

A 'No Analogue' State: the Anthropocene and its implications

Dave O'Farrell

The term Anthropocene has gained widespread acceptance over the last decade. Although the term and similar ones have been used in the past, to describe more or less similar ideas, the notion that the scale of human activity has now reached a level where we have entered a new geological epoch was formally proposed in May 2000 by scientists Paul Crutzen and Eugene Stoermer in the newsletter of the *International Geosphere–Biosphere Programme* (IGBP)¹ following an apparently off-the-cuff remark from Crutzen at a previous meeting of the IGBP.²

Noting the 'major and still growing impacts of human activities on earth and atmosphere, and at all, including global, scales' they suggested it was 'more than appropriate to emphasize the central role of mankind in geology and ecology by proposing to use the term "anthropocene" for the current geological epoch'.

Given the fact that geological epochs are generally defined in terms of major markers or changes in the geological record and usually last millions of years while our – still current – epoch, the Holocene, only began about 11,700 years ago, the idea that we have moved into a new geological epoch is a radical idea and its rapid adoption is somewhat surprising. In no small part driven by the growing alarm amongst climate scientists and those studying earth systems science the progress of the Anthropocene from proposal to a near universal acceptance in the scientific community has been

staggering. Despite not yet having been officially adopted as a formal unit of geological epoch division a working group has been established and the term has appeared frequently in scientific journals, books and news articles.

If this rapid adoption of the Anthropocene in the scientific community has been surprising the much wider use of the term in other, sometimes unexpected, fields is staggering. The term Anthropocene regularly appears in titles at conferences on an array of topics including sociology, art, design and literature. The Canadian ecosocialist Ian Angus even relates encountering a blog post on 'reading the book of Mormon in the Anthropocene'! This proliferation of the use of the term is understandable given its close association with climate change, that existential crisis that more than any other can be said to loom large in the general public consciousness. Despite an abject failure to real deal with climate change it still looms large in daily life for many of us, from the increasing extreme weather events, the near constant stream of public policy pronouncements which claim to tackle it (however ineffectually) or even the addition of some form of 'environmentally friendly' style tagline to the marketing spiel of the never ending list of commodities we encounter. In many ways, not to dismiss the growing body of serious social, economic and political study of the topic, Anthropocene has become something of a byword for our modern times.

Whilst I think most socialists would welcome an

increasing awareness of climate change it should also be a source of concern that some usage of the term in a broader sense can often be very wide of the mark. Not only is the science sometimes misrepresented but the implications of it can be missed entirely. If this is true in terms of the science it is doubly true when it comes to the politics of the Anthropocene. Climate change denialists notwithstanding, the science behind the Anthropocene, its causes and likely effects are broadly understood and accepted but the politics behind this are very much a battle ground. If as Marxists we are serious about tackling climate change it is vital that we understand the Anthropocene and what it means. We need to grasp not only the science and its implications for our world but also the politics that have led us to this point – if we cannot grasp how we have gotten here we cannot hope to change for the better.

In this article I want to give a brief overview of what the Anthropocene means scientifically and investigate some of the serious debates, in particular on the left, around the politics of the Anthropocene and hopefully point towards some strategies for change.

Planetary terra incognita

As I have noted, for most people the Anthropocene is strongly associated with climate change. While this is certainly an important aspect, the Anthropocene involves much more besides and encompasses a much fuller account of earth system science.

The concept was (re)invented out of the work of the *International Geosphere–Biosphere Programme* (IGBP) which ran from 1987 to 2015 with the goal of providing ‘scientific knowledge to improve the sustainability of the living Earth.’ The IGBP focused on gaining an accurate picture of the totality of the earth system and ran a series of

‘projects around the major compartments of the Earth System (i.e. land, ocean, and atmosphere), the interfaces between them (land-ocean, ocean-atmosphere and land-atmosphere) and a system-wide integration (Earth System modelling and palaeo-environmental research).’³

This approach of analysing the earth system as a whole gave rise to some startling insights. Since the earth is essentially a materially closed system with a primary external energy source in the sun it is possible

– indeed necessary – to look at various cycles within the earth system. Given the materially closed nature of the earth system – the addition of new material from extraterrestrial sources like meteorite impacts is essentially negligible on the timescales of interest to us – there are constant processes at work moving material from place to place and/or converting it from one form to another. The carbon cycle, particularly in relation to CO₂ in the atmosphere, is probably the best known but there are also cycles or flows of many other materials such as water, nitrogen, phosphorous and ozone. From these studies two important concepts emerge, *the great acceleration* and the idea of *planetary boundaries*.

Between 1999 and 2003, while they worked on the first synthesis report, the IGBP set out to:

‘Build a more systematic picture of the human-driven changes to the Earth System, drawing primarily, but not exclusively, on the work of the IGBP core projects. The idea was to record the trajectory of the “human enterprise” through a number of indicators and, over the same timeframe, track the trajectory of key indicators of the structure and functioning of the Earth System.’⁴

A key result of this project was the creation of 24 graphs tracking 12 features of the earth system and 12 features of human activity from 1750 to 2000. These graphs were subsequently updated in 2015 to take account of data up to 2010.^{5,6} Looking at the graphs they noticed that:

‘One feature stands out as remarkable. The second half of the twentieth century is unique in the entire history of human existence on Earth. Many human activities reached take-off points sometime in the twentieth century and have accelerated sharply towards the end of the century. The last 50 years have without doubt seen the most rapid transformation of the human relationship with the natural world in the history of humankind.’⁷

They went on to christen this phenomenon *the great acceleration*.

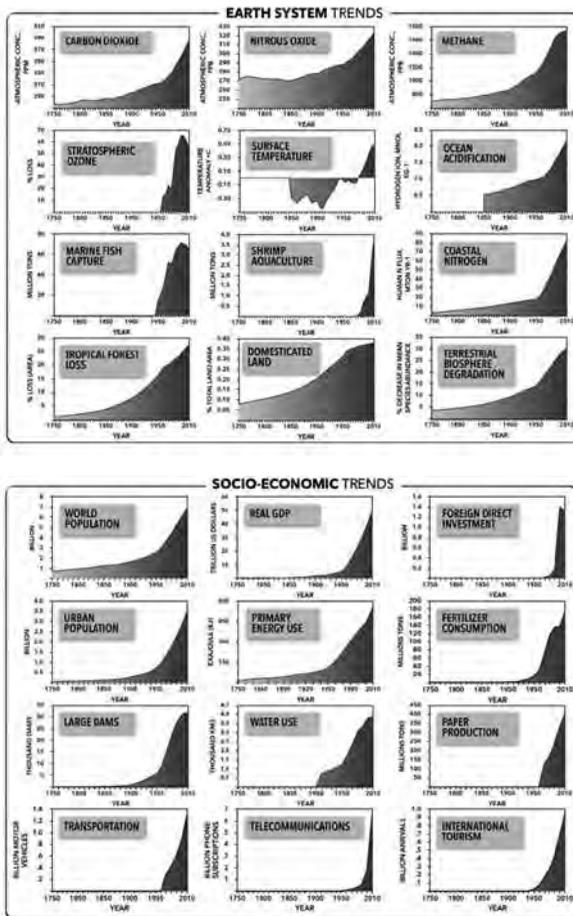


Figure 1. Updated graphs showing the great acceleration.⁸

The quantitative results from the study are shocking and indicate that human activity has pushed many features of the earth system outside of the ranges they have displayed during the entire time that human civilisation has existed. It is truly difficult to overstate the importance of the role a stable climate has played in the development of human civilisation, while modern humans (in an evolutionary sense) have existed for close to 200,000 years it was only at the end of the last ice age – the end of the Pleistocene and beginning of the Holocene – that global temperatures stabilised to the degree where human agriculture became possible. During the Pleistocene CO₂ concentration levels varied between 180ppm (parts per million) during ice ages to 280ppm during interglacial periods and it is only when

these levels stabilised close to 300ppm at the beginning of the Holocene that agriculture developed – at which point it developed apparently independently within a short time not only in the fertile crescent of the middle east but also in other areas including Africa and both North and South America in what is generally termed the Neolithic Revolution after the term first coined by the great archaeologist, V. Gordon Childe in the 1920s.

As of June 2018 atmospheric CO₂ concentrations stand at 411ppm,⁹ a level that has not been exceeded during the past 420,000 years and likely not during the past 20 million years.¹⁰ It is data such as this, combined with how far outside of historic bounds that other indicators such as nitrogen and phosphorous flows – in large part driven by the development and use of artificial fertilisers – have been driven, that has led to talk of the Anthropocene being ‘uncharted territory’, ‘planetary terra incognita’ or a ‘no analogue state’. Human activity has propelled the earth system out of the Holocene conditions which represent the only known conditions in which we are sure human society can exist in the form of complex large scale civilisation. This extremely disquieting realisation lead a group of prominent climate scientists headed by Johan Rockström of the Stockholm Resilience Centre to propose a series of planetary boundaries, with appropriate measurable control variable(s) where possible, which would represent ‘a safe operating space for humanity’.¹¹ Their proposal involved nine planetary boundaries which seek to cover:

‘the global biogeochemical cycles of nitrogen, phosphorus, carbon, and water; the major physical circulation systems of the planet (the climate, stratosphere, ocean systems); biophysical features of Earth that contribute to the underlying resilience of its self-regulatory capacity (marine and terrestrial biodiversity, land systems); and two critical features associated with anthropogenic global change (aerosol loading and chemical pollution)’.¹²

The boundaries, like the great acceleration graphs, were subsequently updated with some modifications in 2015.¹³ It is worth noting that while these boundaries are not necessarily tipping points, moments where relatively small changes in a system can lead to much larger and possibly irreversible changes as a result of internal system interactions or feedbacks, they could

be said to bear resemblance to them. Changes to one boundary can lead to effects on another, for example a change of land use involving clearing of rainforest for agriculture can have effects on monsoon patterns and hence on the availability of fresh water.¹⁴ Feedback loops can also play an important role: for example studies on the Greenland ice sheet have shown that as the surface melt increases with global temperatures more and more particular matter such as dust and soot are exposed, in years of particularly high melt many years of accumulated dust can clump together resulting in a much darker surface when it refreezes. This darker surface in turn absorbs more heat and increases the rate of melting in subsequent years.¹⁵

While all these boundaries are clearly important the research does suggest a certain hierarchy to them. They note

‘An analysis of the many interactions among the boundaries suggests that two of them—climate change and biosphere integrity—are highly integrated, emergent system-level phenomena that are connected to all of the other PBs. They operate at the level of the whole Earth system and have coevolved for nearly 4 billion years. They are regulated by the other boundaries and, on the other hand, provide the planetary-level overarching systems within which the other boundary processes operate. Furthermore, large changes in the climate or in biosphere integrity would likely, on their own, push the Earth system out of the Holocene state. In fact, transitions between time periods in Earth history have often been delineated by substantial shifts in climate, the biosphere, or both.

These observations suggest a two-level hierarchy of boundaries, in which climate change and biosphere integrity should be recognized as core planetary boundaries through which the other boundaries operate. The crossing of one or more of the other boundaries may seriously affect human well-being and may predispose the transgression of a core boundary(ies) but does not by itself lead to a new state of the Earth system.¹⁶

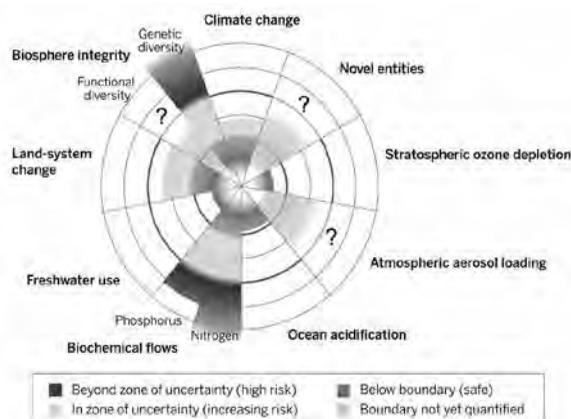


Figure 2: Schematic indicating the status of 7 of the 9 identified planetary boundaries¹⁷ (some boundaries do not yet have well defined control variables while some have more than one control variable).

In light of this hierarchy a quick look at the schematic of planetary boundaries in figure 2 should give cause for concern. Measures of genetic diversity are already beyond the boundary; by some estimates we are now facing into a sixth mass extinction and extinction rates are estimated to be running at near to 1,000 times the background rate (See Linda Kehoe’s article page 59). Climate change, as measured by the CO₂ concentration in the atmosphere, is in an area of increasing . Most worryingly, given the long lived nature of CO₂ in the atmosphere and the fact that what really matters is the total cumulative amount emitted, we are actually increasing our carbon emissions. In 2010 emissions were 31 percent higher than in 1990, the year the Kyoto Protocol was negotiated.¹⁸ In short the more we know of the dangers of using fossil fuels the more we burn.

How did we get here?

Given that we now know not only about the dangers of climate change but also how to deal with it, i.e. a rapid switch away from fossil fuels, how do we answer the question of why, instead of taking the required steps, we are instead doubling down on fossil fuels?

In order to answer this question it is necessary to consider how we have arrived at this point and this is best achieved by an examination of how our capitalist economy has developed to be so reliant on fossil fuels.

The widespread use of fossil fuels in industry has its

origins the industrial revolution in nineteenth century Britain. In his excellent *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming*¹⁹ Andreas Malm demonstrates that the switch to steam power which occurred in early to mid-nineteenth century in Britain was not automatic. Contrary to some previously advanced narratives the alternatives, mainly water power, were still plentiful and cheap and the switch was instead driven by conflict between labour and capital. For example a key element in bringing about the transition were the Factory Acts, particularly the Ten Hours Act of 1847, which arose in response to sustained periods of workers' militancy - including the general strike of 1842. Prior to the Acts 'capital had primarily been accumulated through the production of *absolute surplus value*' by 'extension of the working day beyond the hours necessary for the workers to produce the equivalent of their wages'. After the Acts there was a move towards accumulation from relative surplus value by curtailing the necessary labour time of each worker through the use of steam engines with their ability to be 'sped up at will' as opposed to water power and its reliance on the flow of water at any given time which was outside of the capitalists control.²⁰

This adoption of steam power led to a fossil economy, defined by Malm as 'an economy of self-sustaining growth predicated on the growing consumption of fossil fuels'.²¹ The internal logic of capitalism then aids the further diffusion of steam power and with it fossil fuels - once coal was being extracted as a commodity in its own right to supply steam engines it was only 'natural' for the mine owners to seek other markets for their product such as replacing wood for heating homes. Once one capitalist has successfully adopted steam others are forced to follow suit or risk going out of business. In many ways this process continues to this day, energy companies - among the largest and most powerful companies in the world - continue to seek out new reserves of fossil fuels despite being unable to use anything even close to their existing proven reserves without throwing the planet in to a scenario of temperatures skyrocketing by much more than the generally accepted limit of 2°C and imperilling humanity's very existence. As illogical as this seems it makes perfect sense to a capitalist focused on profit above all else for as David Harvey noted in his *The Limits to Capital* once 'capitalists purchase fixed

capital, they are *obliged to use it* until its value (however calculated) is fully retrieved. Fixed capital 'engages the production of subsequent years'.²² In other words if giant corporations have invested hundreds of billions in factories producing petrol driven cars or coal driven steel plants there is no way, left to their own devices, they will abandon their investments until they are 'used up', which may be decades.

The politics of the Anthropocene: what's in a name?

It makes a lot of sense for Marxists to embrace the idea of the Anthropocene, it proposes a radical change in our understanding of climate change and the dangers it poses while being widely accepted both within the scientific circles and among much of the population at large. Yet some figures on the left, both self-described Jason Moore like Andreas Malm and others like Naomi Klein have objected to the term, often proposing the Capitalocene as an alternative.

Without wanting to do a disservice to some of the often detailed arguments that have been put forward for such an alternative term the arguments at their most basic level generally boil down to what has been termed the 'equity issue' - essentially arguing that the term Anthropocene implies that all humans are equally responsible for climate change and ignoring, or at least downplaying, differences between both countries and classes - and a desire to link climate change more explicitly to capitalism. While I think most Marxists, including myself, will very much sympathise with such objections I do not think the arguments justify arguing against the term and in fact there are a two very good reasons to talk about the Anthropocene.

Firstly the term is now widely accepted, has a strong scientific validity and it fits within the accepted conventions for designating geological epochs - which are defined in terms of the deposits left in the geological strata. A common misconception exist that claims the Anthropocene means 'the human age' or similar. In fact the suffix, *-cene*, is derived from the Greek *kainos* and does not mean 'age' or 'epoch' but rather 'recent' meaning that the term refers to deposits of a recent human origin which are different precisely because of human activity in a manner analogous to using the term anthropogenic to distinguish climate change due

to human activity from any natural changes in climate.²³

In some ways this argument can be linked to the debate over when exactly the Anthropocene started. Crutzen's initial suggestion placed the start date around the start of the industrial revolution and James Watt's invention of the rotary steam engine.²⁴ This date, or even an earlier one, can hold a certain attraction for those who wish to use the term Capitalocene or similar to link the origins of capitalism with the start of climate change but it suffers two major draw backs. Humans have always altered the world around them in the process of creating their means of existence – for Marxists doing this consciously is practically the definition of being human – and using the origins of an economic system as an arbitrary start point for a geological epoch is, at best, scientifically inconsistent. In contrast the most recently proposed, and indeed widely accepted, start date for the Anthropocene of the mid 1950's has the advantage of being much more scientifically rigorous. Geological deposits after this date should be much more identifiable to any future being that set out to excavate the remains we leave behind today from a large number of markers including the amounts of concrete, plastic and other man made substances, radioactive isotopes from nuclear weapons and power generation and the rapid species loss which will likely be recorded in the future fossil record. In fact it can be argued that this much later start date for the Anthropocene at the start of the great acceleration is a much better one to highlight the role of capitalism in the climate crisis given that it corresponds with capitalisms 'golden age' of the post war boom.

Secondly, while arguments that the scientific considerations around the Anthropocene may have ignored equity issues may well have had some validity in the past, by and large many scientists involved in climate research now make explicit reference to the inherent inequality in terms of the vastly different impacts different groups around the world have actually had on the climate.

While it is probably unrealistic to expect the large numbers of climate scientists to all suddenly adopt an explicitly Marxist analysis they have often responded to the criticism they have received for the perception that they have treated humanity as an undifferentiated whole when discussing the Anthropocene and its causes. By

way of example the 2015 update to the great acceleration graphs now includes a section titled 'Deconstructing the socio-economic trends: the equity issue'. This welcome development acknowledges that:

'Insofar as the imprint on the Earth System scales with consumption, most of the human imprint on the Earth System is coming from the OECD world. This points to the profound scale of global inequality, which distorts the distribution of the benefits of the Great Acceleration and confounds efforts to deal with its impacts on the Earth System.

'... Furthermore, by treating "humans" as a single, monolithic whole, it ignores the fact that the Great Acceleration has, until very recently, been almost entirely driven by a small fraction of the human population, those in developed countries'.²⁵

In addition, for the ten socioeconomic graphs where data was available they have attempted to show the individual contributions from different groups of countries.

While there is still no attempt at a class analysis it is at least acknowledged, referencing the work of *The Spirit Level* authors, Richard Wilkinson and Kate Pickett, that 'inequalities in income and wealth both within and between countries continue to be a significant problem, with consequences for individual and societal well-being'.²⁶

While as Marxists we would clearly like to go much further, particularly in analysing the class dimensions, it is surely a good sign to see climate scientists taking these concerns on board and responding to them. This is even more true when we remember that the group who carried out the research, the IGBP, in its earlier days shared that regrettable trend all too common in scientific research of somehow standing separate to or even above society and certainly politics. Consider the account of João Manuel F de Moraes who joined the IGBP in 1995 and was the Deputy Director, Social Sciences, from 1996 to 2012.

'IGBP also saw itself as a "neutral forum": its leadership pointed out that the Human Dimensions Programme – which at the time represented the social-science research relevant to global change – was closely related to policy and that IGBP should "avoid being drawn into politics"'.²⁷

In a similar manner the update on planetary

boundaries now also contains a section acknowledging its shortcomings in addressing societal issues while the IPCC issues specific summaries of its work for policy makers.

These welcome developments that have seen climate scientists at least begin to engage in a serious way with genuine criticism about the lack of a social dimension to their work would seem to render the idea that we need to mount a battle against the term Anthropocene on such grounds moot. In some ways this can be viewed as more and more scientists catching up with the general climate movement for whom demands around social justice have been the norm for decades. In fact if the scientists are engaging in these debates then surely we should instead embrace the term and continue to promote it and push it in the most radical and anti-capitalist direction we can.

Conclusion

Building a movement around climate change is a . Despite the magnitude and ever present nature of the climate threat it can be hard to mobilise significant numbers. While people will readily protest on particular issues in some ways the overall issue is just so big as to be almost demobilising. As the old saying goes 'it is easier to imagine the end of the world than to imagine the end of capitalism' and yet if we really want a resolution to the climate crisis it is exactly the end of capitalism that we need.

The new reality facing the planet, and of course humanity, is captured extremely comprehensively in the concepts of the Anthropocene and the related concepts of the great acceleration and planetary boundaries. Given that the term already has a wide public recognition it is vital that Marxists have at least a basic knowledge of the science behind the Anthropocene combined with a Marxist understanding of its roots in the capitalist system. With the correct analysis it can be a powerful tool to promote socialist solutions.

We need to seize every opportunity to highlight the capitalist system as the root cause of climate change. This can be done in many ways from supporting specific policies or legislation like the People Before Profit Climate Emergency Bill, which seeks to stop the government from issuing any new exploration licences for oil or gas, to integrating demands for

environmentally friendly initiatives like improved and expanded public transport. It is difficult for the representatives of the capitalist class to outright reject such simple, 'common sense' demands like these and when they do oppose them or say it's a good idea but just not practical or possible it exposes the underlying capitalist reasons for the opposition.

The housing crisis offers other opportunities to raise demands about creating environmentally sustainable jobs building new sustainable public housing and retrofitting existing housing. Such demands are important for achieving real change as they can aid in mobilising the working class around climate demands through another capitalist induced crisis.

Ultimately real change will only come from a mass movement from below and as the climate crisis accelerates and worsens the need for such a movement grows. If we can continue to campaign where we can and keep raising our demands the hopefully the likelihood of such a movement emerging can also grow..

Notes

- 1 Paul J. Crutzen and Eugene F. Stoermer, 'The Anthropocene' in the newsletter of the International Geosphere–Biosphere Programme (IGBP) 41 May 2000. p.17 Available at igbp.net/download/18.316f18321323470177580001401/1376383088452/NL41.pdf
- 2 For an account of the history of the term see Ian Angus Facing the Anthropocene: fossil capitalism and the crisis of the earth system, *Monthly Review Press*, New York 2016.
- 3 From igbp.net available at web.archive.org/web/20100429214408/http://www.igbp.net/page.php?pid=113
- 4 Will Steffen et al. 'The Trajectory of the Anthropocene: the Great Acceleration' *The Anthropocene Review* Vol 2, Issue 1, 2015. Available free at openresearch-repository.anu.edu.au/bitstream/1885/66463/8/01_Steffen_GREAT%20ACCELERATION_2015.pdf
- 5 *Ibid.*
- 6 As part of the update the scientists also replaced one of the socioeconomic graphs which aimed to track globalisation by measuring the number of McDonalds restaurants with a new graph measuring primary energy usage.
- 7 *Ibid.*
- 8 Created by R. Jamil Jonna based on data in Will Steffen, Wendy Broadgate, Lisa Deutsch, Owen Gaffney, and Cornelia Ludwig, "The Trajectory of the Anthropocene: The Great Acceleration," *Anthropocene Review* 2, no. 1 (April 2015): 81–98. Taken from Ian Angus 'When did the Anthropocene begin, and why does it matter?' First published in *Monthly Review*, September 2015 available on Climate & Capitalism blog at <http://climateandcapitalism.com/2015/09/10/when-did-the-anthropocene-begin-and-why-does-it-matter/>
- 9 See www.co2.earth for up to date concentrations. Concentration of 411ppm retrieved on 15 June 2018 based on preliminary data released on June 4, 2018 by the Mauna Loa Observatory in Hawaii.
- 10 Climate Change 2001: The Scientific Basis IPCC. Available at ipcc.ch/ipccreports/tar/wg1/pdf/WG1_TAR-FRONT.PDF
- 11 Johan Rockström et al 'Planetary Boundaries: Exploring the Safe Operating Space for Humanity' *Ecology and Society* 14(2): 32. Available at ecologyandsociety.org/vol14/iss2/art32/ See also a less technical summary of the titled 'A Safe Operating Space for Humanity' published in *Nature* available at nature.com/articles/461472a
- 12 *Ibid.*
- 13 Will Steffen et al 'Planetary boundaries: Guiding human development on a changing planet' *Science* 13 Feb 2015: Vol. 347, Issue 6223. Available at science.sciencemag.org/content/347/6223/1259855.full
- 14 Paul Supantha et al. 'Weakening of Indian Summer Monsoon Rainfall due to Changes in Land Use Land Cover' *Scientific Reports* volume 6, Available at nature.com/articles/srep32177
- 15 'Greenland's ice is getting darker, increasing risk of melting, Feedback loops from melting itself are driving changes in reflectivity' sciencedaily.com Available at sciencedaily.com/releases/2016/03/160303145741.htm
- 16 Will Steffen et al 'Planetary boundaries: Guiding human development on a changing planet' *Science* 13 Feb 2015: Vol. 347, Issue 6223. Available at science.sciencemag.org/content/347/6223/1259855.full
- 17 Will Steffen et al 'Planetary boundaries: Guiding human development on a changing planet' *Science* 13 Feb 2015: Vol. 347, Issue 6223. Available at science.sciencemag.org/content/347/6223/1259855.full
- 18 IPCC, 2014: Summary for Policymakers, In: *Climate Change 2014, Mitigation of Climate Change*. Available at ipcc.ch/pdf/assessment-report/ar5/wg3/drafts/fgd/ipcc_wg3_ar5_summary-for-policymakers_approved.pdf
- 19 Andreas Malm *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* Verso 2016
- 20 *Ibid.* p. 306-7
- 21 *Ibid.* p. 11
- 22 David Harvey, *The Limits to Capital* Verso 2006 p.220 (the quoted section is a reference to Marx's Grundrisse)
- 23 For a more detailed argument see 'What's in a name?' in the Appendix to Ian Angus Facing the Anthropocene: fossil capitalism and the crisis of the earth system, *Monthly Review Press*, New York 2016.
- 24 See Paul J. Crutzen and Eugene F. Stoermer, "The 'Anthropocene'" in the newsletter of the International Geosphere–Biosphere Programme (IGBP) 41 May 2000. p.17 Available at igbp.net/download/18.316f18321323470177580001401/1376383088452/NL41.pdf
- 25 Will Steffen et al 'Planetary boundaries: Guiding human development on a changing planet' *Science* 13 Feb 2015: Vol. 347, Issue 6223. Available at science.sciencemag.org/content/347/6223/1259855.full
- 26 *Ibid.*
- 27 João Manuel F de Morais 'A personal note on IGBP and the social sciences' IGBP's Global Change magazine 84, November 2015 Available at igbp.net/news/features/features/apersonalnoteonigbpandthesocialsciences.5.950c2fa1495db7081e18757.html