalism comes with the assumption that humanity can somehow collectively lessen its appetite in an almost ant-like fashion. Historically, such totalising visions have not fared well. Both Pol Pot's resetting of the calendar to "Year Zero" in Cambodia and North Korean attempts to stamp out capitalist accumulation at the micro-level should provide ample warning for environmentalists. Yet, very rarely do traditional environmentalist writings engage with the question of dissent or how to deal with other countries that reject demands for ecological austerity.

5 Ever higher stakes

If an optimal and timely response to the climate crisis is not forthcoming, there are good reasons to believe that political attention will turn to Solar Radiation Management (SRM) or other forms of climate engineering. Theoretically, stratospheric aerosol injection of sulfate particles can offer "an escape route against strongly increasing temperatures" (Crutzen, 2006:216) should mitigation efforts prove insufficient. While clearly no permanent solution, or a substitute for reducing atmospheric concentrations of greenhouse gases since it would not address ocean acidification, SRM would presumably "buy time" (Wigley, 2006) for mitigation by stemming sea level rise and preventing possibly irreversible damages in terms of biodiversity (Long, 2016).

For ecomodernists, SRM represents a daunting predicament. On one hand, it is precisely the kind of large-scale intervention in nature that ecomodernism revolts against. In addition, the use of SRM would likely reduce the political urgency of developing new supply-side solutions such as next generation nuclear. On the other hand, considering the catastrophic ecological and human losses that SRM has the potential of averting as well as ecomodernism's overriding commitment to development, it would be unethical to reject SRM simply on the basis that it is "unnatural", especially when considering how deeply entangled humanity already is in nature. As such, most ecomodernists probably agree with Joshua Horton and David Keith in that "given the very strong evidence that SRM would significantly reduce global temperatures and thereby limit climate impacts, particularly in the developing world, we view research on SRM as a moral imperative" (Horton & Keith, 2016:90). If nothing else, ecomodernists reckon that such research can be motivated on the basis of ensuring that false hopes are not tied to a technology that ultimately does not work.

It should not come as a surprise that traditional environmentalists have arrived at a very different analysis of the possible risks and benefits of SRM. Naomi Klein for instance explains how "geoengineering will certainly monsterize the planet as nothing experienced in human history" (2014:279) whereas Clive Hamilton sees it as "the fulfilment of three and a half centuries of objectification of nature" (Hamilton, 2013:200). While environmental arguments against SRM are sometimes invoked, it is clear that the main line of criticism has to do with morality and politics (Anshelm & Hansson, 2014). When Justin McBrien writes that "capital now seeks to postpone its

demise through planetary geoengineering" (McBrian, 2016:135), it is easy to see how insistence on absolute "system change" drives resistance to SRM and other forms of climate engineering. After all, if SRM can indeed reduce the risk of a climate catastrophe, it would also deprive traditional environmentalism of a key motivational vehicle for its politics.

If the world were to stay on its current path towards 3-5°C of warming above pre-industrial levels, SRM may quickly emerge as a very real policy option given its short response time compared to emissions reductions (Van Vuuren & Stehfest, 2013). If that were to happen, it is likely that an intense political struggle would ensue. With ever rising stakes, the macro-political disputes of the Anthropocene would probably become even harder to settle.

Similarly intractable, ecomodernism has given rise to a fierce debate over the role of intensification and industrial agriculture in land-sparing (Balmford *et al.*, 2018). Echoing many of the arguments above, ecomodernists claim that urbanisation and higher-yielding concentrated agriculture have the potential of freeing up land elsewhere for habitat restoration and rewilding (Blomqvist, Nordhaus and Shellenberger, 2015:34). However, for this mechanism to actually deliver meaningful results in terms of conservation, there has to be a strong biophilic ethic in society that ensures that the land spared by intensified agriculture is in fact returned to nature and not converted into for instance energy forestry (as has been the case in much of Europe and the United States). In any case, it seems safe to say that until the hypothetical arrival of truly "game-changing" technologies such as molecular assemblers, the ecomodernist case surrounding agriculture appears comparatively weaker than the arguments advanced in relation to energy and climate. This is especially so when considering factory farming and the unethical treatment of non-human animals in general.

5 Conclusion

As the world approaches what James Martin once described as the "mid-century canyon" of increasing environmental stress (Martin, 2012), there is an urgent need for grand-scale decisions. This chapter has outlined some of the ways in which an ecomodernist vision of such decisions would differ from those of traditional environmentalism. Still, for all their apparent differences, these two visions of the future share some important characteristics, in particular a highly idealist understanding of history and a belief in human exceptionalism (Mann, 2018:455). For ecomodernists, human exceptionalism calls for completing the emancipation from nature that begun with the Enlightenment and realising humanity's axiological potential as a technologically mature species. For traditional environmentalism, it means that humans, unlike any other species, can avoid extinction by collectively self-regulating their reproduction rate and resource use and thus restore a stable equilibrium in relation to its environment. In political terms, ecomodernism promises a democratic and pluralist future characterised by ever greater measures of fluidity whereas traditional environmentalism seeks to restore a common sense of belonging and permanence.

However, one does not have to look further than "Mouvement des gilets jaunes" or Brexit to realise that the real world does not unfold according to these kind of ideal types. Often, inertia and irrationality seem as important as ideas and visions. Regardless, the 21st century does not bode well for non-human nature. Both ecomodernists and traditional environmentalists probably agree that things will get significantly worse before they get any better.

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