

An Eco-Revolutionary Tipping Point?

Global Warming, the Two Climate Denials, and the Environmental Proletariat

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In the summer of 2016, the acceleration of climate change was once again making headlines. In July, the World Meteorological Association announced that the first six months of 2016 had broken all previous global temperature records, with June being the fourteenth month in a row of record heat for both land and oceans and the 378th straight month of temperatures greater than the historical average. Heating has been especially rapid in Arctic regions, where thawing effects are releasing large amounts of methane and carbon dioxide. On July 21, 2016, temperatures at locations in Kuwait and Iraq reached 129°F, the hottest ever recorded in the Eastern Hemisphere. The disruptive effects of bi-polar warming were evident in the unprecedented crossing of the

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equator by the Northern Hemisphere jet stream, where it merged with the

Southern Hemisphere jet stream, further threatening seasonal integrity with unforeseen impacts on weather extremes and the overall climate system.¹ Meanwhile a report from the United Nations Environment Program (UNEP) described the December 2015 Paris Agreement on climate change as *outdated even before it takes effect*, with climatologists now expecting a global warming of at least 3.4°C (more than double the 1.5°C limit supposedly built into the agreement) even if the promised emissions goals of the nations involved are somehow achieved despite the lack of binding enforcement mechanisms. *The world will still be pumping out 54–56*



¹ ↗ Lisa Schlein, “WMO: Global Warming Happening Faster than Predicted,” Voice of America, July 21, 2016; Jason Samenow, “Two Middle East Locations Hit 129 Degrees,” Washington Post, July 22, 2016; David Edwards, “‘Unprecedented’: Scientists Declare Global Climate Emergency After Jet Stream Crosses Equator,” Alternet, June 30, 2016.

gigatons of carbon dioxide equivalent a year by 2030 under current plans, well above the 42 gigatons needed to limit warming to 2 degrees, according to the UNEP report.²

The historical irony in this situation is hard to miss. Just a couple decades ago, we were told that neoliberal capitalism

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marked the “end of history.” Now it appears that the system’s ideologues may have been right, but not in the way they envisioned. The system of fossil-fuelled neoliberal capitalism is indeed moving toward an end of history, but only in the sense of the end of any historical advance of humanity as a productive, political, and cultural species due to the increasingly barbaric socio-economic and environmental conditions the system

creates. There is now no alternative to the end of history as we know it. The sustainable development of human society co-evolving with nature including other species now depends on a definite historical break with capitalism (wage-labor, market competition, production for profit) as the dominant mode of production. That is the main lesson of three recent books: Ian Angus’s *Facing the Anthropocene*, Andreas Malm’s *Fossil Capital*, and Naomi Klein’s *This Changes Everything*. To solve the climate crisis—which is only part of the broader environmental crisis created by capitalism—competitive,

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profit-driven production under unequal class control must be replaced with a system in which working people and their communities collectively and democratically regulate production and other interactions with their material and social environment. Sustainable development of people cooperatively co-evolving in a healthy way with other species must replace the profit motive, exploitation, and competition as the motive force in production and in the entire system of material provisioning. To deny that the

climate crisis is hardwired into capitalism, and that we need a new system to deal with it, is just as misleading and dangerous as to deny the existence of human-induced global warming. Both forms of climate denial must be overcome in theory and practice.

This lesson was forcibly driven home for me last fall, with the heating-up of the monumental struggle by the Standing Rock Sioux, allied indigenous peoples, and their supporters against the Dakota Access Pipeline. In line with “business as usual,” the mainstream media and President Obama only visibly responded to this struggle (and then tepidly) when demonstrators were physically attacked by the police and corporate security forces live on guerrilla internet broadcasts, followed by the arrival of U.S. military veterans and thousands of others (including some major political and entertainment figures) to support the water protectors. While the corporate media and Obama described the conflict as one over protection of local land and water rights pure and simple, many of the indigenous people and their allies saw it as a struggle to protect the whole earth from an economic system whose imperative to extract fossil fuels for a profit fails to recognise the integrity of the land and its inhabitants as a web of physical, cultural, and spiritual life-forces.³ Another reason everyone should read the aforementioned books is that, taken together, they provide a powerful analysis of the political meaning of apparently localised struggles over land rights such as Standing Rock—further putting the lie to end-

² ↪ Jessica Shankleman, “Climate Headed for Catastrophic Change Despite Paris Accord,” Bloomberg News, November 3, 2016; see also Megan Darby, “Scientists: Window for Avoiding 1.5°C Global Warming ‘Closed,’” Climate Home, June 29, 2016, <http://climatechangenews.org>; Nika Knight, “Despite Paris Climate Pledge, Planet on Track to Surpass 3 Degree Temperature Rise,” Common Dreams, November 3, 2016, <http://commondreams.org>.

³ ↪ See various reports on the Standing Rock struggle from the following organisations and websites: Stand with Standing Rock, <http://standwithstandingrock.net>; Digital Smoke Signals, <http://digitalsmokesignals.com>; Indigenous Rising, <http://indigenoustrising.org>; and Last Real Indians, <http://lastrealindians.com>. Kevin Gilbert’s on-site reports and eyewitness footage, posted on Facebook, were very important in getting the word out on the violence perpetrated by security forces against the water protectors.

of-history thinking. They show that conflicts over pipelines and other fossil-fuel installations can be seen as the cutting edge of an intensifying global class struggle between the dominant sectors of capital and what John Bellamy Foster and others have termed the “environmental proletariat.”⁴

Although the three books overlap in their coverage of the history and political economy of the climate crisis, they have distinct and complementary analytical vantage points. Angus analyses global warming through an ecological Marxist interpretation of the Anthropocene, defined by natural scientists as a new epoch of biospheric history in which humans play a leading role in altering global geological processes including the climate.

Malm’s book details the close connections between the burning of fossil fuels (the main source of human-induced climate change) and capitalism’s development of industrial production—a convergence that he terms “fossil capital.” His historical analysis establishes that the fossil fuelling of the economy was not driven by generic considerations of scarcity or technical efficiency, but rather by the requirements of exploiting wage-labor, class-monopolisation of the benefits of production, and the system’s preference for private competition over social cooperation in the realm of energy use.

Finally, Naomi Klein focuses on the role of neoliberal policies as an enabler of fossil-fuelled capitalism and climate change, and as a barrier to sustainable and socially progressive solutions to the climate crisis. She argues that the crisis can be converted into a positive opportunity insofar as it clarifies the clash between capitalist and ecological life-values, but only if we can combat neoliberal capital’s opportunistic use of climate disasters to implement regressive free market and technical “fixes” (including so called climate engineering). Klein describes how environmental proletarians (or, as she terms them, “Blockadians”) are forging innovative combinations of indigenous, communal, feminist, and scientific ways of thinking, as they resist the incursions of oil extraction and transport projects into communal lands and begin the construction of a sustainable alternative to fossil capital.

For present purposes, however, it makes sense to start with Angus’s synthesis of climate science and the history of modern capitalism.

A Material and Historical Crisis

Angus does not see climate change as a discrete issue. For him, it is not a separate environmental problem that can be treated in isolation. Instead, he locates it within a broader tendency of human activities (especially production and consumption, but also military operations) to have major environmental effects. Based on the work of Earth-system scientists, he argues that, in the late 1940s, the world entered a new geological epoch, the Anthropocene, in which human-caused environmental impacts became the main driver of changes in the Earth system as a whole, and that these planetary impacts are now endangering the conditions needed for a stable and healthy development of human civilisation (not to speak of the threats posed to non-human species). In the Anthropocentric epoch, the throughput of human production and consumption (and military activities) is rapidly reaching “tipping points” beyond which it will have large and partly unforeseen impacts across a variety of global geological sub-systems.

In addition to the climate system, these tipping points encompass issues such as: (1) declining biosphere integrity—based on reduced diversity of life both functionally and genetically; (2) the capacity of ecological systems to absorb and otherwise adapt to the introduction of novel entities (new chemical and biological substances) consistent with system

⁴ ↪ John Bellamy Foster, Brett Clark, and Richard York, *The Ecological Rift* (New York: Monthly Review Press, 2010), 47, 398, 440.

states conducive to human and other forms of life; (3) ozone depletion, i.e., reduction of the concentration of ozone in the stratosphere, which raises exposure of terrestrial life to cancer-causing ultraviolet radiation; (4) ocean acidification, which disrupts oceanic and related food chains starting with corals, plankton, and shellfish; (5) biogeochemical flows, especially the nitrogen and phosphorus cycles that have been overloaded by fertiliser runoffs into inland fresh waters and the oceans, again disrupting ecological systems; (6) land-system change, i.e., expansion of agriculture and other activities onto former grasslands, savannahs, and forest areas; (7) freshwater use, where water absorption by agriculture and industry is rapidly rising toward the global limit, and many areas have already reached regional limits; (8) air pollution, or “atmospheric aerosol loading,” which is already linked to 7.2 million human deaths per year.⁵

It should be obvious that these phenomena are closely intertwined. For example, deforestation worsens global warming, which then leads to increased thawing and exposure of peat lands worldwide, further boosting greenhouse gas emissions, and so on. (As I wrote this article, the New York Times reported that *in the fall of 2015, Indonesia peat fires released more carbon per day than the European Union*.)⁶ Water pollution from fertiliser runoffs and ocean acidification damage the integrity of the ocean system. Air pollution further alters the climate by reducing monsoon activity. Such interlinks increase the likelihood that the tipping points of environmental systems will be crossed, leading to abrupt and irreversible changes that will be difficult to predict, and even more importantly, difficult for human society to respond to on terms that maintain the earth as a “safe operating space for humanity.”⁷

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Angus’s account of the emergence of the Anthropocene concept within the scientific community, and the data he marshals to support it, should put an end to any lingering doubts about the multidimensional reality of planetary environmental crisis. Nonetheless, Angus clearly views the climate dynamic as not just the most threatening, but as the primary force driving the Anthropocene crisis as a whole. To see why, one must first recognise that for Angus, the Anthropocene cannot be adequately understood by natural science alone. The material and energy throughput of human activity, and its ecological effects, should not be considered apart from the historically specific social relationships structuring that activity. That would mean surrendering to those who would treat the crisis as a straightforward outgrowth of human nature or of ecologically incorrect ethics or values ahistorically considered—an obvious dead-end analytically and politically. The crisis is, in short, both historical and material and has to be analysed as such, using the tools of historical materialism. Angus thus sees *the Anthropocene project as an opportunity to unite an ecological Marxist analysis with the latest scientific research in a new synthesis*.⁸

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Accordingly, Angus explains the timing of the Anthropocene not as the sudden onset of a global mania for economic growth, but as the historical product of a total system of capitalist production, consumption, and military activities. This system was only consolidated globally, with its central base in the United States, in the years following the Second World War, and it hinged crucially on the extraction, combustion, and industrial processing of fossil fuels. As Angus puts it: *Fossil fuels are not an overlay that can be peeled away from capitalism, leaving the system intact. They are embedded*

⁵ ↪ Ian Angus, *Facing the Anthropocene* (New York: Monthly Review Press, 2016), 71–77.

⁶ ↪ Henry Fountain, “[Scientists Map Vast Peat Swamps, a Storehouse of Carbon, in Central Africa](#),” *New York Times*, January 12, 2017.

⁷ ↪ Angus, *Facing the Anthropocene*, 73.

⁸ ↪ Angus, *Facing the Anthropocene*, 23.

in every aspect of the system.⁹ It is in this historical sense that Angus roots the Anthropocene in the growth of “fossil capitalism” on a global scale, led by the United States. This claim is, in part, based on Malm’s historical analysis of the close affinity between capitalist relations and fossil fuel use (see next section). Angus also draws upon John Bellamy Foster’s reconstruction of Marx’s “metabolic rift” analysis of environmental crisis, especially the tensions between the pace and spatial pattern of matter-energy flows as structured by capitalist production and the flows needed for a sustainable and healthy reproduction of ecological systems. Capital’s imperative to constantly grow, to accelerate the accumulation of surplus value (an imperative enforced by competition), also goes a long way toward explaining the unprecedented encroachment of human production on biospheric limits—an encroachment crucially enabled by the combustion and processing of fossil fuels.¹⁰

As alluded to above, however, Angus gives these general concerns a very concrete meaning in his analysis of the “petroleum-automobile complex,” whose development was initially centred in the United States. This complex involved far more than cars and gasoline. Through various technological and demand/supply linkages, “automobilisation” (including suburbanisation of residential and industrial development) and intensive fossil-fuel use were key lynchpins in the whole post-Second World War system of capital accumulation, encompassing such important sectors as industrial chemicals, steel and other metal products, plastics, goods transport, air travel, construction, and industrial agriculture (pesticides, fertilisers, mass-produced animal feeds, farm machinery, etc.)—with the entire complex largely powered by coal-fired electricity plants. Angus clearly shows us the leading role of fossil fuels in the development of a capitalist industrial agglomeration that would eventually place pressure on a variety of biospheric systems, including the climate system.¹¹

The development, growth, and eventual globalisation of this fossil complex received powerful boosts from the prior concentration of industrial capital into giant corporations, and from the rise of the military-industrial complex. Angus demonstrates how the combination of strategic military imperatives during hot and cold wars with concentrated corporate-bureaucratic control reinforced the movement of production onto an ecologically unsustainable path. The military provided both a ready-made market for products of the fossil-capital complex (weapons, vehicles, and the various goods needed to sustain military personnel) and plentiful government financing for new product development (with, for example, plastics, vacuum packaging and computer technology initially developed this way). As the military itself became increasingly industrialised—a process greatly accelerated during the two world wars and ongoing ever since—it became a major consumer of fossil fuels, and a major source of carbon emissions, radioactive fallout, and other forms of pollution in its own right. Of course, while keeping other countries firmly in the capitalist orbit, a prime directive of the military has been to ensure that capitalist enterprises, and the military itself, maintain access to petroleum and other strategic resources internationally—a directive fulfilled by various armed interventions by the United States and allied capitalist governments around the world.¹²

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⁹ ↪ Angus, *Facing the Anthropocene*, 173.

¹⁰ ↪ For Angus’s endorsement of Andreas Malm, see Angus, *Facing the Anthropocene*, 128–29, 135, 166, 171. On the metabolic rift approach see, 113–25; John Bellamy Foster, *Marx’s Ecology* (New York: Monthly Review Press, 2000). An excellent application of metabolic rift theory to the oceanic fishing and aquaculture industries is Stefano B. Longo, Rebecca Clausen, and Brett Clark, *The Tragedy of the Commodity* (New Brunswick, NJ: Rutgers University Press, 2015). On the general ecological contradictions of capitalism and its value forms (money, prices, rents), see Paul Burkett, *Marx and Nature* (Chicago: Haymarket, 2014).

¹¹ ↪ Angus, *Facing the Anthropocene*, 130–34, 153–60. On automobilisation and suburbanisation, see two articles by Paul M. Sweezy, “Cars and Cities,” *Monthly Review* 24, no. 11 (April 1973): 1–18, and “Capitalism and the Environment,” *Monthly Review* 41, no. 2 (June 1989): 1–10.

¹² ↪ Angus, *Facing the Anthropocene*, 130–31, 134–35, 137–49, 160–63.

With this system of fossil-fuelled industry and military activity in place, it is not hard to see why the U.S. and European “golden age” of relatively rapid economic growth during 1945–73, and the subsequent spread of transnational

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monopoly capitalist industry to new peripheral centres of rapid accumulation, especially China and East Asia, resulted in what Earth-system scientists term the “Great Acceleration” of human impacts on the global environment.¹³ The Anthropocene, and the climate crisis in particular, are crises of actually existing capitalism. That is a historical and scientific fact.

In so far as the Soviet Union and other so-called socialist countries contributed to these crises (and their contributions were most certainly less than those of capitalism in the aggregate), they did so mainly because and insofar as they adopted capitalist, fossil-fuelled industrial systems, thereby reproducing the same metabolic rifts between production and the laws of ecological sustainability.¹⁴

How Climate Change Was Hardwired into Capitalism

Malm sees the installation of coal-fired steam engines by British textile manufacturers in the first half of the nineteenth century as the key turning point in the development of a fossil-capital economy, i.e., one in which fossil fuels *are utilised across the spectrum of commodity production*, and thus become *the general lever for surplus-value production*.¹⁵ His analysis focuses on the ground level of industrial workplaces, and of class struggles over wages and control of production, further establishing the deep capitalist roots of the Anthropocene. That Malm himself is skeptical about the Anthropocene framework need not detain us. His concern is that some Anthropocene theorists have ignored or downplayed the capitalist origins of the fossil economy, instead blaming it on human nature or some “original sin” such as the initial use of coal as fuel or even the discovery of fire. Malm seems to have written his book before Angus showed that it is possible to recast the Anthropocene in ecological Marxist terms focusing on the key role of capitalist relations. In fact, Angus’s broader treatment of the fossil complex seamlessly incorporates the main points in Malm’s analysis of fossil capital. What remains of this largely semantic controversy would seem mainly to involve the best method of dating the transition. Does the Anthropocene start when human production actually begins to have significant impacts on the global environment? This approach, embraced by Angus and others, would date the Anthropocene to the late 1940s when the fossil complex was consolidated and began its long post-war expansion.¹⁶ An alternative convention, consistent with the spirit of Malm’s analysis, would date the transition much earlier, to the nineteenth-century Industrial Revolution when the foundation of the fossil economy was laid via the adoption of coal-steam power in the all-important manufacturing and transport sectors. Given the historically cumulative character of the fossil economy’s carbon emissions and other environmental impacts, one could make a viable argument for either approach.

What is important is not the formal method of dating transitions but rather a consistent focus on the capitalist character of the entire historical process. A key distinction that enables Malm to maintain this focus is that between fossil economy and proto-fossil economy. The use of coal for heating buildings, and for heating materials in manufacturing, long

¹³ ↪ Angus, *Facing the Anthropocene*, 42–46. Angus also explains how Europe’s adoption of the fossil-economy model (albeit in a less extreme form than the United States) was encouraged through the tying of Marshall Plan aid to purchases of oil and other goods from U.S. companies (see 145–8). It should be added that Europe’s incorporation into this accumulation regime also involved covert and overt interventions by the United States in European elections and the use of Mafia enforcers to suppress communists in France and other countries, not to mention the ongoing direct U.S. military presence in Europe. For the emergence of China as the leading source of carbon emissions, see Andreas Malm, *Fossil Capital* (London: Verso, 2016), chapter 14.

¹⁴ ↪ Angus, *Facing the Anthropocene*, 208–11; John Bellamy Foster, *The Vulnerable Planet* (New York: Monthly Review Press, 1999), 96–101. This is not to say that the adoption of anti-ecological forms of production in the Soviet Union, especially during and after Stalin assumed leadership, was not contested by environmental thinkers and activists in the USSR itself. On this point, see Natalia Mirovitskaya and Marvin S. Soroos, “Socialism and the Tragedy of the Commons,” *Journal of Environment and Development* 4, no. 1 (1995): 77–110; John Bellamy Foster and Paul Burkett, *Marx and the Earth* (Chicago: Haymarket, 2017), 225–28.

¹⁵ ↪ Malm, *Fossil Capital*, 288 (italics in original).

¹⁶ ↪ See John Bellamy Foster’s foreword to Angus, *Facing the Anthropocene*, which argues that “the Anthropocene is probably best seen as arising in the late 1940s and early 1950s,” after which there was “a major spike, marking a Great Acceleration in human impacts on the environment” (9).

predates the Industrial Revolution. One must distinguish such pre-industrial usage from the modern fossil economy in

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which “self-sustaining growth” is predicated on the growing consumption of fossil fuels...generating a sustained growth in emissions of carbon dioxide.¹⁷ Accordingly, Malm describes the proto-fossil economy as one in which (1) a coal industry has developed, with underground mines and regular trade; (2) coal has become the major source of heat in the domestic

sphere; (3) coal has penetrated industry as a heat provider; (4) domestic consumption is predominant; and (5) impressive rates of growth in coal consumption are achieved during the phases of substitution, without any self-sustaining economic growth being predicated on fossil fuels.¹⁸

This distinction between fossil and proto-fossil economy enables Malm to easily dismiss Malthusian arguments, which blame the transition to fossil economy on population growth and resultant scarcities of wood and other fuels. The Malthusians obviously conflate transitional increases in the demand for coal under proto-fossil economy with the fossil economy’s much more explosive, self-sustaining process of growth in industrial coal usage. As Malm shows, the main

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source of increased demand for coal after 1830 was for firing industrial steam engines, not for the functions associated with proto-fossil economy. Simply put, the crucial significance of the Industrial Revolution was that it dissociated coal burning from population growth. The “spiral” of accelerated fossil fuelling was set off at the moment when the fetters of fertility were burst—that is, when population ceased to determine the pattern of coal consumption.¹⁹ It might be added that although England

did suffer from a timber famine during the sixteenth, seventeenth, and early eighteenth centuries, this famine did not result mainly from population growth as such, but rather from rising demand for wood-charcoal for iron smelting. The substitution of coal for wood-charcoal (through the new coking process for smelting iron) thus involved a transitional effect within proto-fossil economy, one having little if any significance for the future fossil economy and climate change.²⁰

The fossil/proto-fossil distinction helpfully focuses Malm’s analysis on the historical transition between these two economic formations. The key issue then becomes: How did self-sustaining economic growth become the main driver of coal burning during the Industrial Revolution? On one level, the question answers itself. There is only one economic system that has ever generated self-sustained growth and fossil combustion on the scale required to explain climate change: capitalism. The reason is that capitalism is the only system driven by the competitive drive for increased monetary values, achieved by extracting surplus value from workers in production using any and all means available, including fossil fuels. Naturally the devil is in the details. Exactly how and why was fossil burning adopted by and then hardwired into the capitalist industrialisation process? Here, Malm gives us a two-part explanation. The first part builds upon Marx’s mature analysis of machinery and factory systems, which, like Malm’s, was based largely on the British textile industry. In volume 1 of *Capital*, Marx pointed out that a prerequisite for capitalists fully to mechanise and apply

¹⁷ ↪Malm, *Fossil Capital*, 11.

¹⁸ ↪Malm, *Fossil Capital*, 52; emphasis added.

¹⁹ ↪Malm, *Fossil Capital*, 256. “By 1870, three times more coal was burnt in general manufacturing, iron, and steel than in the hearths and homes of Britain, the fires decoupled from population growth and linked to self-sustaining economic growth” (Malm, *Fossil Capital*, 250).

²⁰ ↪For details see Foster and Burkett, *Marx and the Earth*, 19–21.

external power sources to production was the wresting of control over the labor process from workers on the shop floor. This presumed that workers had been alienated from control over the tools and machinery employed in production—and such alienation is a defining characteristic of capitalist class relations. But this alienation itself occurs in two stages, which Marx termed the formal and real subsumption of labor under capital. In formal subsumption, the capitalist establishes control of the means of production but has not yet transformed them in ways that ensure reproduction of the capitalist relationship. Here, workers maintain some control over the labor process, because their skills, hence their motive force—their own animate power—still limits the pace of production. In real subsumption, by contrast, capitalists mechanise production to free it from the residual impediments posed by skilled labor, enabling the process to be more fully driven by external power sources. In short, real subsumption, represented for Marx by integrated mechanised factory systems, completes the three-fold alienation of workers from the means of production, labor process, and the power sources used in production.²¹

The first part of Malm's analysis thus details the transition from formal to real subsumption in the British textile industry. He describes how the long boom of the cotton sector ended with severe crises of overproduction starting in 1825 and continuing until 1848. Falling prices and profits, and the threat of bankruptcy, caused individual capitalists to press for wage reductions and production speed-ups, leading to waves of worker unionisation, strikes, and intensified class struggles at the point of production. In response, capitalists sought mechanical solutions to their "labor problems": the self-acting mule to spin cotton, the power loom to weave cotton cloth, and combing machines (alongside power looms) in the worsted wool sector. As *mechanisation spread to other sectors than cotton, demand for the work of the machine-makers naturally rose, whereupon unions of these master craftsmen pushed up wages and prices*. The pressure for real subsumption thus spread to the machinery sector, where new "machine-tools" were devised and installed—the *basic principle of which was a self-acting instrument for cutting or shaping an object, with power from a non-human prime mover and precision from within the instrument itself*.²² Meanwhile, the mechanisation of spinning, weaving, and other operations facilitated the joint application of a single "central prime mover" in combined factories that *integrated the whole production chain in one sprawling complex*.²³

A key question posed to capitalists was what the "central prime mover" of mechanised production would be. The main competitors for this role were water wheels and coal-fired steam engines. Up to this time, water power had predominated in British industry. Why did coal displace it? The answer comprises the second part of Malm's analysis. Contrary to mainstream Ricardian-Malthusian accounts, the victory of coal-fire over "the flow" had little to do with any absolute or relative scarcity of water power. During the transition to steam power, *no water scarcity loomed on the horizon, no general shortages occurred—not even in the central cotton districts*. There was, in fact, *an overall abundance of unexploited watersheds throughout the crucial transition period*. In addition, there was *no sign of any substantial fall in coal prices in the decades of the transition, nor of any technological revolution in coal mining*. The unit cost of water power was evidently less than that of coal power as late as the 1870s. In short, *The transition to steam in the British cotton industry occurred in spite of the persistent superior cheapness of water*.²⁴

As Malm shows, the primary reason coal won out was that it was more congenial to capital's exploitation of wage labor. The portability of coal allowed capitalists to relocate production to the larger towns featuring plentiful supplies of

²¹ ↪Karl Marx, *Capital*, volume 1 (New York: Vintage, 1976), 496–97, 645, 1019–25. For the classic update of Marx's analysis of real subsumption, see Harry Braverman, *Labor and Monopoly Capital* (New York: Monthly Review Press, 1974). On the natural science background of Marx's analysis, and the implications for ecological economics, see Foster and Burkett, *Marx and the Earth*, 151–56.

²² ↪Malm, *Fossil Capital*, 197. For the mechanisation of spinning, weaving, and wool combing, see 64–75, 196–97.

²³ ↪Malm, *Fossil Capital*, 75.

²⁴ ↪Malm, *Fossil Capital*, 83, 91.

exploitable labor power—supplies created largely by prior migrations from rural areas depopulated by the capitalisation of agriculture. The large-scale movement of industry to the towns resulted in agglomeration economies (proximity to markets, suppliers, business services, etc.) that further benefited capitalists. In short, *concentrations of populations trained to industrious habits—as well as markets, workshops, and all the other attractive features of the town—made cotton capitalists turn to steam.*²⁵ Meanwhile, compared to water wheels, the use of steam engines facilitated a more continuous and intensified exploitation of workers by enabling greater continuity and spatial regularity in the running of machines. Apparently, the tendency of the steam engines to explode (especially when run above safe pressure levels, to speed up machinery and the labor process) was more than offset by the extra surplus value reaped by capitalists avoiding the seasonal and locational irregularities of water power. This comparison was made even more important by the installation of new machines in production itself, as competition dictated that such fixed capital investments be amortised as quickly and regularly as possible. The use of coal thus created a further incentive for capitalists to lengthen and intensify workers' labor time.²⁶ Indeed, Malm shows that the victory of coal over water was finally clinched by the growing struggles over the working day, leading to the 1833 Factory Act and the 1847 Ten Hours Bill. Such legal restrictions on work time made it more difficult for the capitalists still using water power to keep up with their coal-fired competitors by offsetting seasonal and other “downtimes” with extended overtime work when the waters were flowing. *As the free disposal of labor power in time was progressively curtailed, cotton manufacturers shifted to a prime mover capable of maximising labor in the time that remained.*²⁷

The coal-fired steam engine thus helped British capital to resolve the industrial crisis and class struggle on its own profitable terms. The breaking of the workers' resistance to steam (see next section) ushered in the fossil-economy epoch. However, there was an additional dimension of the transition according to Malm. Compared to coal and steam engines, water facilities had more the character of a public good, which contradicted the regulation of production by competition among individual capitalist enterprises, i.e., the market system and private property rights.

Malm describes how in Britain, networks of self-acting reservoirs were devised that could expand and regulate water flows, to even out the amount of power available both hourly and seasonally. But the implementation of these projects posed problems of pricing, coordination, and cooperation among individual capitalists. Residual differences in the amount and regularity of power available at different locations in the grid meant that *rates to be paid might very well deviate from the exact benefit reaped by the enterprise.* The basic *incongruence between the demands of individual mills and the supplies from a large-scale structure* engendered *major collisions of interests* among individual capitalists. The plans tended to flounder on the unwillingness of competing capitalists to engage in cooperative behaviour for the good of the collective, even if that collective was capitalist. Coal-fired steam engines, which could be privately financed and monopolised (and located with greater discretion) did not suffer from these *problems of coordination and resource distribution.* Compared to water power, coal itself was much more *piecemeal, splintered, amenable to concentration and accumulation, [and] divisible.*²⁸

Here again, the shortcomings of the “flow of energy” from waterways had nothing to do with scarcity, inefficiency, or relative costs. Water's real defect was that it *did not halt before the fences of private property, ...respected no deeds or titles, bowed to no monetary transactions; rather it continued on its course, unmoved by conceptions of private property*

²⁵ ↪Malm, *Fossil Capital*, 162.

²⁶ ↪Malm, *Fossil Capital*, 167-8, 246-47.

²⁷ ↪Malm, *Fossil Capital*, 175-7, 180-92 (quotation from 192).

²⁸ ↪Malm, *Fossil Capital*, 110, 118-19. On patterns of accumulation and monopolisation in the British coal industry, see Paul M. Sweezy, *Monopoly and Competition in the English Coal Trade* (Cambridge, MA: Harvard University Press, 1938); a useful discussion of Sweezy's analysis is Michael A. Lebowitz, “Paul M. Sweezy,” *Monthly Review* 56, no. 5 (October 2004): 44-45.

because it was always in motion.²⁹ With river-power projects, energy consumption became a matter of public control and decision making. They represented a form of collectivised prime movers, the *res communes* of water imposing its

The growth of fossil fuel use must stop now, followed by absolute reductions of carbon emissions to near zero levels by sometime later in the twenty-first century.

logic on wary manufacturers each of whom wanted to be fully his own boss. In sum, the planning, coordination and collective funding required for expansion of water power threatened to politicise energy use in ways that limited the capitalists' class monopoly over production decisions.³⁰ None of this means that capitalists will never

cede necessary infrastructure to the government or cooperative associations, especially when there is no profitable alternative more consistent with capitalist control. But coal was just such an alternative for British industry—one that gave capitalists a powerful weapon in the class struggle. This is how fossil fuels became *material requirements for value creation* under capitalism, ushering in the era of fossil capital or *self-expanding value passing through the metamorphosis of fossil fuels into CO₂*.³¹ Historically speaking, to deny this connection is just as much a form of climate denial as is disbelief in Anthropocentric climate change itself.

Energy Transition, Energy Contradictions

From its origins in the nineteenth century Industrial Revolution, fossil capital has developed into a monstrous complex generating multiple biospheric crises, including climate change. To head off a catastrophic warming of the atmosphere, it will be necessary to de-fossilise the global economy over the next several decades. The growth of fossil fuel use must stop now, followed by absolute reductions of carbon emissions to near zero levels by sometime later in the twenty-first century. Nothing less is acceptable if we want a liveable planet for the majority of humanity and other species. Such a transition has been shown to be, physically speaking, quite feasible. The technology needed for a full replacement of fossil fuels with renewable energy in all production, transport, and residential systems in the developed countries already exists, and could be installed within a couple decades.³² Economically, investments in energy conversion seem to make sense, especially with the global economy suffering from deepening stagnation, a jobs crisis, and an overabundance of speculative financial activity.³³

Unfortunately, under mature capitalism things are not done according to human needs, environmental sustainability, or common sense. Both economically and politically, this system is dominated by monopoly-finance capital (MFC) and its state functionaries. Two basic facts must be noted here. First, MFC's ideology and policy program are both constituted by neoliberalism (deregulation, privatisation, and anti-union policies—in short, market fundamentalism—combined with militarism and imperialism). Second, MFC is inextricably tied to the fossil-capital complex. It follows from these two facts that at this point in history, de-fossilising the economy means overthrowing MFC power and moving toward a worker-community controlled economy, socialism.³⁴

As Klein, Malm, and Angus all observe, the quick energy conversion the planet needs entails massive government investments and the planned reallocation of resources locally, nationally, and globally. Outside the special circumstances of the First and Second World Wars, such a huge and rapid upsurge of public investment and planning

²⁹ ↪Malm, *Fossil Capital*, 117.

³⁰ ↪Malm, *Fossil Capital*, 105, 118.

³¹ ↪Malm, *Fossil Capital*, 289–90.

³² ↪See the studies cited by Angus, *Facing the Anthropocene*, 172; Malm, *Fossil Capital*, 368; Naomi Klein, *This Changes Everything* (New York: Simon and Schuster, 2014), 101–02. The quicker the energy transition in the core capitalist countries, the more time that could be available for a full conversion to renewables in lower income nations.

³³ ↪Robert Pollin, *Greening the Global Economy* (Cambridge, MA: MIT Press, 2015).

³⁴ ↪On monopoly-finance capital and neoliberalism, see John Bellamy Foster and Fred Magdoff, *The Great Financial Crisis* (New York: Monthly Review Press, 2009); John Bellamy Foster and Robert W. McChesney, *The Endless Crisis* (New York: Monthly Review Press, 2012).

has been anathema to capitalism. It is certainly in direct contradiction with neoliberalism, especially if public investment is financed, as seems necessary, by taxing the profits of fossil capital and MFC banks.³⁵ It will also mean a severe

if fossil capital and the big banks are to become instruments of rather than barriers to renewable energy conversion, they will probably have to be nationalised and subjected to public control.

devaluation of the gargantuan stock of fixed capital residing in fossil-fuel installations worldwide. Given mature capitalism's systemic shortage of productive and profitable investment opportunities, this fossil capital is a key MFC asset. The same can be said of the many new fossil-fuel projects being constructed or planned worldwide.³⁶ As Klein amply documents, fossil capital and its MFC financiers have

shown no sign of willingly agreeing to *forfeit trillions of dollars of future earnings by leaving the vast majority of proven oil reserves in the ground.*³⁷ In short, if fossil capital and the big banks are to become instruments of rather than barriers to renewable energy conversion, they will probably have to be nationalised and subjected to public control. Such a strategy would dovetail nicely with the need to municipalize and decentralise power facilities (see below), but it is not exactly in vogue among neoliberal state managers and their MFC patrons. It would likely require what Bernie Sanders called a political revolution.

Malm and Klein detail MFC's distinct lack of interest in developing solar and wind power even as an eventual replacement for fossil fuels. Continued growth of global demand for energy in general, and for fossil fuels in particular,

publicly owned utilities, co-ops, and individual households appear to have taken over the leading edge in renewables installations.

ensures that they remain profitable even with the expansion of renewables. That is why the energy transition requires an active suppression of fossil fuels, not just adding renewables as *another slice to an ever growing energy pie.*³⁸ Once renewables facilities are constructed, they offer less opportunities for ongoing objectification of workers' surplus labor in material use values than do fossil

installations with their continuous flows of coal, petroleum, and natural gas. The sun and wind are not easily monopolised and therefore not efficient bearers of value. Solar and wind structures appear more amenable to decentralised control by individual communities and households prioritising use value over exchange value. True, mega projects in solar and wind are physically possible and have been undertaken. But their profitability, compared to fossil investments, is much lower, more uncertain, and requires longer decision horizons—all of which are repugnant to MFC with its unquenchable thirst for maximum short-term profits. Increasingly, potential corporate partners in mega-renewables projects are demanding massive government financing of the kind that few neoliberal governments are able or willing to afford. As a result, publicly owned utilities, co-ops, and individual households appear to have taken over the leading edge in renewables installations even as MFC and its neoliberal state functionaries push for further privatisation of public utilities. Meanwhile, advances in decentralised renewables technologies and resultant declining renewables prices have made MFC, and fossil capital and private-corporate utilities in particular, even less interested in renewables development, due to the associated reductions in prospective profit margins.³⁹

Another factor making de-fossilisation a relatively unprofitable proposition is the ability of MFC to profit from global warming itself. As Klein shows, corporate capital is not only able to gain lucrative contracts for rebuilding infrastructure

³⁵ ↪ Klein, *This Changes Everything*, 401, 452; see also Malm, *Fossil Capital*, 385, on "wartime mobilisation as a model for rapid abatement of climate change."

³⁶ ↪ For discussion of this worsening fossil capital overhang problem, see Angus, *Facing the Anthropocene*, 170–73; Malm, *Fossil Capital*, 358–61. In China the issue is a growing excess capacity of state-capitalist coal-fired power plants. Greenpeace has reported that "China is on track to add an average of one new coal-fired plant a week until 2020." Edward Wong, "China Pledged to Curb Coal Plants. Greenpeace Says It's Still Adding Them," *New York Times*, July 14, 2016. Despite a subsequent central government announcement that more than a hundred of the new projects would be cancelled, the "glut of coal power plants" was still "acting as a dead weight on the country's ongoing energy transition." See Michael Forsythe, "China Cancels 103 Coal Plants, Mindful of Smog and Wasted Capacity," *New York Times*, January 19, 2017.

³⁷ ↪ Klein, *This Changes Everything*, 452.

³⁸ ↪ Malm, *Fossil Capital*, 382. Here Malm draws on the analysis of Richard York, "Do Alternative Energy Sources Displace Fossil Fuels?" *Nature Climate Change* 2 (2012): 441–43.

³⁹ ↪ Klein, *This Changes Everything*, 97, 130–33; Malm, *Fossil Capital*, 367–82.

as the oceans rise and tropical storms multiply and worsen, but also positions itself to impose neoliberal deregulation,

Climate disasters help feed a growing fad for high-end “survivalism,” i.e., preparing for a crackup of civilisation... Then there is the ultimate corporate climate management scheme, geoengineering... That geoengineering would likely kill hundreds of millions, e.g., by disrupting the Asian Monsoons, is of little concern to its growing ranks of super-rich.

de-unionisation, privatisation, and police-state security measures in the wake of such climate shocks, thereby further increasing profit opportunities.⁴⁰ Escalating temperatures mean expanding markets for air conditioners and other ameliorative goods and services. Climate disasters help feed a growing fad for high-end “survivalism,” i.e., preparing for a crackup of civilisation... among technology executives, hedge-fund managers, and

others in their economic cohort in places like Silicon Valley and New York City. Such bunkering strategies—even new floating island cities, outer space colonies, or relocation to other planets—offer large potential profits to adventurous developers.⁴¹ Then there is the ultimate corporate climate management scheme, geoengineering, which, much like defence outlays, could be a boon to profits (if governments can be brought on board) while keeping any requisite planning operations under centralised bureaucratic-corporate control to minimise interference with other MFC activities. That geoengineering would likely kill hundreds of millions, e.g., by disrupting the Asian Monsoons, is of little concern to its growing ranks of super-rich MFC patrons, including Bill Gates, on the look-out for alternatives to de-fossilisation.⁴²

One begins to see the basic complementarity of MFC, neoliberalism, and the two forms of climate denial. One can also understand why the Pentagon and MFC defence contractors are hatching plans for worldwide military suppression and control of the victims of climate change. The elite vision, as Angus aptly phrases it, is one of “environmental apartheid” (insulating affluent areas from popular unrest) through “environmental militarism” and, where necessary, absolute “exclusion and exterminism.”⁴³ We turn now to the human source of these ruling-class fears.

The Making of the Environmental Proletariat

As a class in itself, i.e., in its objective social relationship to its conditions of existence, the proletariat has always been environmental. This class originates in the forcible separation of the direct producers from the land and other conditions of production, and their conversion into wage-labourers who must submit to exploitation by capital in order to gain access to necessary material means for their survival and development as human beings. From its beginning, the proletariat is alienated from both nature and its own labor, as the productive interchanges between people and nature are converted into means of competitive profit-making. The proletariat’s struggle for a decent life has always been a struggle in and against unhealthy conditions both inside and outside the workplace, at home and at work—a struggle for a healthier connection with nature as a condition of human development.⁴⁴ The climate crisis sheds new light on the different phases in this struggle, and their lessons for today.

The destruction of machines by workers as a struggle tactic has often been treated patronisingly by economic historians. In light of the development of fossil capital and global warming, however, it can be seen as an initial battle in the struggle to de-fossilise production and create a more sustainable energy system. According to Malm, the sabotaging of

⁴⁰ ↪ This applies the argument made in Naomi Klein, *The Shock Doctrine* (New York: Penguin, 2008).

⁴¹ ↪ Klein, *This Changes Everything*, 46–52; Angus, *Facing the Anthropocene*, 184–88. Mike Ives, “As Climate Change Accelerates, Floating Cities Look Like Less of a Pipe Dream,” *New York Times*, January 27, 2017; Evan Osnos, “Doomsday Prep for the Super-Rich,” *New Yorker*, January 30, 2017. On the ability of capital to profit from environmental crises, and the need to distinguish accumulation crises from environmental crises in general, see Burkett, *Marx and Nature*, 107–32; *Marxism and Ecological Economics* (Chicago: Haymarket, 2009), 220–300.

⁴² ↪ Klein, *This Changes Everything*, 256–90; Malm, *Fossil Capital*, 386–88.

⁴³ ↪ Angus, *Facing the Anthropocene*, 176–84.

⁴⁴ ↪ Burkett, *Marx and Nature*, 57–68, 203–22; Frederick Engels, *The Condition of the Working Class in England* (Moscow: Progress Publishers, 1973); Marx, *Capital*, volume 1, part 8.

steam engines was a key tactic in the explosion of worker unrest in British industry leading up to the General Strike of 1842 (a key episode in the Chartist movement). Efforts by workers to “pull the plug” on fossil capital were often coordinated with work stoppages by coal miners that interrupted the flow of fuel to the factories. As Malm describes it, *the general strike of 1842 invented a formula for a new era: the working class could impose its will on capital by closing the spigots of the fossil economy...idle engines and inactive mines were seals of proletarian power.*⁴⁵ Such *collective bargaining by rioting against the fossil economy* was driven largely by the hatred labourers felt for the unhealthy conditions that coal-burning and coal-mining created in both their workplaces and their neighbourhoods. There was evidently *plenty of steam demonology in the minds of British workers in the 1840s, as workers came to associate the rise of steam with the rise of temperatures and the impoverished atmosphere in the mills. At home, workers were bedevilled by...the smoke, the acid rain, the sulphurous fog [which] literally killed off flora and fauna, sights of trees and birds and even the sun itself.* Conditions in and near coal mines were often worse. In short, British industrial workers were not just struggling for higher wages. This was also a revolt against the *palpable deterioration of the immediate environment caused by the concentration of wage labourers in certain places where coal was burnt or extracted.* In this rebellion, there was a clear if somewhat *less tangible...perception of alienation from the environment, as nature decayed and receded from the lives of working people.* In this sense, it was a “proto-environmentalist” movement.⁴⁶

Neoliberalism and biospheric crises, including climate change, are now creating a similar convergence of economic and environmental struggles around the world. As John Bellamy Foster observes, with *objective forces...progressively erasing*

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previous distinctions between workplace exploitation and environmental degradation, there have arisen wider alliances of oppressed groups around degraded material conditions. This broadening of working-class struggles into environmental struggles facilitates the forging of diverse community alliances...of gender, race, class, indigenous, and environmental movements. We are seeing, in short, the

rise of a globalised environmental proletariat as a conscious class for itself, i.e., as a worker-community formation with a *new ecological sociability, embracing a vision of human production in its most fundamental sense as the metabolism of nature and society.*⁴⁷

Here, Klein notes that the multiple socio-economic and environmental crises generated by neoliberal fossil-fuelled

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capitalism increasingly sharpen certain key questions concerning the values that will inform and shape economic and political institutions worldwide.⁴⁸ Should nature be seen primarily as a source of use values that can be profitably extracted for production and

consumption, or instead as a necessary co-evolutionary partner in a process of sustainable human development—as a life value rather than a purely economic value? Similarly, should the restructuring and renewal of energy supplies be geared toward maintaining business as usual, or instead treated as a project enhancing democratic worker-community

⁴⁵ ↪Malm, *Fossil Capital*, 234.

⁴⁶ ↪Malm, *Fossil Capital*, 236, 242, 244–48.

⁴⁷ ↪John Bellamy Foster, “The Epochal Crisis,” *Monthly Review* 65, no. 5 (October 2013): 10–11.

⁴⁸ ↪Klein, *This Changes Everything: The Shock Doctrine*.

control over production and the whole system of material provisioning?⁴⁹ Is it right to treat science and education as means for business and its human inputs to remain productive and “get along,” or should they instead be converted into convivial tools for the creation of human beings and institutions that embrace basic life values such as empathy, nurture, sustainability, creativity, and self-management on individual, workplace, and community levels?⁵⁰ Why do even unions at times still see a conflict between jobs and environmental sustainability, as in the AFL-CIO’s endorsement of the Dakota Access Pipeline (despite opposition by several individual unions), when it has been clear for some time now that many more jobs can be created per dollar with renewable energy and energy conservation investments than with new fossil-capital installations?⁵¹ What is the value of a fracking or pipeline job if it hastens destruction of the planet for our children, grandchildren, and other species?

Currently the leading edge in the fight against fossil capital is occupied by struggles of indigenous peoples against new mining and pipeline installations encroaching on their lands. As Klein and Angus together show, however, these defensive struggles have a great potential for triggering a broad coalescence of anti-neoliberal and anti-MFC interests into a majority-based ecological socialist movement.⁵² The ecological and communitarian values brought to the table by indigenous land and water protectors (and their green allies) are beginning to make productive contact with newer

Solidarity among people, and between people and the earth (with all its inhabitants), and the search for sustainable modes of good living (placing use value ahead of exchange value), seem to be the ideological glues holding the emergent eco-proletarian coalition together.

varieties of feminism and with the values of economic democracy, and of municipal, cooperative, and union power, championed by more “traditional” proletarians. Cross-sector political synergies are being enhanced by efforts of indigenous communities to defend and reinvigorate their communal property systems using

modern decentralised energy and agricultural technologies.⁵³ (The much-maligned base-superstructure model still works here.) Meanwhile, in and around urban centres, municipal power and public transit advocates, co-operatives, farmers’ markets, urban gardeners, and other worker-community groups are constructing new circuits of sustainable material provisioning—often informed by indigenous life-values. Even battles against school privatisation and budget cutbacks, and for community-based health care alternatives, can be seen as part of this developing pro-ecological coalition. Solidarity among people, and between people and the earth (with all its inhabitants), and the search for sustainable modes of good living (placing use value ahead of exchange value), seem to be the ideological glues holding the emergent eco-proletarian coalition together.

This new popular upsurge, and its reconstruction of the planet’s productive base, have already begun to approach eco-revolutionary “tipping points” in some parts of the world—and not a minute too soon. Deteriorating environmental conditions, and the neoliberal-capitalist dispossession and impoverishment of working people and communities, are calling forth neofascist solutions (Trump, Le Pen, and others). “Socialism or barbarism” has both a traditional and a brand-new meaning now in the age of planetary crisis.

⁴⁹ ↪Barry Commoner, *The Poverty of Power* (New York: Knopf, 1976).

⁵⁰ ↪See Ivan Illich, *Deschooling Society* (New York: Harper and Row, 1972); *Tools for Conviviality* (New York: Harper and Row, 1973).

⁵¹ ↪Klein, *This Changes Everything*, 126–27; Pollin, *Greening the Global Economy*; and *Back to Full Employment* (Cambridge, Massachusetts: MIT Press, 2012), 102–09. On the conflicts within the union movement over climate change and fossil capital, see Paul Hampton, *Workers and Trade Unions for Climate Solidarity* (London: Routledge, 2011).

⁵² ↪Klein, *This Changes Everything*, part 3; Angus, *Facing the Anthropocene*, 192–223.

⁵³ On the wider ecological potential of indigenous efforts to defend and renew their communal production systems, see David Barkin, *Wealth, Poverty, and Sustainable Development* (Mexico City: Centro de Ecología y Desarrollo, 1998); “Commentary on ‘Marxism and Ecology,’” Great Transition Initiative, October 2015, <http://greattransition.org>; David Barkin and Blanca Lemus, “Overcoming Rural Poverty from the Bottom Up,” in Julio Boltvinik and Susan Archer Mann, eds., *Peasant Poverty and Persistence in the Twenty-First Century* (London: Zed, 2016), 345–65.

Useful links:

- The Jus Semper Global Alliance
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- Víctor Toledo: [What are we saying when we talk about sustainability?](#)
- Álvaro J. de Regil: [True Sustainability and Degrowth in the Citizens Imaginary](#)
- Alejandro Teitelbaum: [The Progressively Accelerated Degradation of the Environment](#)
- Adolfo Gilly & Rhina Roux: [Capitals, Technologies and the Realms of Life. The Dispossession of the Four Elements](#)

❖ **About Jus Semper:** The Jus Semper Global Alliance aims to contribute to achieving a sustainable ethos of social justice in the world, where all communities live in truly democratic environments that provide full enjoyment of human rights and sustainable living standards in accordance with human dignity. To accomplish this, it contributes to the liberalisation of the democratic institutions of society that have been captured by the owners of the market. With that purpose, it is devoted to research and analysis to provoke the awareness and critical thinking to generate ideas for a transformative vision to materialise the truly democratic and sustainable paradigm of People and Planet and NOT of the market.

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