



LEEDS
BECKETT
UNIVERSITY

Citation:

Gills, B and Morgan, J (2020) Economics and climate emergency. Globalizations. pp. 1-16. ISSN 1474-7731 DOI: <https://doi.org/10.1080/14747731.2020.1841527>

Link to Leeds Beckett Repository record:

<https://eprints.leedsbeckett.ac.uk/id/eprint/7290/>

Document Version:

Article (Accepted Version)

This is an Accepted Manuscript of an article published by Taylor & Francis in Globalizations on 16th November 2020, available online: <https://doi.org/10.1080/14747731.2020.1841527>

The aim of the Leeds Beckett Repository is to provide open access to our research, as required by funder policies and permitted by publishers and copyright law.

The Leeds Beckett repository holds a wide range of publications, each of which has been checked for copyright and the relevant embargo period has been applied by the Research Services team.

We operate on a standard take-down policy. If you are the author or publisher of an output and you would like it removed from the repository, please [contact us](#) and we will investigate on a case-by-case basis.

Each thesis in the repository has been cleared where necessary by the author for third party copyright. If you would like a thesis to be removed from the repository or believe there is an issue with copyright, please contact us on openaccess@leedsbeckett.ac.uk and we will investigate on a case-by-case basis.

Economics and Climate Emergency

Barry Gills and Jamie Morgan

Primary contact:

Professor Jamie Morgan, School of Economics, Analytics and International Business, Room-520 The Rose Bowl, Leeds Beckett University Business School, Portland Place, Leeds, LS1 3HB

j.a.morgan@leedsbeckett.ac.uk

Bios:

Barry Gills is Editor in Chief of *Globalizations* and Professor of Global Development Studies at the University of Helsinki. He has written widely on World System theory, neoliberalism, globalization, global crises, democracy, and resistance.

Jamie Morgan is Professor of Economic Sociology at Leeds Beckett University. He co-edits the *Real-World Economics Review* with Edward Fullbrook. He has published widely in the fields of economics, political economy, philosophy, sociology and international politics.

Economics and Climate Emergency

Barry Gills and Jamie Morgan

Abstract In this essay we provide introductory comment for the collection of solicited essays on Economics and Climate Emergency. In the first section we suggest that recent critique of the climate movement has broader systemic significance and this is indicative of issues that bear on the collected essays. In the following section we rehearse some of the standard arguments leading to complacency and delay to action on climate change and ecological breakdown. In the last section we set out the broad themes of the essays.

Key words Economics; climate emergency; ecological breakdown; carbon emissions

Introduction: pushback, complacency and delay*

This collection of essays in *Globalizations* has been commissioned to critically address the relationship between economics, especially mainstream economics, though with some comment on the history of political economy, current international political economy and tensions in heterodox positions, and the global climate emergency. That emergency, of course, is one aspect of a broader ecological breakdown crisis now facing humanity. The stakes are extremely high: the future well-being, and possibly even survival of the human species, and myriad other species on our planet is now in question (IPBES 2019; Oosthoek and Gills 2005; Amen et al. 2008; Gills 2008, 2020; Fullbrook and Morgan 2019; Gills and Morgan 2020a).¹ Just posing this possibility of existential threat provokes pushback. There is, for example, currently a concerted effort to delegitimise Extinction Rebellion. Critics have seized on internal dissent, disruptions created by protest (and differences over the effectiveness of these) and on some of the purported claims regarding bleak futures to suggest the movement has been captured by extremists with political agendas that have little to do with the climate issue. It is important, however, to place this critique in proper context and this, as we shall see, bears on the purpose of the essays collected here. How to adequately express the seriousness of a situation, how to create awareness, how

* The authors would like to confirm that they are joint and equal co-authors of this article.

¹ Note the 2020 UNEP Convention on Biological Diversity *Global Biodiversity Outlook 5* report highlights progress made and opportunities that still exist despite the underlying scale of problems of loss of biodiversity and threatened extinctions etc. highlighted by the IPBES.

to persuade and what to propose are never simple matters when the very terms of debate suggest the problems are urgent and *systemic*.

Still, there is no lack of evidence regarding the fundamental systemic tendencies and there is now scientific consensus that we have *entered* a global climate emergency. These points are conjoint. Current evidence does not indicate countries are collectively tending to significantly ‘dematerialise’ their economies. They are not achieving absolute ‘decoupling’ between material and energy use and scale of economy, measured by GDP (Schröder and Storm 2020; Parrique et al. 2019; Hickel and Kallis 2019; Fletcher and Rammelt 2017). There has been and remains an underlying tendency for material and energy use to increase as economies grow (for context see Wiedmann et al. 2015) and for carbon emissions to also grow. This has had and continues to have consequences. The ‘Alliance of World Scientists’ suggests that we risk ‘ecocide’ if radical transformations are not implemented very soon (Ripple et al. 2019). Leading systems analysts and climate scientists argue that we have in fact already exceeded, or are now fast approaching, the threshold for 9 tipping points in the global climate system, and this is set within other broader environmentally destructive trends (Lenton et al. 2018). According to the IPCC *Global Warming of 1.5°C* report (IPCC 2018), and the UNEP 9th ‘Emissions Gap’ report (UNEP 2018), global carbon emissions need to fall by 45% by 2030, from the 2017 level of 53.5 Gigatonnes CO₂ equivalent (GtCO_{2e}).² That is, if we are to have some reasonable possibility of limiting average temperature rises over this century and into the next based on the goals of Article 2 of the Paris Agreement. However, the nature of those goals and achieving them remains problematic (Anderson et al. 2020; Newell and Taylor 2020; Spash 2016; Morgan 2016). According to the 10th Emissions Gap report, global emissions actually *increased* from the 2017 level, to reach 55.3 GtCO_{2e} in 2018 (UNEP 2019). Both levels were record highs. According to a UNEP 10-year summary report, emissions ‘show no signs of peaking’ and current emissions policy is not sufficient to offset the ‘key drivers’ of ‘economic growth and population growth’ (Christensen and Olhoff, 2019: 3). Moreover, according to the 10th Emissions Gap report, based on the current ‘implementation deficit’ in COP member ‘nationally determined contributions’ (NDCs), emissions are projected to *continue* to increase to 59 GtCO_{2e} by 2030.³ By contrast, the report states a need for emissions to be reduced by 7.6% per annum from 2020 to 2030, in order to get back on track with Paris goals (rising to 15% if we delay sufficient action until 2025).

We are on the clock and that is obvious. Time is of the essence, and it is important to bear in mind that the planet as a complex dynamic system evolves through time. What our species (some more than others in some places more than others)⁴ has been doing has brought an avoidable possible future into the

² The UNEP report calls for a 55% reduction by 2030 in its introductory summary.

³ Though one should note China augmented its commitments in September 2020, committing to carbon neutrality by 2060 and peak GHG emissions in the coming decade. Policy detail and real commitment are, of course, what will ultimately matter (the nature of ‘net’, the difference between ‘carbon’ and all GHGs for some metrics etc.).

⁴ As Jason Moore notes, the influence of climate on socio-economic change is not unique to the present, but the current situation is perhaps better understood as capitalist produced (‘Capitalocene’) rather than more generically an ‘Anthropocene’ – though he argues the term is not meaningless as geological Anthropocene (see e.g. Moore 2015). Class and capitalism, not man and nature are the appropriate context for Moore. So, whilst larger global population is not irrelevant, what matters more is the spread of industrialisation and of a consumption model within an asymmetrical capital accumulation system. It is important to note a simple focus on population as ‘overpopulation’ tends to distract attention from issues arising from a capital accumulation system and shift responsibility from the relatively few producing much of the problem (Fletcher et al 2014). According to a recent Oxfam and Stockholm Environment Institute report, between 1995 and 2015: ‘The richest 10% of the world’s population (c.630 million people) were responsible for 52% of the cumulative carbon emissions – depleting the global carbon budget by nearly a third (31%) in those 25 years alone; The poorest 50% (c.3.1 billion people) were responsible for just 7% of cumulative emissions, and used just 4% of the available carbon budget; The richest 1% (c.63 million people) alone were responsible for 15% of cumulative emissions, and 9% of the carbon budget – twice as much as the poorest half of the world’s population’ (Gore 2020: 2). Moreover, World Bank data clearly indicates that emissions closely track GDP ranking and that the top 10 countries by GDP produce the majority of emissions. China accounts for about 30%, USA 15% and the EU collectively 10%. Note, figures can vary using per capita measures and consumption measures rather than production measures, but the *general* relation between GDP and emissions remains similar and the fact a *few* countries are responsible for the majority of emission

present. We are already experiencing increasingly erratic weather and an increase incidence of extreme events. Average global temperatures are approximately 1 degree higher since the beginning of the industrial revolution and each year this century has been amongst the hottest since records began. Human activity now shapes the majority of land and affects much of the oceans and the very make-up of the air we breathe (e.g. IPCC 2019; IPBES 2019). So, from an ‘emergency’ point of view the future is ‘now’ because of what we have done, but what we do now and what we are observably continuing to do will also shape the planet for hundreds and perhaps thousands of years.

As Julia Steinberger notes, we have not just brought the future into the present, our future is also a kind of accelerated pathway to a dangerous past. In a recent piece on the ‘planetary climate clock’, she suggests we have affected ‘planetary time’ on a human timescale of little more than one long lifetime (Steinberger 2020). A human unit of 1,000 years is about 40 generations, 12,000 years takes us back to the end of the last ice age and the beginning of the ‘Holocene’ period. Conditions in the Holocene have been highly conducive to the development of civilization. Drawing on recent earth systems research in *Nature* (Vega et al. 2020) she notes that we have in the last hundred years or so increased atmospheric CO₂ from an average 304 parts per million (ppm) to 415 ppm and rising.⁵ This takes us out of the normal range for the Holocene and is considerably higher than the 360 ppm of the Pliocene, 3.3 million years ago when average temperature was 3 degrees higher and sea levels 20 meters higher. So, whilst acknowledging uncertainty and some variation, it is reasonable to infer this is the future that is *now* feeding through in the coming decades and over this century and the next. Moreover, based on current trends in emissions we are heading towards GHG levels not seen since the Miocene (15 million years ago) and perhaps the Eocene (50 million years ago), when a devastating set of volcanic events (which may have set off a cycle of methane release) induced warming of 5 degrees. We simply do not know whether our farming systems and complex and specialised long supply chain based civilizations can adapt to these changes (and bear in mind this is not just temperature and sea level effects, it is ecological breakdown). The beginning of the Eocene was recently recognized as an additional likely mass extinction period in the fossil record.

Of course, we may still prevent a continuing acceleration of temperature changes and other effects *if* we reduce emissions. Some future effects are ‘baked-in’, but that is no reason to continue to feed the fire. And to be clear, 2030 is *not* a cliff edge, failure to fully reduce emissions by that date in accordance with goals or address broader ecological problems should not be taken as a signal that further action has become pointless. Failure to act with urgency, however, cannot be considered as anything other than reckless and irrational given the weight of evidence (see also Wunderling et al. 2020; Steffen et al. 2018, 2015; Hansen et al. 2017).⁶ It is with this in mind that one should read any critique of the climate movement. The overwhelming goals of the climate movement are to create awareness, induce *concern* and motivate immediate action. It would, then, be absurd to suggest that overall and given the direction of travel suggested by the evidence, the main intent amounts to ‘scaremongering’. Perhaps the more pertinent question to ask regarding the criticism is why critics focus on and seek to accentuate division at this time?

remains the same. As Goodman and Anderson (2020) note, 65% of global emissions 1751-2010 were produced by 90 entities (of which two thirds were corporations), and 71% of emissions 1988-2015 were produced by 100 corporate and state entities. See Heede (2014) and Griffin (2017). For a useful graphical summary of emissions contributions see:

<https://www.vox.com/energy-and-environment/21428525/climate-change-west-coast-fires-cause-charts>

⁵ She begins from 304 ppm in 1921; preindustrial levels for the Holocene typically report 180 to 280 ppm. Hansen et al. (2107), argue that Paris notwithstanding it makes more sense to target a return to less than 350 ppm. Note also that 1) a ton of carbon equates to about 3.7 tons of carbon dioxide in the atmosphere 2) ppm measures can vary globally and *model* estimates for ppm associated warming effects have also varied and are subject to readjustment as observations change. For example, 450 ppm has previously been used as a trigger for 2 degrees warming (which seems to be an underestimation). This, however, is an issue of general evidence trends under rational uncertainty rather than spurious precision.

⁶ Note, Wunderling et al. 2020 had not yet completed review at the time of writing.

There is, of course, growing media attention to the consequences of climate change and ecological breakdown – this has become impossible to ignore now. It is now common for reporting to have some connective thread – the recognition of climate change and so on. But this is not quite the same as the emergence of a common narrative where continuous coverage holds governments to *account*, which places critical pressure on those with the immediate power to create policy, directing criticism towards *them*. The IPCC and UNEP are not radical organizations, but they are now calling for mobilization equivalent to wartime and yet governments are manifestly *not* responding with urgency. It is for this reason that organizations like Extinction Rebellion, Greenpeace, Stay Grounded and many others are so important.⁷ Their very existence is a signal of civilizational failure. Civil society organizations are rarely perfect, but again, there is another issue here, where does the burden of proof really lie for whether in fact current policy is adequate and whether in fact there is sufficient urgency? Surely it lies primarily with the relatively small number of corporations and governments responsible for the vast majority of emissions?

But there is also the systemic issue. The ‘political agendas’ of climate movement activists encompass a broad spectrum of systemic critiques of capitalism because capitalism is *the* dominant framework of economy and society in the world. Capitalism is in the main the system in which consequences have been and continue to be produced. This too is important to bear in mind when considering pushback. To suggest that a campaigning organization that criticises corporations and governments has been ‘captured’ by political agendas that have little to do with the climate issue implies either that the climate issue is somehow separate from the systemic features of economy and society (domestic and global) within which those issues have arisen or that the system itself is giving rise to timely solutions to the problems that are arising. The latter is clearly false and the former is manifestly contradictory. The main question that should be asked and answered here is one that is more appropriately *directed* at corporations and governments: does the evidence suggest that the scale and intensity of our economies are compatible with the ecological and climate balance on which we depend? If we think of an economy as a material subsystem operating within an earth system, then we must recognize that the kinds of economies we have created exhibit structurally *inscribed tendencies* which affect that earth system. These are not somehow separate matters. As such, the ‘political agendas’ of climate activists are not ‘capture’ they are highly relevant (if sometimes contentious) sources of insight and critique regarding the sources of tendencies.⁸

The point we are driving at here is that pushback on the climate movement, and most recently focused on Extinction Rebellion, is itself indicative of something systemic. Climate emergency does not just invite us to explain the material features of our economic systems that produce consequences, it invites inquiry regarding how it is that we have found ourselves in such a position of emergency. We have agency, we are reflexive, but as Marx noted, we do not choose the conditions in which we choose because we are born into societies that pre-exist us as individuals. There is nothing intrinsically subversive or radical about stating this, it is just another way of saying conscious social beings do not experience the world as though they were encountering it anew from moment to moment (creatures like us and civilization itself would be impossible if that were so). Every system has its socialisations, its system serving, interest bearing and belief inculcating features, its information, persuasion and knowledge practices. These may be complex, evolving and multi-faceted, but some are more influential than others. This brings us to the purpose of this collection of essays. Ecological economists and critical social scientists have been arguing for many years that mainstream economics and especially its sub-disciplinary theory of the environment, is falsely posed, and that it fosters dangerous complacency and delay (e.g. Daly 2015, 1997, 1974; Hickel 2018, Dale 2018). Though mainstream economics has not been the only source of complacency and delay (see e.g. Lamb et al 2020; Stevenson 2020; Dale 2012)

⁷ For example, Stay Grounded campaigns for a just transition reduction in aviation as a necessary aspect of real decarbonization to mid-century (e.g. Smith 2019).

⁸ The point, of course, does not condone the personal dynamics of conduct and intra-organizational struggles involving matters of identity, recognition respect etc. It merely highlights the use made of division to undermine a movement.

it has been an important source.⁹ It has played a prominent role as a source of concepts, theory, policy and education and many other issues and disciplines are influenced by it. It contrasts sharply with ecological economics. Ecological economics takes as its point of departure the key insight that an economy is a subsystem that depends on and mutually influences broader biophysical systems (for range in relation to this core commitment see Spash 2020b, 2017). Using concepts such as throughput and metabolic flow ecological economics seeks to assess the relationship between systems. As such its basic insight is that an economy is a material processes involving entropy and waste creation. This is quite different than a mainstream focus on processes of value creation through the exchange of goods and services (see O'Neill 2007; Daly and Morgan 2019). With this in mind it is worth rehearsing some of the mainstream archetypal arguments for delay, since awareness of those arguments helps to make sense of the significance of the essays.

Mainstream archetypal arguments for delay

Let us consider the influence mainstream economics precepts have had when translated via the mainstream sub-disciplinary concerns of 'environmental economics'. They form a set of policy arguments and attitudes whose general direction of travel has always erred on the side of delay (a distorted idea of caution dictates 'do not intervene and prevent the system doing its thing'). The cumulative effect has been systematic complacency. As more historically-minded and older readers may know the 1970s was a period of 'oil shocks' and growing concern over resource security and environmental damage. Mainstream economic theorists of the environment began to argue that forecasts and warnings about the trends and consequences of expanding economies across the globe (scale and intensity) were expressions of unwarranted hysteria, lacking proper data and correct appreciation of economic mechanisms; that there is, in any case, plenty of time to solve environmental problems, by taxing externalities to make markets more efficient or by creating property rights to turn problems into assets that can be traded away, and more fundamentally by harnessing market processes of competition. Beginning in the 1970s, several standard lines of argument (and assumption) have emerged drawing from the mainstream economic framework:¹⁰

- 'Dynamic efficiency' in the form of induced technological progress will mainly take care of emissions via 'price signalling' and the profit motive.
- We can always find some 'backstop substitute' for whatever resource we use up.
- It is counterproductive to prevent economic activity now when future societies will be wealthier and more able to solve the problems we bequeath them.
- Pollution and environmental damage necessarily reduce as societies become wealthier.
- There are some economic benefits to climate change in some places and these may offset the economic costs or problems created elsewhere.
- One person's (or country's) waste is another person's (or country's) opportunity, so environmental profligacy and damage in one place may actually produce economic development elsewhere, leading to aggregate dynamic efficiency.
- Not all sectors of an economy are affected equally by climate change, and so economic activity can incrementally transfer from one to the other.
- There is no limit to human ingenuity, and there is, therefore, no *necessary* limit to how we grow into the environment we occupy and depend on (what seems like a major problem being created now will not seem so in the future...).

The serious weaknesses and flaws in these ('Panglossian') claims are now well documented (Spash 2017). Fundamentally these claims involve two basic problems of perspective. First, they treat an aggregate globally connected cumulative problem of increasing collective scale and intensity of human

⁹ There are many other subjects one might focus on, such as the work of Bjorn Lomborg.

¹⁰ The concept of an externality is, of course, much older. We are highlighting the prominence given to some standard lines of argument and suggesting readers should find this familiar and that each is a source of complacency and delay.

interventions in myriad natural systems as if it were merely a localised set of individually manageable circumstances. Second, the claims all relate to a notional, i.e. imagined and ‘utopian’ future. That optimised future is conceived of as being the site where all serious tensions concerning the environment will be reconciled, i.e. where the problems being created now will all be solved (thus generating an attitude of deferral, delay, and complacency in the present). This logic suppresses the significance of the mounting empirical scientific evidence of current and past climate change and ecological problems, and tacitly or even explicitly counsels *against* prohibitions or major change of direction (rejecting or deferring these in favour of facilitating current trends and activity in practice). Taken together these arguments are appropriately characterized as being: implicitly system supportive; policy permissive; and, as evidence has now accumulated, historically reckless. Nevertheless, they have been basic to policy for the last forty years, and have become familiar as the ‘business as usual’ stance (a stance that is now increasingly being challenged, albeit mainly as green growth agendas). To non-economists, these conventional mainstream claims clearly violate the ‘precautionary principle’.¹¹

It is important to bear in mind that there is a ‘market conforming’ rationale behind each of these claims that sits comfortably within the mainstream framework of economic reasoning: price signals provide information that communicates to us that it is time to stop doing some things (e.g. it has become too expensive based on resource exhaustion and environmental or social damage) and that it is time to start doing other things (the state of the world induces investment in alternative ways of doing things and in resolving the problems created, and there is always the next period in which this can happen). Mainstream economic theory has no fundamental roots in earth system dynamics, material process or biophysical boundary states, but even though mainstream economic theory lacks these, there is a presupposition that our economic signalling system will divert us away from any seriously problematic biophysical limits. It is, for example, typically assumed we will avoid ‘tipping points’ even though measurement of these is not intrinsic to mainstream economics (hence no *necessary* limits need be imposed now to the economy).

The key point is that mainstream economic thinking has conveyed the central idea that even severe environmental problems being produced today can simply be thrown into the future, and that we can trust (have faith) that in the end all will be well. Moreover, it is continually assumed that the economic ‘costs’ are limited to some lost growth within *continued* growth and that innovation and technological change (‘progress’) will be sources of solutions to any given environmental problem. This perspective produces a frame of mind similar to Voltaire’s famous jibe in *Candide* against the ridiculous optimism purveyed by some thinkers in his own day, i.e. that this economic theory and system perpetually (re)produces ‘The best of all possible worlds’! This is despite ever increasing evidence to the contrary. This has been and remains (albeit increasingly in tension) a permanent drag on recognising the urgency of our situation and the necessity of radical transformation. Moreover, it continues to instil ‘faith’ in market mechanisms and the logic of capitalism in the form of an expansionary capital accumulation system. By default it leads to a de-emphasis of the positive or even necessary role for prohibitions, large scale state intervention, government planning, and regulation, in halting and reversing material expansion. Moreover, it entirely ignores radical social change organised ‘from below’ (substituting for this the green consumer).

In environmental economics, one of the first times these arguments were played out was in *the American Economic Review* in 1974. In that year the *Review* published Robert Solow’s Ely Lecture, and in the same issue a special section of papers by Herman Daly, William Nordhaus and others (Daly 1974; Solow 1974). In 1972, the Club of Rome report *Limits to Growth* (Meadows et al. 1972) was published, and as noted the 1970s generally started to bring issues of finite resource supply and resource security to the fore. Against this background Daly makes the case for a ‘steady-state’ economics in his 1974

¹¹ Principle 15 of the 1992 Rio Declaration states: ‘In order to protect the environment, the precautionary principle shall be widely applied by the States [UN members] according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.’ The cost effective’ clause is, however, obviously open to problematic abuse.

essay. The basic premise is that a rational economic system must develop a set of measurements of its economic activity that ensure it stays within really existing environmental limits, and that it requires a set of systematic institutional mechanisms to ensure that this is achieved. In his Ely Lecture, Solow, a future Swedish Bank ‘Nobel’ Prize winner and seminal figure in mainstream economic growth modelling, covers the same issues. What is notable, however, is that he translates the whole into a mainstream context. Solow does not reference Daly, and for Solow, Daly’s type of concerns are reduced to the relative emphasis different economic theorists put on markets or the state in a mixed economy. As such, he shifts the grounds of debate away from the problem of material expansion and the issue of evidence regarding long term trends. Whilst he initially makes some reference to work on the limits to growth (via a 1931 essay, and alluding to Meadows et al. 1972), he dismissively refers to *Limits* as ‘doomsday’ and ‘cosmic’, not unimportant, but not a serious matter for economists. Instead, he affirms his confidence in economics as a discipline that can guide our thinking, and discusses ‘backstop technologies and resources’ (the argument that there can be continuous and infinite substitution of one resource for another, including the environment itself). Though Solow notes that the real world might differ from textbook economics, he does not take this as a signal that the fundamentals that shape his attitude to both states and markets might be in error. For Solow, the problem is one of more or less faith in market processes and in different kinds of imperfections (failures).¹² Though Nordhaus pays closer attention to Meadows et al., he does not refer to Daly, and he starts from the assumption of ‘stimulated competitive markets’, efficient pricing, and allocation of energy resources over the long term. He recognises however that this is not very ‘realistic’, and notes that there is a further problem of possible ‘environmentally unacceptable’ atmospheric carbon levels, and yet he also (re)states (the faith) that ‘with sufficient time and money – emissions can be brought into conformity with any reasonable set of standards’, essentially through technology (Nordhaus 1974: 25). No need to worry then, or to take radical urgent action, nor to change the dominant paradigm of economics in theory or practice.

In any case, both Solow and Nordhaus’s arguments entirely miss Daly’s central point. The ecologically-informed argument is rooted in the growing realisation that a disastrous ecological future was obviously built into the general observed tendencies: i.e. the (increasingly globalised) spread of industrialisation, urbanisation, and consumption-heavy lifestyles, as well as the secular trend of targeting high economic growth (an economic system predicated on compound growth in GDP and attendant material expansion). This insight was by no means restricted to Daly in the 1970s (see e.g. Schumacher 1973 [1993] and Ivan Illich, discussed Samerski 2018). Moreover, the central ecological argument was not actually about the relative merits of future technologies, nor whether we opt for more ‘state’ or more ‘market’ per se. The central point was that it made very good sense to *avoid* rather than have to retrospectively manage the foreseeable negative consequences of a material *growth* system.¹³

However, for decades everything about the mainstream framework counselled ‘wait and see’ and this became a continual drag on organizational responses through the 1980s and 1990s and into the new Millennium. To be clear, however, the mainstream framework has not been entirely antithetical to limited state intervention, but it has been blind to the concept of *absolute limits*. And it would be disingenuous to suggest that mainstream economics in general or environmental economics in particular have remained unchanged since the 1970s, or that they lack internal concerns and criticism (perhaps most notably from Nicholas Stern, e.g. Stern 2013). What we want to emphasise is that environmental economics has evolved through mainstream economics, and mainstream economics may have changed as a consequence, but it has not been transformed (see Röpke 2020; Söderbaum 2018; Mearman et al. 2018a, 2018b; Morgan 2015).

¹² For a critique of mainstream economic thought as a belief system, see George and Sabelli (1994).

¹³ To be clear, not all ecological economists are anti-capitalist, nor do they reject the idea of price signals. The shared commitment is that adequate theorisation of a sustainable economic system must start from material processes and their consequences, rather than simply assume these are taken care of by exchange values. Most ecological economists also place strong emphasis on distribution, justice, fairness and alternatives to commodified and consumerist versions of identity.

Mainstream economics has not yet addressed the fundamental points made by ecological economists. It has not yet been restructured around a full recognition and internalisation of the realities of material processes, their consequences and (planetary) limits. Its primary focus remains a system of exchange values, price signals, and induced efficiencies, predicated on the (unlimited and perpetual) dynamism of growth. Issues of ‘discount rates’, energy intensity measures of \$GDP, debates over absolute and relative decoupling, for example, have not led mainstream economists to accept the ecological economics position – even though sometimes the two can seem superficially similar, such as modern abatement analysis and use of integrated assessment models.¹⁴ Complacency and delay have been and continue to be the dominant mainstream response. In the meantime, problems have continued to mount (carbon emissions, temperature rises, extreme events, species extinctions, plastic levels etc.), and so ‘business as usual’ frameworks have started to shift towards a language of more fundamental change in the form of green new deals (GNDs) and some versions of these are more radical than others. The more radical versions of GNDs emphasise climate crisis as an opportunity to address the cumulative pathologies of neoliberal economies and so tend to be critical of mainstream economics. These GNDs, for example, embrace alternatives such as Modern Monetary Theory (MMT) or post Keynesian finance theory and place greater emphasis on equalising wealth and income, full employment and improving infrastructure and welfare services whilst greening the economy and society. Laudable though this is there is still a question mark against the green growth aspect of these GNDs. In any case, mainstream economics typically opposes the financing proposals of radical GNDs and remains deeply problematic as a source of constructive theory, policy and education in the context of our climate emergency.

The essays

The IPCC is best known for its collation of findings of models on trends in emissions of greenhouse gases, but its various panels do not just report emissions trends and related forecast scenarios. Material is produced on socio-economic consequences, impacts on GDP and on ‘adaption’ and ‘mitigation pathways’. These issues inform policy frameworks and the IPCC and the UNEP, like governments in general, look to mainstream economists and their models to inform this aspect of their work – depending, for example, on integrated assessment models developed by Nordhaus (and it was mainly for this he received the 2018 Swedish Bank ‘Nobel’ Prize). There has always been a disjuncture between the impacts in climate and earth system models and mainstream economic models use of those impacts (and more critical mainstream economists have recognised this, see Stern 2013). In recent years, climate and earth system scientist IPCC panel members have become increasingly vocal (especially when speaking in a personal capacity) regarding the need for action on climate change and increasingly concerned about the drag on such action, so the difference between the climate science and the economics has become more obvious over time.

The IPCC and UNEP, of course, are acutely aware that climate change is a politically sensitive issue and that governments around the world operate under different sets of pressures, but always with a core concern for the economy. And, of course, mainstream economics is an established ‘quantitative science’ and carries disciplinary legitimacy. As a consequence, there has always been institutional reluctance to formally criticise the economics. Criticisms, however, have abounded. One major focus has been the ‘discount rates’ environmental economists apply to their models. Since impacts occur in the future, but are avoided through action taken in the present, economists apply discount rates as a way to distribute in time the economic costs against the benefits. The higher the discount rate then the greater weight placed on the present compared to the future. This implies numerous things, such as less pressure to reduce emissions now and lower likely immediate investment in mitigation or abatement. Behind this stands the whole array of arguments for delay we listed earlier. The UK Stern review of 2006, for

¹⁴ Integrated assessment models, such as the Dynamic Integrated Climate-Economy (DICE) model, are *very* different, but when explained to a layperson they can seem to be covering the same ground as ecological economics in so far as they pay lip service to climate systems. See later and also Keen (2020).

example, used a relatively low average discount rate whilst Nordhaus has advocated a higher rate.¹⁵ In our essay collection, Steve Keen (2020) goes much further and provides a comprehensive critique of mainstream economic modelling and evidence use.

According to Keen, assumptions and estimates used to calibrate integrated assessment models have been deeply dubious and these have underpinned the claim that climate change will merely reduce by some small proportion the growth of economies. Looking across the whole array of Nordhaus's work and the work that has mainly followed it, he notes much of economic activity (up to 90%) is assumed to be unaffected by climate change because it occurs in 'controlled environments'. Moreover, based on the observation of differences in output in relation to geographic temperature (a cross sectional observation i.e. of places and not changes in time), models assume that there will be benefits for economic activity in some places and costs in others as average temperatures rise *in the future* (i.e. an inference is drawn for complex processes in time). This facilitates the conclusion that climate change will be net beneficial, with the underlying implication that climate change does not prevent *continual* economic growth, and that there is an 'optimal' level of global warming. Concomitantly, Nordhaus has 'consistently reduced the value of parameters' in his 'damage function', meaning that values used to calculate the impact of global warming on GDP have *reduced* over time. Clearly, this can influence findings for net benefits and Nordhaus's optimal warming in his Nobel lecture is *4 degrees* – quite at odds with the concerns of climate science, which one might otherwise think would inform his work. According to Keen, the whole enterprise lacks realism, it misinterprets climate and earth system science, cannot adequately deal with feedback and tipping points and marginalises the expressed opinion of scientists, whilst placing great weight on mainstream economic 'expert' opinion about climate science. Keen suggests that the socio-economic consequences might be mis-specified by an order of magnitude. As everything we have said in the previous sections indicates, not least based on the sharp contrast with ecological economics, mainstream economic expertise is profoundly problematic.

Keen's paper illustrates how mainstream economics has worked against calls for early and decisive action to prevent climate change and ecological breakdown. James Galbraith (2020) explores a parallel argument. Economics has consistently treated the problem of climate and ecological limits with 'derision' and offered deeply unrealistic policy proposals. He states:

economics must be adjusted to the peculiar circumstances of the planet Earth, surrounded as it is by a fragile sheath of light gases, one of which has the annoying habit of trapping heat. The ability to withstand the heating of the atmosphere imposes a global limit, against which there is no appeal. An economics oriented toward the long term survival of human society in tolerable form must be adjusted to the reality of that limit, in which the terminal constraint is not the availability of carbon in the ground, but the necessity to restrict the concentrations in the air. (Galbraith 2020)

Galbraith also notes the tremendous challenge we now face, since decarbonisation requires use of *existing capital, rooted in carbon energy resources* to produce a decarbonised future. Even if decarbonised technology is possible it does not follow that a transition at equivalent levels is feasible and this has basic implications for the scale of economies, consumption and waste.¹⁶ This raises a whole set of issues regarding the nature of economies and the role of economists in theorising and legitimating those economies and this is the subject of two essays by Clive Spash. Spash is a prominent advocate of social ecological economics and in 'Apologists for growth' (Spash 2020c) he argues that 'growthism' ('productivism', 'extractivism' etc.) is not just a mainstream economics issue. Many heterodox economists – including some post Keynesians – are critical of neoliberal economics, but advocate solutions which do not come to terms with the problem of scale and the commitment to material expansion (they are more concerned with solving income distribution problems and managing

¹⁵ Though it is worth noting that even mainstream economists when surveyed think low discount rates are more appropriate – at around 2% – and, of course, the whole endeavor ignores proper context of impacts etc. (Drupp et al. 2018).

¹⁶ There are, for example, issues regarding transport transition and electric cars (Morgan 2020) and contradictory assumptions about future policy and matters of income and wealth inequality (Morgan 2017).

aggregate demand with the goal of producing full employment in a renewed industrial economy and tend to lack clarity on whether this is in fact compatible with material use etc.). Moreover, some proponents of staying within planetary boundaries are also inconsistent on this issue and Spash looks particularly at the work of Tim Jackson and Kate Raworth. In his second essay, Spash generalises his growthism point and uses the Covid-19 pandemic to highlight the structural fragility of capitalist economies and the tendency to respond to crisis through policies intended to induce more demand and thus get growth ‘going’ (Spash 2020a). For Spash, there are fundamental issues with capitalist accumulation. This remains the case as ‘business as usual’ evolves, since green growth does not come to terms with its basic material commitments within structures of accumulation and based on real biophysical limits.

The issue of biophysical limits also informs Gareth Dale’s essay (Dale 2020). Paralleling Spash, Dale ties together theory which fails to consider the fundamental structural tendencies of economic systems, Raworth’s position and a longer history of economic thought beginning with the Physiocrats (Dale 2020). The fundamental problem of material growth associated with economic growth and critique of growthism also lies behind the degrowth movement. Jason Hickel is a well-known advocate of degrowth and his essay sets out to clarify the meaning of the term, since it is a term easily misunderstood (Hickel 2020a). He distinguishes degrowth from recession. Degrowth is a coordinated and designed reduction in scale involving redirection of activity, resource use and priorities. It focuses on provisioning, livelihoods, welfare and care and thus quality of life. Degrowth is not about sacrifice, cuts and austerity in a neoliberal context, but rather is an alternative to that context and this includes also the exploitative ‘development’ relations between the global North and South. This focus on reducing and reorienting economies also informs the concept of postgrowth and there is considerable overlap between postgrowth and degrowth. Max Koch and Hubert Buch-Hansen have written extensively on degrowth and postgrowth. With this in mind their essay argues that critical political economy needs to do more to assimilate the insights of ecological economics and in order to avoid emulating the errors of mainstream economics. The varieties of capitalism literature, for example, tends to neglect an ecological perspective. They suggest:

Within the emerging and diverse political economy of and for the postgrowth era, the Marxian tradition, with its simultaneous focus on historically specific economic categories, social relations and modes of consciousness, is capable of playing a constructive part. And some of the concepts of contemporary critical political economy approaches such as regulation theory may give a hint into the further particulars of an analysis of this new epoch. Like growth economies, postgrowth economies will have institutions that may be understood in terms of ‘institutional forms’. (Koch and Buch-Hansen 2020)

This line of argument raises basic issues regarding transitions and the scope for constructive change, which is the subject of James Goodman and James Anderson’s essay (Goodman and Anderson 2020). Clearly, no one acts for or speaks on behalf of capitalism in general and this means that cumulative changes to capitalism based on climate issues experience complex feedback, which in turn leads to new political pressures. According to Goodman and Anderson, and following on from the general theme of sources of complacency and delay, ‘drivers’ for climate action from within capitalism have been relatively weak, but there is notably growing scope for ‘deepening politicization and socialisation’. Nick Fox and Pam Alldred bring a new materialist perspective to this issue in terms of competing policy propositions (Fox and Alldred 2020). According to Fox and Alldred, economics plays a different role in different policy assemblages and they suggest there is an opportunity for selection and synthesis to overcome apparent incommensurability. They state that in conjunction with practical actions one might assemble:

From the *liberal environmentalist* policy, a focus on environmental protection and efforts to change individual and collective human behaviour to lower energy and fossil fuel use, reduce consumption of other resources and the production of waste. From the *United Nations* policy assemblage, action to redistribute income locally and globally, recognising that poverty is one of the drivers of environmental destruction. From the *green capitalism* assemblage: support for technological

innovation to limit and remove greenhouse gases from the environment. From the *no-growth* policy, action to limit economic growth and wasteful competition. These provide the foundation for incremental actions locally, nationally and globally to address the physical, biological, social, economic and political affects within the climate change event-assemblage. (Fox and Alldred 2020)

Ultimately, if socialisation is significant and strategy matters, then the role of education also matters. In ‘Teaching climate complacency’, we explore the role of the mainstream economics textbook as a source of complacency and delay (Gills and Morgan 2020b). Our essay focuses mainly on the negative – what the textbooks omit, how mainstream economics informs environmental economics and how this framing produces complacency. We highlight what needs to be unlearned and suggest some ways to transform economics. Finally, Jana Bacevic reminds us that there are additional complicating factors in any attempt to transform the conditions of knowledge production (Bacevic 2020). According to Bacevic, ‘any attempt to think about the future that is *not* capitalist or extractive-colonial faces the seemingly impossible task of undoing its own conditions of possibility’. The implication is that change ‘requires undoing not only of modes of production (capitalism) *or* habits of thought (Occidentalism, Eurocentrism) that have arisen as a consequence of this history, but the modes of production *of* thought that are, themselves, its product.’ Clearly, this *is* a challenge (structural, ideational etc.), but Bacevic is not a pessimist. The apparently ‘impossible’ is not really insurmountable. If it were then the critical faculties used to question conditions of possibility would, in turn, be either impossible or irrelevant. This brings us back to where we began when we suggested, how to create awareness, how to persuade, what to propose are never simple matters when the very terms of debate suggest the problems are urgent and *systemic*. We recommend the essays in this collection to our readers, and we trust that in them you may find not only the basis of a powerful critique of mainstream economics, but also sources of inspiration for the radical reconstruction of our understanding of economics and its ecological and social context, ideas that go to the roots of the crisis and lead us to new ways through.

Conclusion

The Covid-19 global pandemic has intervened in the trajectory of 2020 and (temporarily) induced cuts in global greenhouse gas emissions (particularly carbon dioxide). A global debate is now in motion about how to construct a post-Covid ‘green recovery’ while simultaneously undertaking deep reductions in global emissions. Yet despite increasingly urgent warnings from the scientific community, the underlying conclusion has been that ‘not enough’ is yet being done. There has been delay at every turn. This habit of delay and deferral of action seems set to continue, despite increasingly alarming scientific reports and widespread recognition of the urgency of radical action to reduce emissions and arrest ecological destruction. Indifference and complacency continue to abound in ‘official circles’ of corporate and government power. The situation is now extremely urgent, and with each delay becomes more so. However, hopelessness and nihilism cannot be our response. It is in this context that the contributors to our collection examine the relationship between the economics discipline and the causes of these existential global crises of our time.

Some uncomfortable truths about the reality of the situation facing the world community today seem fairly clear: aggregate annual global greenhouse gas emissions must fall rapidly, rather than continue to increase year on year as at present. The cumulative level of CO₂ and other greenhouse gases in the atmosphere must fall globally, and do so rapidly, rather than continue to increase year after year. The global rate of biodiversity loss and species extinctions must decrease significantly, and ecological restoration must become a central aim of policy, including at local, national, regional and global policy levels. The fundamental drivers of global extractivism, ecocide, and climate catastrophe must be addressed: with new radical ideas and transformations, not by short term system supporting technical fixes intrinsic to the dominant growth economy. Faith in the market mechanism and the corporate-finance private sector to deliver the type of radical transition necessary should not only be questioned, but abandoned. We need a new paradigm of development, drawing on just transitions, degrowth, postgrowth, social ecological economics, ecofeminism and many other resources (e.g. Newell and Simms 2020; Spash 2020b, 2017; Büchs and Koch 2017; Hickel 2020b; Kallis et al. 2020; Liegey and Nelson 2020). Given the scale and intensity of the crises we are facing, it seems clear a profound

transformation in how the field of economics is conceptualised, taught, and practiced will be absolutely essential if humanity is to successfully combat the global climate emergency and arrest on-going ecological destruction across the planet (Røpke 2020). The mainstream economics that has been dominant for so long, and which continues to drive profound existential crises today, must once and for all be scientifically discredited, academically delegitimised, and socially rejected. The real task now is to collectively construct a viable radical alternative paradigm fit for purpose: and that purpose is to profoundly arrest an accelerating set of global processes leading us to ecological destruction and gross future human insecurity. It is time to ‘overturn economics’ in its conventional mainstream form.

References

- Amen, M., Bosman, M. M., & Gills, B. K. (2008). Editorial: The urgent need for global action to combat climate change. *Globalizations*, 5(1), 49–52.
- Anderson, K. Broderick, J. Stoddard, I. (2020). A factor of two: how the mitigation plans of ‘climate progressive’ nations fall far short of Paris-compliant pathways. *Climate Policy*, <https://doi.org/10.1080/14693062.2020.1728209>
- Bacevic, J. (2020). Unthinking knowledge production: from post-Covid to post-carbon futures. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1807855>
- Büchs, M. and Koch, M. (2017). *Postgrowth and wellbeing. Challenges to sustainable welfare*. Basingstoke: Palgrave Macmillan.
- Christensen, J. and Olhoff, A. (2019). *Lessons from a Decade of Emissions Gap Assessments*. Nairobi: UNEP.
- Dale, G. (2020). Rule of nature or rule of Capital? Physiocracy, ecological economics, and ideology. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1807838>
- Dale, G. (2018). The Nobel Prize in climate chaos. *The Ecologist*, October 12th <https://theecologist.org/2018/oct/12/nobel-prize-climate-chaos-romer-nordhaus-and-ipcc>
- Dale, G. (2012). The growth paradigm: A critique. *International Socialism*, 134: 55-88.
- Daly, H. (2015). *Essays Against Growthism*. London: WEA/College Books.
- Daly, H. (1997). Forum, Georgescu-Roegen vs. Solow/Stiglitz. *Ecological Economics*, 22, 261-266.
- Daly, H. (1974). The economics of the steady-state. *American Economic Review* 64(2), 15-20.
- Daly, H. and Morgan, J. (2019). The importance of ecological economics: An interview with Herman Daly. *Real-World Economics Review*, 90, 137-154.
- Drupp, M. Freeman, M. Groom, B. and Nesje, F. (2020). Discounting disentangled. *American Economic Journal: Economic Policy*, 10(4): 109-134.
- Fletcher, R. and Rammelt, C. (2017). Decoupling: A Key Fantasy of the Post-2015 Sustainable Development Agenda. *Globalizations*, 14(3): 450-467.
- Fletcher, R. Breitling, J. and Puleo, V. (2014). Barbarian hordes: the overpopulation scapegoat in international development discourse. *Third World Quarterly*, 35(7): 1195-1215.
- Fox, N. J. and Alldred, P. (2020). Climate change, economics and the policy-assemblage: Four policies and a materialist synthesis. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1807857>
- Fullbrook, E. and Morgan, J. (eds.) (2019). *Economics and the Ecosystem*. Bristol: World Economic Association Books.
- Galbraith, J. K. (2020). Economics and the climate catastrophe. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1807858>
- George, S. and Sabelli, A. (1994). *Faith and Credit*. London: Penguin.
- Gills, B. K. (2020). Deep Restoration: From the Great Implosion to the Great Awakening. *Globalizations*, 17(4), 577-579.
- Gills, B. K. (2008). Climate Change: A Global Call to Action. *Globalizations*, 5(1), 83-87.
- Gills, B. K. and Morgan, J. (2020a). Global Climate Emergency: After COP24, climate science, urgency, and the threat to humanity. *Globalizations*, 17(6): 885-902.
- Gills, B. K. and Morgan, J. (2020b). Teaching climate complacency: mainstream economics textbooks and the need for transformation in economics education. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1808413>

- Goodman, J. and Anderson, J. (2020). From climate change to economic change? Reflections on 'feedback'. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1810499>
- Gore, T. (2020). Confronting carbon inequality. Oxfam, September 21st.
- Griffin, M. (2017). *Carbon Majors Report*, CDP and Climate Accountability Institute: London.
- Hansen, J., Sato, M., Kharecha, P., von Schuckmann, K., Beerling, D. J., Cao, J., ... Ruedy, R. (2017). Young people's burden: Requirement of negative CO₂ emissions. *Earth System Dynamics*, 8, 577–616.
- Heede, R. (2014). Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854–2010. *Climatic Change*, 122(1-2): 229-241.
- Hickel, J. (2020a). What does degrowth mean? A few points of clarification. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1812222>
- Hickel, J. (2020b). *Less is More: How Degrowth will Save the World*. Penguin Random House UK.
- Hickel, J. (2018). The Nobel prize for climate catastrophe. *Foreign Policy*, December 6th.
- Hickel, J. and Kallis, G. (2019). Is green growth possible? *New Political Economy*, 25(4): 469-486.
- IPBES (2019, May). *Summary for Policy Makers* of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Geneva: Author.
- IPCC (2019, August). *IPCC Special Report on Climate Change, Desertification, Land Degradation Sustainable Land Management Food Security and Greenhouse Gas fluxes in Terrestrial ecosystems*. Geneva: Author.
- IPCC (2018, October). *Global Warming of 1.5°C: Summary for policymakers*. Geneva: Author
- Kallis, G. Paulson, S. D'Alisa G. and Demaria, F. (2020). *The Case for Degrowth*. Cambridge: Polity Press.
- Keen, S. (2020) The appallingly bad Neoclassical Economics of climate change. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1807856>
- Koch, M. and Buch-Hansen, H. (2020). In search of a political economy of the postgrowth era, *Globalizations*, <https://doi.org/10.1080/14747731.2020.1807837>
- Lamb, W. Mattioli, G. Levi, S. Roberts, J. Capstick, S. Creutzig, F. Minx, J. Muller-Hansen, F. Culhane, T. and Steinberger, J. (2020). Discourses of climate delay. *Global Sustainability* 3, e17, 1–5. <https://doi.org/10.1017/sus.2020.13>
- Lenton, T. Rockstrom, J. Gaffney, O. Rahmstorf, S. Richardson, K. Steffen, W. and Schellnuber, H. (2020). Climate tipping points too risky to bet against. *Nature*, 575, 592-595, November 28th
- Liegey, V. and Nelson, A. (2020). *Exploring Degrowth: A Critical Guide*. Pluto Press.
- Meadows, Donnella. Meadows, Dennis. Randers, J. and Behrens, W. (1972). *The Limits to Growth*. New York: American Library [Club of Rome].
- Mearman, A. Berger, S. and Guizzo, D. (2018a). Whither political economy? Evaluating the CORE project as a response to calls for change in economics teaching. *Review of Political Economy*, 30(2), 241-259.
- Mearman, A. Berger, S. and Guizzo, D. (2018b). Is UK economics teaching changing? Evaluating the new subject benchmark statement. *Review of Social Economy* 76 (3), 377-396.
- Moore, J. (2015). *Capitalism in the Web of Life*, Verso: London.
- Morgan, J. (2020). Electric Vehicles: The future we made and the problem of unmaking it. *Cambridge Journal of Economics*, 44(4), 953-977.
- Morgan, J. (2017). Piketty and the growth dilemma revisited in the context of ecological economics. *Ecological Economics*, 136, 169–177.
- Morgan, J. (2016). Paris COP21: Power that speaks the truth? *Globalizations*, 13(6), 943–951.
- Morgan, J. (2015). Is economics responding to critique? What do the UK QAA 2015 Subject Benchmarks for Economics indicate? *Review of Political Economy*, 27(4), 518-538.
- Newell, P. and Simms, A. (2020). How did we do that? Histories and political economies of rapid and just transitions. *New Political Economy*, <https://doi.org/10.1080/13563467.2020.1810216>
- Newell, P. and Taylor, O. (2020) Fiddling while the planet burns? COP 25 in perspective. *Globalizations*, 17(4), 580-592.
- O'Neill, J. (2007). *Markets, Deliberation and Environment*. London: Routledge.
- Oosthoek, J. and Gills, B. K. (2005). Humanity at the crossroads: The globalization of environmental crisis. *Globalizations*, 2(3), 283-291.

- Parrique, T., et al., (2019). Decoupling Debunked. *European Environmental Bureau*. July. eeb.org/library/decoupling-debunked
- Ripple, W. Wolf, C. Newsome, T. Barnbard, P. Moomaw, W. and 11,258 signatories (2020). World Scientists' Warning of a Climate Emergency. *BioScience*, 70(1), 8-12.
- Röpke, I. (2020). Econ 101—In need of a sustainability transition. *Ecological Economics*, 169: article 106515.
- Samerski, S. (2018). Tools for degrowth? Ivan Illich's critique of technology revisited. *Journal of Cleaner Production*, 197(Part 2): 1637-1646.
- Schumacher, E. (1973 [1993]). *Small is Beautiful: A Study of Economics as if People Mattered*. London: Vintage.
- Schröder, E. and Storm, S. (2020). Economic growth and carbon emissions: The road to 'hothouse earth' is paved with good intentions. *International Journal of Political Economy*, 49(2): 153-173.
- Smith, T. (ed. for the collective) (2019). *Degrowth of Aviation: Reducing Air Travel in a Just Way*. Stay Grounded. <https://stay-grounded.org/new-study-measures-to-reduce-air-travel-in-a-just-way/>
- Söderbaum, P. (2018). *Economics, ideological orientation and democracy for sustainable development*. London: WEA Books.
- Solow, R. (1974). The economics of resources or the resources of economics. *American Economic Review* 64(2), 1-14.
- Spash, C. (2020a). The economy as if people mattered: Revisiting critiques of economic growth in a time of crisis. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1761612>
- Spash, C. (2020b). A tale of three paradigms: Realising the revolutionary potential of ecological economics. *Ecological Economics*, 169: article 106518.
- Spash, C. (2020c). Apologists for Growth: Passive Revolutionaries in a Passive Revolution. *Globalizations*, this issue.
- Spash, C. (ed.) (2017). *Routledge Handbook of Ecological Economics: Nature and Society*. New York: Routledge.
- Spash, C. (2016). This changes nothing: The Paris Agreement to ignore reality. *Globalizations*, 13(6), 928–933.
- Steffen, W., Rockström, J., Richardson, K., Lenton, T. M., Folke, C., Liverman, D., ... Schellnhuber, H. J. (2018). Trajectories of the Earth System in the Anthropocene. *Proceedings of the National Academy of Sciences of the USA*, 115, 8252–8259.
- Steffen, W. Richardson, K. Rockstrom, J. Cornell, S. E. Fetzer, I. Bennett, E. Biggs, R. Carpenter, S. de Vries, W. de Wit, C. Folke, C. Gerten, D. Heinke, J. Mace, G. M. Persson, L. M. Ramanathan, V. Reyers, B. & Sornlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223): 736–46.
- Steinberger, J. (2020). Cogs in the climate machine: A short course in planetary time, for planetary survival. *Climate Conscious*, Blogged July 10th <https://medium.com/climate-conscious/cogs-in-the-climate-machine-167cfl6750dd>
- Stern, N. (2013). The structure of economic modelling of the potential impacts of climate change: Grafting gross under-estimation of risk onto already narrow science models. *Journal of Economic Literature*, 51(3), 838–859.
- Stevenson, H. (2020). Reforming global climate governance in an age of bullshit. *Globalizations*, <https://doi.org/10.1080/14747731.2020.1774315>
- UNEP (2019, November). *Emissions Gap Report 2019* (10th edition). New York: Author.
- UNEP (2018, November). *Emissions Gap Report 2018* (9th edition). New York: Author.
- Vega, E. Chalk, T. Wilson, P. Bysani, R. and Foster, G. (2020). Atmospheric CO₂ during the Mid-piacenzian Warm period and the M2 glaciation. *Nature*, 10(11002) <https://doi.org/10.1038/s41598-020-67154-8>
- Wiedmann, T. Schandl, H. Lenzen, M. Moran, D. Suh, D. West, J. and Kanemoto, K. (2015). The Material Footprint of Nations. *Proceedings of the National Academy of Sciences*, 112(20), 6271–6.

Wunderling, N. Donges, J. Kurths, J. and Winkelmann, R. (2020). Interacting tipping elements increase risk of climate domino effects under global warming. *Earth System Dynamics*, <https://doi.org/10.5194/esd-2020-18>