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For Land
Capital as Extinction

Prolekult

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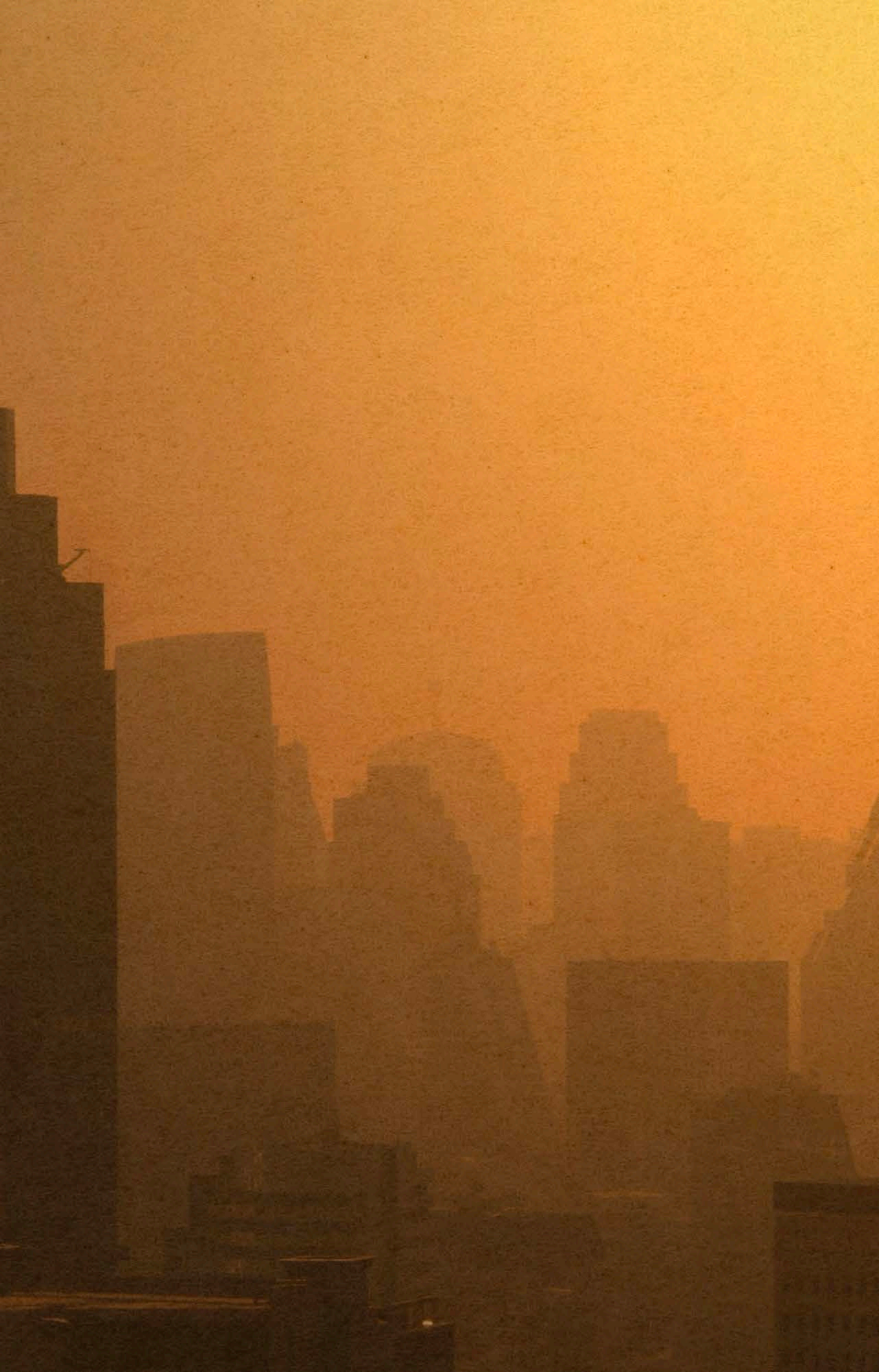

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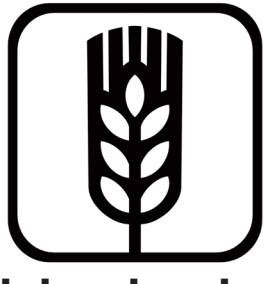
Annotated Scripts & Study Guide
for the Acclaimed Film, *For Land: Part One*



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Contents

Introduction

The core contention of this film,[1] the first in an intended trilogy, is simple: capitalism *is* the sixth mass extinction. This is to say that capitalism is responsible for both global climate change and, more importantly, cataclysmic biodiversity loss. It is the motor driving these processes, as we argue throughout the piece.

To a certain extent, this position has been argued within the Marxist tradition quite cogently, beginning with Marx's own engagement with the work of the soil chemist, Justus von Liebig. That climate change is rooted in capitalist relations of production and exchange has been argued with brutal precision in Andreas Malm's masterful history of the turn to steam in Britain, *Fossil Capital*. Whilst Malm himself makes plain that his case is not a full account, pointing to a major historical role of changes in land use in the formation of contemporary greenhouse gas concentration, his work decimates dominant, Malthusian arguments that population growth and resource scarcity led to the adoption of fossil fuels in industry. History simply does not agree with Malthus.

Yet, despite this and the work of other theorists on capital's need for fossil fuels,[2] neo-Malthusianism continues to pollute most attempts to explain climate change. This is nowhere clearer than in the concept of the anthropocene. Though recently rejected as an official designation of our epoch, this conception still dominates the scientific literature. On the one hand, this is easily explainable as an ideological reflection of cap-

1 'For Land | Part one: Capital as extinction,' Prolekult, video available online at https://www.youtube.com/watch?v=f-P479d1-KE.

2 For example, Jason W. Moore's concept of the capitalocene in *Capitalism and the Web of Life*, Adam Hanieh's *Crude Capitalism* or Simon Pirani's *Burning Up*, to name but a handful of such accounts.

italist dominance over society—the bourgeoisie are hardly likely to fund and promote literature which necessitates their overthrow. On the other, the Marxist argument is largely confined to rather intimidating and expensive books produced within humanities departments, just one of an ever growing list of "eco" disciplines. However thorough, this is hardly a position primed for popular reception.

The initial ambition for this piece, therefore, was relatively humble: to produce the Marxist argument in a more popular form, to aid in its proliferation. However, in the research for this initial version we hit a rather stark problem. Bluntly, Marxist arguments on biodiversity loss are thin on the ground. Whilst theorists like Jason W. Moore, Angus Wright, or Ian Rappel—among others—have explored how biodiversity loss and ecocide result from capital accumulation, the focus has overwhelmingly fallen on industrial agriculture. Even where this is not the case—and Rappel is a prime example—arguments tend to rely on a portrait of capitalism as the only *inherently* environmentally destructive mode of production in history. A simple glance at the collapse of Mesopotamian agriculture, the impact of Roman *latifundia* on the African continent's biodiversity, or the destruction of forests for war in Ancient Greece shows this to be utter nonsense. We are left with an a-historical Marxism, grasping at isolated examples for proof of its political convictions.

A moment which underlined this observation came early in our research. In searching for a Marxist account of what constitutes a mass extinction event *we found none*. It is likely we missed something, but to search and find nothing evident in Marxism's canon is proof, at least, that this is not a pressing concern in ecosocialist spheres. In contrast, the bourgeois and scientific literature on the sixth mass extinction is entirely shaped by extinction studies. In view of this, we set out to put together an account of capital as a mass extinction event in dialogue with contemporary scientific understandings of mass extinctions *per se*.

This script is the result of these efforts. It has flaws, even a year in hindsight. It is also incomplete, with part two (on capital's inability to adapt to the crises it has formed) and part three (on ecology, communism and revolution) of the trilogy still in production. Despite this, we hope it opens some new ground for Marxism and sets out, clearly, established ar-

guments within our movement's canon in a broader context. Though theory is no shield from the continued development of capital's extinction, it is necessary to orientate any strategy capable of pushing back against it. Together, we are convinced that Marxism can offer such orientation.

Finally, we would like to dedicate this work to Paul Burkett, who died whilst we were putting the last touches to the film. Though we have some disagreements with Burkett which part two of this trilogy will explore—particularly on capital's capacity to reconstitute itself through ecological crisis—he has been a vital voice in the formation of modern ecosocialism. His work has been a powerful influence on our approach, and the communist movement is much poorer for his passing.

For Land
On the Capitalist Mass Extinction

Annotated Script: Part One
Capital as Extinction

“Estrangement appears not only in the fact that the means of my life belong to another and that my desire is the inaccessible possession of another, but also in the fact that all things are other than themselves, that my activity is other than itself, and that finally—and this goes for the capitalists too—an inhuman power rules over everything.”

—Karl Marx
“Need, Production and Division of Labour,” *Economic and Philosophical Manuscripts* (1844)

1

In 2021, a number of studies found that the Amazon rainforest is today a net emitter of carbon and other greenhouse gases, particularly methane.[1] Lung to tumour.

Accounting for over half of the world's remaining rainforest[2] and 20% of liquid freshwater,[3] the Amazon exerts more power over the earth's carbon cycle than any other terrestrial ecosystem.[4] It has already lost between 17 to 20% of its span to deforestation.[5]

The carbon and methane thrown into the atmosphere by these incursions, or the vast cattle ranches and cramped mines which follow in their wake, have thus unleashed a deeply dangerous feedback loop.

1 See Monitoring of the Andean Amazon Project, "The Amazon and Climate Change: Carbon Sink vs Carbon Source," *MAAP #144* (2021), Kristofer Covey et al, "Carbon and Beyond: The Biogeochemistry of Climate in a Rapidly Changing Amazon," *Frontiers in Forests and Global Change* (2021), Nancy L. Harris, "Global maps of twenty-first century forest carbon fluxes," *Nature Climate Change 11* (2021), and Luciana V. Gatti et al, "Amazonia as a carbon source linked to deforestation and climate change," *Nature 595* (2021).

2 University of Leeds, "Amazon Rainforest Carbon Sink Threatened By Drought" (2009).

3 Amazon Aid, "The Amazon and Water" and WWF, *Healthy Rivers, Healthy People* (2018), p.7.

4 University of Leeds (2009) and World Bank Group, *Why the Amazon's Biodiversity is Critical for the Globe: An Interview with Thomas Lovejoy* (2019).

5 Stephen Eisenhower's special report in *Reuters* puts current deforestation at 17% of total cover of "the original Amazon canopy" in 2021. Nature and Culture International put deforestation at 20% of the rainforest lost within the last forty years. Stephen Eisenhammer, "The Amazon's Little Tipping Points," *Reuters* (2021) and Nature and Culture International, "Amazon Rainforest."

Wildfires, a common result of deforestation,[6] show the sheer scale of this problem. In 2005, tree loss provoked by a dry year released an additional amount of carbon equivalent to the annual emissions of Europe and Japan combined.[7] Whilst the potentially exponential catalyst provided to atmospheric greenhouse gas concentration by this process is evident, its significance extends further still.

Rainforests play a key role in the cycling of water, returning rain from soil, vegetation and fungi to the skies as steam or in droplets plucked by clouds from the boughs of the tallest trees. Annual rainfall has already fallen across 69% of the forest,[8] and a 2023 study suggests that South American monsoon patterns are now approaching a critical conjecture, potentially lowering rainfall by as much as 30% in the coming years.[9] This poses major problems for the Amazon's survival, for other ecosystems across the region, and for the human systems of production dependent upon their fruit.

From these symptoms and others, it is clear that a tipping point has been passed. The ecosystem we have known as the Amazon, home to around 25% of terrestrial biodiversity,[10] is now gone, its aggregate func-

6 "Deforestation contributes to increased fire risk in surrounding woodland. Reducing tree cover and ground vegetation dries out forests, especially tropical rainforests. This leads to a greater risk of fire in the area around a deforested zone. Global Forest Watch (GFW) found that, in the past 20 years, fires around the world are increasing annually by 3%, even in areas that have regular fires as part of the ecosystem. These fires are becoming more severe and spreading over larger areas than they have in the past." Western Fire Chiefs Association, 'What is the relationship between deforestation and forest fires?' (2023).

7 University of Leeds (2009).

8 Thomas Hilker et al, "Vegetation dynamics and rainfall sensitivity of the Amazon," *Proceedings of the National Academy of Sciences of the United States of America 111(45)* (2014) and WWF (2018), p.9.

9 More up to date research, published since this section went into film production, gives a better picture of the change in rainfall patterns and broader ecological destabilisation across the Amazon. This estimates that between 10 to 47% of the rainforest will be undergoing dramatic climatic shifts by 2050. See Bernardo M. Flores et al, "Critical transitions in the Amazon forest system," *Nature 626* (2024), pp.555-564. For more introductory reading on rain patterns in the Amazon see Eisenhammer (2021).

10 World Bank Group (2019).

tion utterly changed. Where some estimates suggest that the loss of just 25% of the original forest will spell its doom, others go further, suggesting that this tipping point has already passed.[11] There is no simple way back, if indeed there is a "way back" at all. As the Marxist biologists Richard Lewontin and Richard Levins put it, "environments are as much the product of organisms as organisms are of environments."[12] At the edges where savannah eats into thin soils and trees wither with disease, by the brooks which babble no more, in the wails of hunted and retreating things—here it is clear that the organisms which have sewn together the Amazon with their communion, whether co-operation or competition, are being dispersed, desiccated, and destroyed. An invasive disease has filled the forest's sinews.

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11 Eisenhammer (2021) and Alex Cuadros, "Has the Amazon reached its 'tipping point'?," *The New York Times* (2023).

12 Richard Lewontin and Richard Levins, "Organism and Environment," *Biology Under the Influence* (2007), p.32. Lewontin and Levins here offer a critique of Darwinian and Lamarckian views of the organism's relation to its environment. Lamarck offered the view that an organism "became permanently and heritably transformed by its willful striving to accommodate itself to nature and so incorporated that nature into itself" (p.31). Lewontin and Levins view this as placing a fetter on the future development of biology, resorting to a view which considers nature outside the organism as given and static. Whilst Darwin's view of the organism as a nexus of internal and external relations offered a framework to burst this blockade asunder, "Darwinism represents the environment as a preexistent element of nature formed by autonomous forces, as a kind of theatrical stage on which the organisms play out their lives" (p.32).

Lewontin and Levins' attempt to preserve a dialectical relation between organism and environment is, therefore, explicitly pitted against a form of eternalism (in the Aristotelian sense) within early modern naturalism. Aside from the stress placed on the core productive relation between these phenomena—that both are products and producers of the other—their framework offers four criteria through which this relation may be viewed: (1) through their activity, organisms determine what parts of the natural world are relevant to them, e.g. some birds use grass to nest and others do not (p.33), (2) "organisms remake the environment at all times and in all places," evidenced with smaller interactions and the creation of oxygen by prior forms of life (pp.33-34), (3) "organisms by their life activities modulate the statistical variation of external phenomena as they impinge on organisms" (p.34), and (4) organisms convert the form of matter even in sensory perception, e.g. vibrations in the air and light photons are converted into the chemical signal of adrenaline when someone sees a rattlesnake (p.34).

We also recommend reading the essay following this in *Biology Under the Influence*, 'The Biological and the Social,' which further develops this frame of viewing organisms and environments.

2

Mass extinctions are complex phenomena. In a technical sense, this term describes a period when real rates of species extinction exceed the background rate—that is, the normal rate of extinction. There is considerable disagreement on the number of such events,[1] but scholars most frequently agree upon the "big five"—that is, periods which saw the extinction of around or over 75% of species globally.[2] These are the Ordovician, the Devonian, the Permian, the Triassic-Jurassic, and Cretaceous-Tertiary mass extinctions.

Each of these periods represented an existential threat to life on earth. The worst of them, the Permian, saw the extinction of up to 96%

1 The recently recognised Capitanian mass extinction event illustrates this disagreement and some of the potential reasons for it. The Capitanian was once considered a part of the Permian mass extinction, but the former had actually occurred eight to ten million years earlier. Steven M. Stanley estimates that around 62% of life on earth was driven to extinction by the Capitanian, leading to some calls to consider it on the same order as the "big five" mass extinctions. Stanley's reading is still contentious, however, and the Capitanian rarely features in a "big six" formulation in the literature. There is a virtue to understanding the Capitanian in Stanley's view, however, as his focus on situating the mass extinction in oceanic as well as terrestrial ecosystems fits well with our approach. See Howard Lee, "Mass extinction event 260 million years ago resulted from climate change, studies say," A*rs Technica* (2023) and Steven M. Stanley, "Estimates of the magnitudes of major marine mass extinctions in earth history," *Proceedings of the National Academy of Sciences of the United States of America 113(42)*, (2016).

2 "The "big five" mass extinctions "have been defined... as events standing out from a steadier background rate of extinction in having extinction rates spiking higher than in any other geological interval of the last 540 million years and involving, somewhat arbitrarily, a loss of over 75% of estimated species." Robert H. Cowie, et al, "The Sixth Mass Extinction: fact, fiction or speculation?," *Biological Reviews 97,2* (2022).

of all species.[3] Their durations are hotly debated, but tend toward the low thousands in number of years. For example, studies suggest that the Cretaceous-Tertiary mass extinction developed over around 32,000 years, the Permian mass extinction lasted around 20,000 years, and the Triassic-Jurassic mass extinction took just 5,000 years.[4] From the perspective of life itself, this situates a mass extinction as an object of long duration, lasting many, many generations. In geological time, it is the blink of an eye.

This poses a particular problem in identifying the causes of the "big five," as the fossil record is often sparse and difficult to parse. A 2017 paper by David Bond and Stephen Grasby, titled 'On the Causes of Mass Extinctions,' provides a viable answer. As events of this scale occur simultaneously on land and in the ocean, they must bridge these ecosystems—by atmospheric change for example.[5] Bond and Grasby are keen to point to the temporal proximity of large-scale volcano eruptions to each of the "big five" mass extinctions in an explanatory capacity, but their analytical framework can account for much more. Whether an asteroid impact's nuclear winter or large-scale eruptions from the Deccan Traps shoved into motion by it led to the Cretaceous-Tertiary mass extinction, both clearly unite terrestrial and oceanic ecosystems. As Franz Broswimmer discusses in his 2002 book, *Ecocide*, the Permian mass extinction was possibly caused by tectonic plates shifting, causing changes in sea levels,

3 Sarda Sahney and Michael J. Benton, "Recovery from the most profound mass extinction of all time," *Proceedings of the Royal Society B 275(1636)* (2008).

4 For Cretaceous-Tertiary mass extinction see Paul R. Renne et al, "Time scales of critical events around the Cretaceous-Paleogene Boundary," Harvard (2013), for Permian mass extinction see Jennifer Chu, "Timeline of a mass extinction," *MIT News* (2011), and for Triassic-Jurassic see Jessica H. Whiteside et al, "Synchrony between the Central Atlantic magmatic province and the Triassic-Jurassic mass extinction event?," *Paleogeography, Paleoclimatology, Paleoecology 244* (2007).

5 "Proximal killers require a driving mechanism, the ultimate killer, and in cases where marine and terrestrial mass extinctions are coincident (as is usually the case, although the terrestrial fossil record is often less well known and is shorter) the ultimate killer must be capable of catastrophically affecting both biospheres. The atmosphere is the obvious linkage between these environments, and so the ultimate killer should be something that can destabilise the atmosphere on a global scale. The two most favoured candidates are LIP volcanism and bolide impacts." David Bond and Stephen Grasby, 'On the Causes of mass extinctions,' *Paleogeography, Paleoclimatology, Paleoecology 478* (2017).

dramatic volcanic eruptions and climatic shifts.[6] Again, these processes clearly provide a bridge between oceanic and terrestrial ecosystems.

Each of the "big five" and their many hypothetical causes point to similar conclusions, and the correctness of Bond and Grasby's theoretical framing. This provides a compelling basis for understanding both mass extinctions and what follows them, with each of the "big five" representing a shift to fundamentally different environmental conditions and, thus, a dramatic upheaval in the evolution of life. With this understanding, the severity of our situation may be approached. We are living through the sixth mass extinction.

Real extinction rates are today estimated at between either 100 to 1,000 or 1,000 to 10,000 times higher than the background rate, and growing. The variation between these estimates is hotly debated, though its growth is less contentious. For example, a 2016 paper by Megan Lamkin and Arnold Miller argues higher estimates tend to exaggerate contemporary extinction rates owing to incomplete fossil records and mathematical extrapolation underestimating deep-time background rates;[7] in contrast, a 2022 literature review by Robert H. Cowie, Phillippe Bouchet and Benoît Fontaine notes that lower estimates tend to rely on the International Union for Conservation of Nature's "red list," which underestimates current extinction rates due to both an attempt to preserve conservation funding and a focus on mammals.[8] Whatever the

6 Franz Browswimmer, *Ecocide: a short history of the mass extinction of species* (2002), pp.1-2.

7 Megan Lamkin and Arnold I. Miller, "On the challenge of comparing contemporary and deep-time biological-extinction rates," *BioScience 66(9)* (2016).

8 The "*Red List* is heavily biased: almost all birds and mammals but only a minute fraction of invertebrates have been evaluated against conservation criteria. Incorporating estimates of the true number of invertebrate extinctions leads to the conclusion that the rate vastly exceeds the background rate and that we may indeed be witnessing the start of the Sixth Mass Extinction." Cowie et al (2022).

Cowie et al's assessment of whether or not a species is considered extinct is remarkably clear in its critique of flaws with the *Red List* as an index of extinction: "The taxonomic literature is full of examples of species for which the authors suggest they are probably extinct but do not dare to declare them so. For example, the Eskimo curlew, *Numenius borealis,* a Nearctic wader, probably became extinct by the end of the 20th century and has been considered subsequently as such, the last reliable sighting dating from 1963. However, Butchart *et al*. (2018) recommended that it remain eval-

case, what is at stake is not whether current rates of biodiversity loss fail to meet the technical criteria for a mass extinction event but, rather, the current speed of this process.

Whilst this is an important question,[9] it is more practical to grasp the historical factors driving the present mass extinction. It is precisely here that scientific accounts tend to fall down, and in this respect Cowie et al.,'s account is typical. Setting themselves against a reactionary apolo-

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uated as Critically Endangered (Possibly Extinct) based on a probabilistic approach. Another example is Bachman's warbler, *Vermivora bachmani* (Audubon), of which there has been no confirmed sighting since 1988, despite targeted searches, and which has also been recognised as extinct. Both species are still listed as Critically Endangered by IUCN because of the slim chance that one or more birds may still be alive, that is, not committing the Romeo Error. Such species are therefore not counted among extinct species, and vast sums of money are often spent in the vain hope that they will be found again. Incidentally, the US government has very recently proposed that Bachman's warbler be considered extinct. More generally, Diamond (1987, 1989) emphasised "the gulf between 'proved extinct' and 'not proved extant'" (Diamond,1989, p. 471) and that if extinction must be based on definitive proof, then the true extinction rate will be under-estimated and a lot of the limited funding available will be directed at lost causes."

9 We should have been clearer in the main text of the film that the question of the speed of the present capitalist mass extinction can only be determined by answering the question of what drives it. As our fundamental contention is that capitalism is the historical force standing behind the sixth mass extinction, this necessarily implies a particular length to our evaluation. Whether we follow Marx's "classical" account of capitalism's origins from the 13th Century, or the contemporary historiography of something like Jairus Banaji's *A Brief History of Commercial Capitalism* (2020), which presents evidence of capitalist production under a merchants' capital system much earlier, we are still, therefore, providing a time-scale much shorter than that seen in previous mass extinctions. There are two significant consequences to this.

Firstly, the severity of the present mass extinction is, to a certain extent, determined by its length. If that length is shorter than the period any prior mass extinctions developed under, yet it still meets the criteria to form one, then this suggests the progress of the present mass extinction to the most severe we have knowledge of.

Secondly, this perhaps explains some of the reasons why explanations which root the sixth mass extinction in "all human-caused extinctions," including even the megafaunal extinctions. Simply put: 45,000-20,000 years is a lot more palatable a timeframe for an extinction event in a discipline which arranges its categories based upon known precedents than any estimate which can be measured in hundreds of years. This is by no means explanatory of the argument, but it provides an insight into a concern within its critical background.

gism which argues that the sixth mass extinction is natural and thus no action should be taken to halt it, their paper draws a strict division between prior "natural" extinctions and the present "human driven" one. More than this, they go on to argue that the present extinction event encompasses "all human-caused extinctions," implicating the global megafaunal extinctions 45,000 to 25,000 years ago, the Neolithic revolutions and the invention of agriculture 12,000 to 10,000 years ago, and the 19th Century industrial revolution as stages of fundamentally the same process.[10]

Here, the fundamental driver of the sixth mass extinction is population growth; humanity has expanded its environmental niche to the detriment of life on earth. This approach is emblematic of what Marx described as "the abstract materialism of natural science, a materialism that excludes history and its process."[11] The present mass extinction is not

10 Cowie et al (2022) take this framework from John C. Avise, Stephen P. Hubbell and Francisco J. Ayala, "In light of evolution II: Biodiversity and extinction," *Proceedings of the National Academy of Sciences of the United States of America 105* (2008). In Avise et al's expression, the framework's reliance on a neo-Malthusian view of population growth is front and centre: "Today, most of the biotic holocaust is due—directly or indirectly—to local, regional, and global environmental impacts *from a burgeoning human population*. The first phase of the current extinction episode started ≈50,000–100,000 years ago, when modern humans began dispersing around the planet. The second phase started 10,000 years ago with further population increases and land-use changes associated with the invention of agriculture. A third phase of environmental alteration and bio diversity loss was ushered in by the industrial revolution." (Italics mine.)

11 "A critical history of technology would show how little any of the inventions of the 18th century are the work of a single individual. Hitherto there is no such book. Darwin has interested us in the history of Nature's Technology, i.e., in the formation of the organs of plants and animals, which organs serve as instruments of production for sustaining life. Does not the history of the productive organs of man, of organs that are the material basis of all social organisation, deserve equal attention? And would not such a history be easier to compile, since, as Vico says, human history differs from natural history in this, that we have made the former, but not the latter? Technology discloses man's mode of dealing with Nature, the process of production by which he sustains his life, and thereby also lays bare the mode of formation of his social relations, and of the mental conceptions that flow from them. Every history of religion, even, that fails to take account of this material basis, is uncritical. It is, in reality, much easier to discover by analysis the earthly core of the misty creations of religion, than, conversely, it is, to develop from the actual relations of life the corresponding celestialised

the result of human life in the abstract. It is the product of a particular historical epoch of production[12]: capitalism.

"In the old days, the place where I live was beautiful. It was beautiful, but my land was **devastated** by them. They left wounds in the earth, they rotted our forest. They contaminated our rivers."

—Fernando
"Gold mining and violence in the Amazon Rainforest," *Forensic Architecture*

forms of those relations. The latter method is the only materialistic, and therefore the only scientific one. The weak points in the abstract materialism of natural science, a materialism that excludes history and its process, are at once evident from the abstract and ideological conceptions of its spokesmen, whenever they venture beyond the bounds of their own speciality." Karl Marx, "Chapter fifteen: Machinery and modern industry," *Capital,* Vol. 1 (1867).

12 In using the term "epoch of production" we are here trying to indicate toward a particular framing of the Marxist concept of a "mode of production." We derive this from Jairus Banaji's incisive essay 'Modes of production in a materialist conception of history,' *Capital and Class 3(1)* (1977). This offers a view which is both adverse to the simplism of a mode of production as reducible to its core relations as is argued by many vulgar Marxisms, and provides a constructive way to view the concept. Banaji observes that Marx uses the term "mode of production" to refer to both precise and concrete, even technical, elements of the productive process *and broad epochal forms of production's social organisation*. As Banaji's work through *Theory as History: Essays on modes of production and exploitation* (2012) shows, this allows for a view which is able to parse through the reality of historical records—where waged labour appears as a feature even in ancient Rome—whilst still tracing a line of continuity and structural change congruent with Marx's critique of industrial capitalism in the 1800s.

Our *Approaching Marxism* episode on modes of production, and an episode of our podcast provide a longer introduction to this thinking than space can allow for here. We recommend any interested readers begin there, and follow the reading list provided alongside the *Approaching Marxism* episode for a start on Banaji's approach to history and Marxist concepts. See Prolekult, "Modes of production," *Approaching Marxism* (2022) and Prolekult, "Modes of production: historical materialism and materialist history," *Podcast 17* (2021).

Gold miners dig pits in the earth, releasing the rainforest's ancient gasses. They use mercury in processing the metal.[13] It seeps into the air, the dirt and the water.[14]

> "They bathe and drink the water from the river where the miners work. On his arm you can clearly see his wounds. We'll put cream on it and let it sit for half an hour. The skin infection can be caused by water contaminated by mercury. [...] Here there's **no access** to other water. We're treating them today, but we'll have to repeat the treatment in a few months. Again and again. There's nothing more we can do."
>
> **—Gisele**
> "Brazil's Yanomami people victims of illegal gold rush in Amazon Rainforest," *France 24*

13 "Mercury plays a central role in the process of purifying the gold collected in small-scale operations. In the ASGM [Artisanal and small gold mining] gold production process, mercury is used to amalgamate—or bundle up together—particles of gold that are mixed in with the soil in riverbeds. When done efficiently, the process requires approximately one kilogram of mercury per kilogram of gold recovered. However, ASGM miners frequently utilize inefficient processes that require much larger quantities of mercury. Sometimes up to 50 units of mercury are used to produce one unit of gold. Further, while tools and technologies exist to reduce the amount of mercury required, or to capture the mercury during the amalgamation process and prevent its release into the environment, ASGM miners often are not aware of or cannot afford such equipment. As a result, ASGM is the largest single source of human-driven mercury pollution in the world, accounting for 37 per cent of all emissions into the atmosphere and into local water sources. In the Amazon region this percentage is even higher, with ASGM responsible for an estimated 71 per cent of all mercury emissions, totalling more than 200 metric tons of emissions each year." WWF (2018), p.19.

14 "Mercury is a volatile chemical element that does not disintegrate over time. As such, mercury emissions into the environment are irreversible and difficult to contain. Mercury released into the air and into local water bodies by mining operations can be carried far from the initial sources through the Amazon's extensive freshwater systems, affecting large swaths of the region." WWF (2018), p.19.

3

One and a half million people in the Amazon already suffer from mercury poisoning.[1] The worst impacts are felt among the rainforest's indigenous peoples and rural poor. Among some indigenous groups it threatens whole populations. For example, over 79% of Nahua people tested on the Nahua-Nanti reserve in Peru had high levels of mercury poisoning in 2014.[2] Alluvial gold mining on indigenous reserves has since increased enormously.[3]

With an average consumption of fish six times the global average,

1 "Overall, mercury is estimated to alter the health conditions of over 1.5 million individuals across the basin. A study conducted in the Madre de Dios region of Peru, a centre of ASGM activity, found dangerous levels of mercury in the hair of 40 per cent of all people tested, including those far from any mine. Another study, by the World Health Organization, estimated that as many as 62.4 per cent of infants in fishing communities of the Brazilian gold mining region would experience a loss of at least two IQ points due to mental retardation caused by mercury exposure." WWF (2018), pp.23-24.

General mercury pollution and its implications globally are discussed in Barbara Gworek, Wojciech Dmuchowski, and Aneta H. Baczewska-Dąbrowska, "Mercury in the terrestrial environment: a review," *Environmental Sciences Europe 32* (2020).

2 Survival International, "Urgent Appeal: Mercury poisoning among tribal peoples in Peru, Brazil and Venezuela," and Survival International, "Peru: Mercury poisoning "epidemic" sweeps tribe" (2016).

3 In 2023, Antonio Francisco Perrone Oviedo and Estevão Benfica Senra wrote that in "the last 10 years, the area degraded by mining on Indigenous Lands [in the Amazon] increased by 400%, totaling more than 18,000 hectares, concentrated mainly (90%) in three territories: Kayapo, Munduruku, and Yanomami." See Oviedo and Senra, "Changing the degradation footprint of mining on Indigenous Lands" *Cadernos de Saúde Pública 39(11)* (2023).

the peoples of the rainforest's dependence upon this staple is clear.[4] Below the waters, the gold's noxious touch waits. A study in the Brazilian Amazon found that 81% of carnivorous fish had detectable mercury levels, implying broader contamination of the food chain.[5] Studies indicate that fish consumption by birds and land animals contributes significantly to the poison's spread. Plants by the riverbanks take the poison into their root systems, dispersing it through the soil. Steam and rain cycle quicksilver through the whole ecosystem.

4 "In many Amazon countries, freshwater fish is the main source of protein for riverine communities. Local annual fish consumption averages 94 kilograms per person, which is almost six times the global average... The most commonly consumed species throughout the region are large migratory catfish, which are highly dependent upon the Amazon River's water quality and connectivity for survival." WWF (2018), p.12.

Reliance on catfish in particular is especially dangerous. The migratory Dorado catfish, a staple of Amazon diets, has had almost all of its population impacted by mercury poisoning: "mercury pollution from local ASGM activities threaten the health and wellbeing of the species. A study in the Ecuadorian Amazon showed that 97% of catfish present high mercury levels, on average, 5 times higher than the recommended mercury concentration on fish for human consumption. The dorado, an apex predator, can consume dangerous quantities of mercury from contaminated prey, accumulated through the food chain." WWF (2018), p.21.

5 "Mercury is easily absorbed by aquatic microorganisms, such as plankton, and accumulates in more dangerous chemical forms, such as methylmercury, in carnivorous fish species higher up in the food chain. This can become particularly dangerous for fish-consuming animals, such as river dolphins and jaguars, which are exposed to high concentrations of mercury from their food sources. A study in the Brazilian Amazon showed that 81 percent of carnivorous fish had detectable mercury levels. Most of those had concentrations higher than the World Health Organization's guideline for maximal exposure (0.5 μg/g). Some samples had concentrations as much as five times this limit. Another recent study of the concentration of mercury in four river dolphin species in the Amazon and Orinoco river basins detected mercury in all samples. More than 26% of sampled dolphins exceeded the mercury limits for humans set by the World Health Organization. Meanwhile, plants can also accumulate lower levels of mercury through the soil, posing a risk to herbivorous animals in the region." WWF (2018), p.22.

Animals also contribute to the spread of mercury by absorbing it into their bodies from polluted waters and then traveling away from the sources. When these contaminated animals are eaten or decompose, they pass the toxins on to their predators through the food chain or release them into the environment. Man-made dams along Amazon waterways can also exacerbate the problem. Plants in newly-flooded areas release additional toxic mercury into the water as they decompose." WWF (2018), p.19.

This also threatens the Amazon's urban centres. These populations, like those in the rainforest proper, are reliant upon fish, with double the global average consumption, and upon freshwater from the rivers. Peru, for example, takes around a sixth of its national water supply from the region.[6]

Through these many watery veins, mercury has travelled vast distances. One study indicates that over 6,000 kilometres of water bodies in the Guianas are tainted by the chemical.[7]

In people, mercury poisoning leads to devastating neurological damage, kidney failure, heart failure and many other convulsions.[8] It also damages the nervous systems and reproductive systems of most animals.[9] Whilst many plants only absorb small amounts of the chemical, it has been shown to reduce growth and damage capacity for reproduction significantly.[10]

6 WWF (2018), p.12.

7 WWF (2018), p.19.

8 United States Environmental Protection Agency, "Health effects of exposures to mercury."

9 "Contaminated animals can experience damage to their reproductive systems, as well as neurological disorders affecting their motor skills and coordination, which has been documented in birds, for example. Consequently, these animals may be less able to hunt effectively or to mate, which threatens the long-term health of their species." WWF (2018), p.22.

10 "Soil, as an essential medium for connecting atmosphere and water, plays a critical role in the global mercury cycle. Soil is not only the sink of mercury but also the source of mercury, receiving the mercury input from the environment and re-emitting the deposit of mercury to the atmosphere, water or plants. Mercury contamination in the soil can suppress crops growth or kill plants, eventually affecting human health through bioaccumulation." Rui Qu, Guilin Han, Man Liu and Xiaoqiang Li, "The mercury behaviour and contamination in soil profiles in Mun River basin, Northeast Thailand," *International Journal of Environmental Research and Public Health 16(21)* (2019).

> "Right now I'm experiencing trembling, my nervous system is **not working** as it should. It always varies. It varies and it happens almost 24 hours a day. Mercury goes through all of your body [...] And there comes a time where you start losing your hair, depending on how fast the disease increases. You lose your vision, your sexual function."
>
> **—Mercury Poisoning Victim**
> "Poisoned by the gold rush," *Vice*

The diffusion of mercury through the Amazon's many winding waterways illustrates something of the depth of the crises facing the rainforest. Their scope is equally staggering. Across its 5,500,000 square kilometres, which encompass Brazil, Peru, Colombia, Bolivia, Ecuador, French Guiana, Guyana, Suriname, and Venezuela, the rainforest is also beset by logging, hunting, overfishing, industrial farming for cash crops and livestock, oil and gas extraction, and urbanisation. Mercury's silent tread is accompanied by rather more obvious forces.

Agricultural run-off and sewage both join in its assault upon the waters and their populations.[11] The mine's competitors declare themselves on the surf, rafts dredging for gold on the river bed.[12] The combination of these economic activities and their byproducts presents a vast number of distinct challenges for the ecosystems they confront. Worse still, the technical nature of the development at play lends itself to expansion. The roads which now cover 41% of the rainforest,[13] a necessity of large-scale

11 "In Brazil, some regions lack sufficient drinking water because water supplies are polluted by agricultural runoff, industrial effluents, and domestic sewage." Kaline de Mello et al, "Multiscale land use impacts on water quality," *Journal of Environmental Management 270* (2020).

12 See Inácio Abreu Pestana et al, "Let's talk about mercury contamination in the Amazon (again): The case of the floating gold miners' village on the Madeira River," *Extractive Industries and Society* 11 (2022) for a case study of dredging.

13 Jonas Botelho Jr. et al for Amazon Institute of People and the Environment,

economic activity and urbanisation, do not only slice through animal migration routes and quicken the pace at which the forest's bounty may reach the market. They also provide easy access to relatively undisturbed canopies. A 2014 study concluded that 94.9% of all deforestation takes place within 5.5 kilometres of a road or 1 kilometre of a navigable river.[14]

It is easy enough to conclude that these forces are those which stand behind the spoliation of the rainforest, its exponential increase in pace, and the changes in its aggregate function in terms of atmospheric greenhouse gas flows. We can even put this causality in simple statistics: deforestation is the primary driver of habitat loss in the Amazon; a 2021 survey found that cattle ranching pastures occupied around 75% of deforested public lands;[15] in the same year, these ranches accounted for 17% of Brazil's methane emissions.[16] However, this alone does not tell us much. In ecological terms, the density of interaction between and among the forces assailing the rainforest and those organisms assaulted allows for abstraction only in terms of broad dynamics. To make any sense of the changing Amazon and the struggle of its multitudes as they really are requires painstaking study of local conditions and long-term observation. Socially, the centrality of extractive industries in the destruction of the Amazon merely tells us that wood, cash crop, meat, oil or gold production in the region today are driving the rainforest's destruction. It does not explain what motivates them.

"Mapping roads in the Brazilian Amazon with artificial intelligence and Sentinel-2," *Remote Sensing* (2022).

14 Christopher P. Barber et al, "Roads, deforestation and the mitigating effect of protected areas in the Amazon," *Biological Conservation 177* (2014).

15 Felipe Betim, "Why cattle ranching is the biggest deforestation driver in the Amazon," *Dialogue Earth* (2022).

16 Aldem Bourscheit, "COP26: Explosive herd growth in the Amazon challenges Brazil's cut in methane emissions," *InfoAmazonia* (2021).

> "The wealth here, we know it won't stay here. The revenue is going in the pockets of the **capitalist** and the politician, and the people here are going to be left with only destruction."
>
> **—Waldimiro Pereira Lima**
> "Communities in Brazil fight Canadian mining company's gold mining plans," *Mongabay*

The overwhelming majority of the workers employed in gold mines across the Amazon are essentially slaves. This is forced upon them in many ways. A combination of debt traps[17]—workers charged for recruitment

17 "In Madre de Dios, it is very common that representatives of the mine owners hold 'lightning' recruitment drives in the markets of Andean provinces such as Cusco and Puno, offering to transfer workers straight to the mines the same day. A local NGO revealed that the representatives offer workers an advance payment and suggest that they will earn as much as USD 3000 on a monthly basis, without revealing that the advance payment is in fact a loan, and that their income will derive only from one day in a seven-day working week. In rural areas, traffickers are paid for each worker they recruit. Some workers know about the inhuman working and living conditions, and that life is only about working and surviving, but young workers often are tempted by the advance payment and subsequently are trapped until they can pay back their 'debts.'

Verité also found some indicators of forced labour among self-employed gold producers in Cusco who had to keep working to pay off moneylenders with a percentage of the gold that they found.

In Puno, Verité found ample evidence of an employment system (*cachoreo*) in La Rinconada that made workers vulnerable to forced labour linked to payment in kind. Under this system, workers had to work for no pay for their recruiters (cooperative members) for a certain amount of time before they could extract gold for themselves, with this gold serving as their payment. Workers reported that in some cases, they extracted little to no gold during the days when they were extracting gold for themselves, in which case they had to borrow money to make it through until the next payday.

In Arequipa, Verité found a system under which workers are hired under 30-day "contracts," and employers deduct from workers' wages the cost of overpriced merchandise in company stores." Verité, "Risk Analysis of Indicators of Forced Labour and Human Trafficking in Illegal Gold Mining in Peru" (2013).

fees, lodgings and food at rates they cannot repay—and trafficking[18] are the most common methods. As a common commodity on trafficking markets, child labour is rife.[19]

Interviewer: "Everything here is traded in gold, right? Cigarettes, water… Can you give me an example, how much is a Coca Cola?"
Worker: "Around a gram of gold."
Interviewer: "A cigarette?"
Worker: "Cigarettes cost two grams."
Interviewer: "For the pack?"
Worker: "Yes, for the packet."

"The illegal Brazilian gold you may be wearing," *BBC News*

18 Trafficking has been uncovered in numerous gold mines across the Amazon. Some stark examples: (a) in Sur de Bolívar, Colombia, 1,500 workers employed at a mine were not able to leave the area without military escorts; (b) indigenous Yanomami people have been found with slave numbers tattooed onto their arms. For more information see Verité (2013) and Global Initiative Against Transnational Organised Crime, "Organised crime and illegally mined gold in Latin America" (2016).

19 "[In] the mining region of Potosí, Bolivia, children can be bought for 3-7 US Dollars." Global Initiative Against Transnational Organised Crime (2016), p.vii.

"Though children may work voluntarily in gold mining at their parent's behest, in many cases they are trafficked for forced labour. The ILO notes that about 20% of children engaged in artisanal mining work for adults who are not their parents. They are trafficked into mining work through a recruiter; recruitment often occurs through informal networks of extended families and acquaintances. Older juveniles may migrate to mining areas to look for work and become vulnerable to exploitation and forced labour when on-site. Due to the extremely hazardous nature of the work, mining is considered a Worst Form of Child Labour (WFCL). Children are commonly used to enter mine shafts too narrow for adults, or are tasked with cleaning gold using mercury. They may have to dig pits and carry heavy bags of ore, leading to musculoskeletal injuries. The isolated nature of illegal gold mining and its intensive nature often require children to miss school, another indicator of WFCL." Ibid, pp.28-29.

Men with guns patrol the mine's edges. They are tasked with stopping escapees. As well as serving as guards, these men also play a crucial role in disciplining the work-force.[20]

20 There is no comprehensive study on the use of force within gold mines in the Amazon. Rather, references to them appear in a variety of treatments. They are not always present, but appear commonly enough in the literature to be regarded as a persistent feature of the mine's labour organisation. Some examples from Global Initiative Against Transnational Organised Crime (2016):

"There are reports that some armed groups have forcibly recruited workers to work in their mines. For example, a 2012 report indicated that the Águilas Negras forced artisanal miners to work in their mines in Valle de Cauca. There are also reports in Sur de Bolívar that 1,500 workers were employed at a mine owned by the wife of an ex-AUC leader and were not able to leave the area without being accompanied by the narco-paramilitary group operating in the area." (p.32)

"Many armed groups obtain money by extorting miners and mine owners, known as charging a "vacuna" (lit. vaccine). According to an in-country expert interviewed for this report, "everyone pays a vacuna"—whether it is a mine owner, a person operating heavy machinery, or small-scale miners who have to pay a percentage of their earnings. The revenue gained through this sort of extortion in illegal mining contexts has financed an array of activities by armed groups in Colombia's mineral-rich regions." (p.10)

"In 2015, the U.S. Department of State reported that forced labour was widespread. Criminal and illegal armed groups reportedly subjected individuals to forced labour, including in illegal gold mining. A recent Reuters report linked human trafficking and forced labour to illegal gold mining, especially in the western rainforest area and the Department of Chocó, known hotspots for human trafficking. In 2014, Colombian victims of trafficking mostly originated from the departments of Antioquia, Cundinamarca, Valle del Cauca, Risaralda, Cauca, Caldas, Tolima, Sucre, Putumayo, Bolívar, and Quindío." (pp.31-32)

Further examples from Verité (2013):

"During worker interviews in Ocongate, Verité researchers were informed that in La Cumbrera and Quince Mil, Cusco, on the border with Madre de Dios, there were relatively large gold mines controlled by heavily armed groups reportedly directed by Chinese, Korean, and Colombian nationals. Although individuals from other countries are not legally permitted to obtain mining concessions, these individuals reportedly did so through proxies. Workers stated that these individuals had used deception and false promises about terms of employment to get workers to the mines. Once they were there, they were told that they had to complete 90-day contracts, as they had incurred a debt as part of their recruitment (induced indebtedness). Some of these employers failed to pay workers any money when their contracts were up, claiming that they were broke (non-payment of wages).

Workers who wanted to leave were held against their will with the threat of physical violence by heavily armed guards. Some workers interviewed also reported that the

An account from a worker rescued from a gold mine explains that anyone at the mine he worked in with too much debt by the end of the month was executed.[21]

Conditions here are abominable. Accidents on the job are common, even those resulting in death, and no personal protective equipment is provided for the workforce.[22] Miners are first on the line for poisoning

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gangs had brought in "kidnapped" Ecuadorian immigrants and prevented them from leaving with the threat of violence. A miner from Ocongate who had worked for a Chinese national in La Cumbrera said that the man and approximately 20 armed Chinese and Peruvian guards literally held workers captive at gunpoint and made them work for no pay. The town finally organized a huge party armed with machetes and elicited the help of the police. They freed the miners and kicked out the five Chinese citizens and their armed thugs." (p.51)

"Some of the workers interviewed reported that they had worked in mines that were extremely physically isolated and that transport was only provided to the mine, but not back to workers' homes. Some miners recounted that the only transport was controlled by mine owners, while others reported that since they were not paid for the first month, they were unable to pay for transport back home. Other workers interviewed reported that the mines in which they worked had locked gates and armed guards who would not let them out of the mining area without permission, resulting in physical confinement of workers in the work location." (p.68)

Summary tables on pp.80-92 [Verité (2013)] give an overview of other incidents, including rumours of human sacrifice, use of force, withholding of wages and refusal to let workers leave.

21 "In some illegal gold mines in which they had worked they had to pay up to USD 66 to get jobs, and in other cases they had to pay a percentage of their earnings. In general, they worked in groups of 7-8 miners, and had to give 70-75% of the gold that they found to the criminal group controlling the mine, and they divided the remaining 25-30% amongst themselves. They reported that they could earn up to USD 4,500 per month, and had heard of people earning as much as USD 150,000, which fueled a "gold fever" and migration to new mining areas.

However, in many cases, they did not find any gold for months, and they knew of people who had not found gold for up to two to three years. During this time, they became indebted and had to take out loans from informal money lenders for which they were charged interest rates of 10% per month. They had to hand over collateral in order to obtain the loans and also reported that if they failed to pay back the loans that they would "be hurt." They reported that people were "killed every day in Segovia" by mining accidents and hired assassins." Global Initiative Against Transnational Organised Crime (2016), p.65.

22 Verité (2013): "Accidents are common in artisanal mining, due to the fact that the ASGM is carried out without the benefit of modern technology or PPE and occurs

from both mercury and cyanide, also used in processing gold. Those who work at the mine are also subject to appalling living quarters, with no protection from extreme heat or cold, no sanitation and contaminated water. Though severe disease is common, medical care is all but unheard of.[23]

Aside from those who directly work the pits, gold mines in the Am-

outside of the purview of the law." (p.23)

"Research indicates that in some formal processing plants, workers are also exposed to cyanide with minimal PPE and many workers are exposed to mercury with little to no PPE in illegal mining. Mercury may be ingested (accidentally during work or when it contaminates water), absorbed through the skin (when it is handled with bare hands or miners have to swim in mercury contaminated water), or inhaled (when the mercury is burnt off of pieces of gold)." (pp.23-24)

"Workers employed in mines in Cusco face a series of health and safety risks. Those employed in alluvial mining face dangers similar to those employed in Madre de Dios, while workers employed in hard-rock mining face a different set of hazards to their health and safety. Workers in hard-rock mining face exposure to vibrations from drilling, explosives, repetitive motions, mine collapses, carrying heavy loads, and exposure to mercury and the elements. Both workers and self-employed miners had little to no PPE (the most being a hard hat) and worked in tunnels that were not designed by engineers and had no internal bracing or escape routes." (p.53).

23 Verité (2013): "In Madre de Dios, housing in mining camps was generally made of plastic sheeting. Most workers lacked electricity and running water, forcing them to drink mercury infested water. A study carried out in 2012 found that three quarters of adults in Madre de Dios registered levels of mercury 300 percent higher than the level considered to be dangerous. For those who had electricity and running water, it was often controlled by mine owners, who set extremely high prices and provided poor service. In remote mining camps, there was the constant threat of poisonous snake or spider bites, malaria and other insect borne diseases, and wild animal attacks, especially among workers who had to sleep in the open. Workers reported that in many mining camps, there was no medical attention at all. If workers could find medical attention, it was generally rudimentary and expensive. Workers interviewed reported that they had to pay for their own medical attention for work-related injuries and illnesses, were not given any compensation, and were not paid during the time that they were recuperating. Workers in Madre de Dios reported that most workers did not live past the age of 40." (pp.44-45)

"La Rinconada is a very isolated area in which there is a severe lack of services and presence of government institutions. Until recently, there was no police station. Now there are four police officers for a city of over 100,000 where crime is rampant. People live in hastily constructed sheet metal boxes, and the town lacks a sewer or a dump. In addition to the risk of criminals, miners face severe risks to their health and safety and all of the residents of La Rinconada face the risk of mercury exposure." (p.57)

azon traffick children and women to work at bars and brothels in the immediate area. Children often make up half or more of those imprisoned in these brothels.[24]

Image: Illegal gold mining in the Amazon rainforest on Munduruku Indigenous land, in the municipality of Jacareacanga, Brazil (Reuters, 2024).

24 "In 2010, Asociación Huarayo, a local NGO in Madre de Dios, calculated that there were approximately 2,000 sex workers employed in 100 brothels in Delta 1 alone. Based on their extensive experience rescuing girls from sex trafficking, they estimated that approximately 20 sex workers were employed in each brothel and that 60 percent of these workers were minors. Therefore, in Delta 1 alone, they estimated that there were 1,200 underage victims of sex trafficking." Verité, (2013), p.45

Global Initiative Against Transnational Organised Crime (2016) provides a more comprehensive overview, giving evidence for sex trafficking in Peru (p.31), Colombia (pp.33-35), Ecuador (p.35), Bolivia (p.35) and Guyana (pp.35-36).

Sex worker: "You'll find youngsters in a place called La Pampa…"
Interviewer: "La Pampa, right?"
Sex worker: That's what I've heard, but I'm scared of that place.
Interviewer: "It's miners over there right?"
Sex worker: "It's full of miners who spend all of the money they make."
Interviewer: "And over there it's full of young girls right?"
Sex worker: "Yes, sometimes they go there to make money for only a day or two, because they know it's dangerous. But then they can get killed for 500 soles ($150). They deceive you to get you there, and once you're there you might not come back."
Interviewer: "They bring them [the girls] from other places, right?"
Sex worker: "They place misleading ads that say 'Ladies wanted for waitressing jobs.' Then they choose the prettier girls and bring them over here."
Interviewer: "Underage girls?"
Sex worker: "Yes. But they mainly take them to La Pampa, to the illegal mining camps."

"Inside the underage sex trafficking brothels of Peru's illegal gold mines," *AJ+*

The workforce drawn to the mines out of economic desperation or trafficking largely consists of undocumented peoples, criminals fleeing arrest, and ex-prisoners. Aside from migrants, these undocumented workers largely consist of indigenous peoples and subsistence farmers dispossessed of their land.[25]

25 "Among these workers are *indocumentados*, Peruvians who lack a Nation-

As deforestation results from all of the economic activities implicated in the Amazon's destruction, it serves as a rough indication of their progress. Prior to the 2000s, population growth stood as the dominant explanation for the loss of forest cover. This position was backed, primarily, by a simple statistical correlation: the registered population of the Amazon basin has risen from an estimate of around 100,000 in 1960 to just under 29 million in 2023;[26] essentially all deforestation has occurred within the same period.[27] Though a shift in academic focus since the 2000s has shown the significance of factors other than population size for deforestation, this has not necessarily disrupted the causal link drawn. Rather, population size is treated as one of a number of determining factors in much of the literature, related to the growth of destructive economic infrastructure as a potential, though not exclusive, motivation.[28]

In contrast, a 2016 study on the population growth and density in the Brazilian Amazon between 2000 and 2010 by Isabelle Tritsch and

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al Identity Document (DNI). For many indocumentados, the illegal mining sector constitutes their only chance for employment, as formal sector employers require that their workers possess a DNI. In some cases, they are extremely poor, geographically isolated, or indigenous Peruvians who never obtained a birth certificate and have thus been unable to acquire a DNI. These individuals are generally very vulnerable due to their lack of alternative employment and their low levels of education and socio-economic status. In other cases, the indocumentados are criminals or people suspected of having committed a crime who are running from the law and seeking refuge in the lawless environment of the mining camps. Indocumentados may thus be vulnerable to labor exploitation and/or individuals who prey on others as human traffickers, robbers, armed guards, or bouncers at brothels." Verité, (2013), p.38.

26 This is errata, preserved due to the script already having gone into production. Isabelle Tritsch and François-Michel Le Tourneau put the population of the Amazon at 2.5 million in 1960 in "Population densities and deforestation in the Brazilian Amazon: New insights on the current human settlement patterns," *Applied Geography 76* (2016). The current population of the Amazon is over 30 million according to the WWF, "Inside the Amazon."

27 Tritsch and Le Tourneau (2016) estimate 18% of original forest cover was lost between 1960 and 2016.

28 Since "the 2000s, this paradigm has been changing, and human population density is no longer pointed out as the principal determinant of tropical deforestation in land-use change studies. Instead, it is viewed as a factor interacting with complex social, economic, and political processes at local and global levels." Tritsch and Le Tourneau (2016).

François-Michel Le Tourneau illustrates that population and deforestation are often decoupled developments.[29] The study highlights that whilst high population-high deforestation patterns do subsist, both high population-low deforestation and low population-high deforestation patterns are growing. "Human deserts" accounted for a third of deforested land and just 1.5% of the population in 2010, with deforestation increasing and population decreasing in these areas through the prior decade. The same period saw a marked increase in the concentration of the rural population both in large villages and within the rainforest itself, and a 30% increase of the urban population. Though the urban population and large villages are associated with an increase in pollution, each of these settlement patterns has a low impact in terms of deforestation. This is particularly true of concentrated populations within the rainforest, largely consisting of indigenous peoples and subsistence farmers, with these regions showing a deforestation rate of around 0.18% of original forest cover. What emerges from this overview is a picture of the settlement pattern driving the deforestation of the Amazon. Rather than population growth, rural depopulation giving way to resource extraction, industrial agriculture and population concentration appears as the primary motor of the process. Though Tritsch and Le Tourneau's analysis only concerns the Brazilian Amazon, the same process can be seen elsewhere, as shown by a 2019 study of the Ecuadorian Amazon[30] and a 2005 study of the Amazon as a whole.[31] The ubiquity of this pattern undermines the conclusions these studies draw from it, each arguing for a greater local focus in analysis. Whilst such analysis is undoubtedly useful, it is clear that this development pattern is united. What unites it is the crucial question.

April 2022. Two hundred tribes fill the Brazilian capital to demonstrate against efforts by the Bolsonaro government to legalise mining on indigenous land. Among them march representatives covered in gold

29 See Tritsch and Le Tourneau (2016) for a detailed discussion of this process. All the information in this section on population densities is taken from their work.

30 Samuel Sellers et al, "Population and development in the Amazon: A longitudinal study of migrant settlers in the Northern Ecuadorian Amazon," *Acta Amazonica 47(4)* (2017).

31 Emilio F. Moran, Eduardo S. Brondizio and Leah K. VanWey, "Population and environment in Amazônia: Landscape and Household Dynamics," *Population, Land Use, and Environment: Research Directions* (2005).

and red to symbolise the violence which comes with gold.[32]

> "Illegal miners have been offering food to our underaged girls in return for sex. They **polluted** our rivers with mercury, and **poisoned** the fish we eat. Now our youngsters feel they depend on gold to survive, and some of our leaders have sided with the miners because they feel they can't depend on the government for protection."
>
> **—Mauricio Yekuana**
> "Illegal mining, abuses surge on Indigenous land in Brazil," *Al Jazeera English*

As alluvial gold mines are illegal across most of the basin, they cut furthest into the rainforest's canopy to remain hidden, leaving a network of roads for other industries to follow. The experience of the Yanomami tribes, who live in a remote region along the border of Brazil and Venezuela, attests to the destruction this incursion brings.

February 2021. Armed miners enter the village of Helepe, searching for a villager. Tensions are already high. Since 2019, the miners have become emboldened. They have exchanged old hunting rifles for pistols and automatics. Gunfire breaks out and the clash leaves a miner dead. Reprisals will follow for months, with many attacks and even massacres in Yanomami villages.[33]

32 For reports on the protest see Rebeca Binda, "It's our land, too: Brazil's indigenous peoples protest against Bolsonaro," *The Guardian* (2022) and Al Jazeera English, "Illegal mining, abuses surge on Indigenous land in Brazil: Report" (2022).

33 Hutukara Associação, Yanomami Associação and Wanasseduume Ye'kwana, "Yanomami Under Attack: illegal mining on Yanomami Indigenous Land and proposals to combat it" (2022), p.30.

> "Some of the **anger** I have in my heart is because the government declared this territory a reserve and gave us… what can I say… they gave us a piece of territory with a piece of paper that said 'agreement' but if we didn't concern ourselves with protecting this place this river may have been destroyed because we've seen how quickly [the miners] work."
>
> **—Indigenous Forest Defender**
> "Our children's river: how indigenous guards fight against gold mining in the Amazon," *Amazon Frontlines*

Open violence has become a staple of life on Yanomami territory since the discovery of gold in the mid-1970s.[34] Gunpowder and lead, however,

34 "The first large invasion occurred during the military dictatorship, between 1973-1975, with the construction of the North Perimeter highway in the states of Roraima and Amazonas. The plan was to cut through the Amazon forest from east to west. The work lasted less than three years and stopped abruptly when 200 kms had been opened in Yanomami lands. However short, three years were enough to wreak havoc on the lives of whole communities. Measles, the common cold and other pestilences devastated families, destroyed their subsistence, killed more than 22 per cent of local communities, and nearly tore their social fabric apart.

In 1975, a survey carried out by Project Radambrasil disclosed information about the soil and subsoil of the Yanomami territory. Soil fertility is poor but the subsoil is rich in minerals. This news did not stimulate an interest in agribusiness but did trigger a number of invasions by placer miners in search of tin. Shortly afterwards, the Surucucu hills, at the heart of Yanomami lands, witnessed a series of armed conflicts between Indians and miners, provoked by the theft of garden produce and sexual abuse of Yanomami women.

In 1980, another assault began, now for gold, on the Upper Uraricoera River. Some 2,000 placer miners who nine years later had become 50,000 took over most of the central part of the Yanomami lands in Brazil, crossed over to Venezuela and caused some diplomatic hassles between the two countries. The situation reached a critical point in August 1989, when thousands of miners descended upon the Yanomami territory. Mercury and silting, part of their mining operations, polluted the entire course of several rivers, including the Mucajaí, Uraricoera, Catrimani and Couto de Magalhães. Incessant landings and take-offs of aircraft and helicopters on more than 80 clandes-

are not the only weapons wielded by the mines. Malaria, brought by miners in the 1980s, is now common. Between 2018 and 2022, an average of three Yanomami infants died every week of the disease.[35] Combined with the mercury and cyanide pollution brought by the pits and a chronic lack of healthcare, the impact of disease in the destruction and dispossession of the tribes is clear.

The pollution brought by the mines not only assaults the health of Yanomami, it destroys their means of subsistence. As the fish have died off or become inedible, the tribes have been forced to go further afield or to seek food from the market or the miners.[36] This dependency is com-

tine runways chased away game animals, bringing famine to the Yanomami and the consequent humiliation of depending on food handed out by the miners.

Epidemics quickly spread. Tuberculosis, malaria and other foreign diseases injured and killed, some with fulminating speed, others slowly, corroding the demographic balance of whole communities, leaving behind stray orphans, seriously threatening the production of material and cultural goods and even social reproduction. Each new runway they opened, each gully they demolished, each new camp they set up contributed to destroying Yanomami life.

We will never know how many Indians perished during that gold rush because, in August 1987, the National Indian Foundation (Funai), the National Security Council and the Governor of Roraima at that time, Romero Jucá, barred researchers, health workers, Catholic missionaries, journalists and other observers from entering Yanomami territory. That prohibition protected clandestine actions from denunciations, thus leaving the job of clearing the land of their Indigenous inhabitants in unwitnessed chaos." Alcida Rita Ramos, "Yanomami: history returns as a tragedy foretold," *Debates Indigenas* (2023).

35 See Sarah Brown, "Yanomami health disaster prompts outrage as Lula vows to tackle crisis," *Mongabay* (2023) for this statistic. For more detailed reporting around this see Ana Maria Machado, Talita Bedinelli and Elaine Brum, "We are not even able to count the bodies," SUMAÚMA (2023).

36 Hutukara Associação et al (2022): "As the Indigenous Peoples themselves indicate, the problem is not the absolute absence of food, but the relative scarcity resulting from the social and economic destructuring that the mining invasion brings about: diseases prevent people from working and caring for their children; young people stop contributing to productive activities in order to exchange their labor for leftover food and second-hand objects; weapons and alcoholic beverages introduced by the miners exacerbate internal conflicts and trigger intercommunity wars. In addition, of course, to the environmental destruction that reduces the availability of fertile land, fish and food for collection around the houses." (p.54)

"According to the indigenous people of the region, with the deepening of relations with the miners, many families have stopped cultivating their fields and have

plemented by the miners' offers of alcohol and other drugs, which have enslaved many seeking to ease their suffering and caused conflict among villages.[37]

January 2023. The returning President Lula declares a national emergency, describing the assault on the Yanomami as a genocide.[38]

> "This year they say they will attack us again. They want to attack us again. 'Let's **exterminate** the Yanomami,' they say. But we are not afraid. We are the rightful inhabitants of the forest and it is our duty to protect it."
>
> **—Fernando**
> "Gold mining and violence in the Amazon Rainforest,"
> *Forensic Architecture*

become dependent on unequal exchanges with the miners. Some work as porters in exchange for payment in cash or gold to later buy food in the camp canteens, where 1 kilo of rice or a frozen chicken costs 1 gram of gold or 400 reais!" (p.83)

37 "Other impacts reported by the leaders concern the introduction of drugs and alcoholic beverages and the intensification of internal conflicts in the communities. They gave the example of Aracaçá which, they described, is on the way to disappearance, such is the social disruption caused by the influence of the miners (Thëpë pirio yai hoximi!). According to the Palimiu Theli in Aracaçá, the Sanöma have stopped opening fields and now depend on the food offered by the miners in exchange for services, such as carrying fuel and conducting small canoe charters. There, again according to the Palimiu Theli, the miners introduced drinks and a "white powder" that left the Sanöma addicted, altered, and violent ("pihi yayoprarioma," "pihi xi warihiprario," "pihi yaiprarioma"), resulting in many episodes of violence among those from Aracaçá." Hutukara Associação et al (2022), p.35.

38 Charlotte Elton, "Brazil: President Lula accuses Bolsonaro of 'genocide' after gold mining causes Indigenous deaths," *Euronews* (2023).

"We indigenous communities are saying, look at the sky, it's changing, the sun is changing, the rain is changing. The men in the cities, we want them to listen and **believe** us, to look to the future and the past, to see what is happening."

—Davi Kopenawa
"Interview with Davi Kopenawa Yanomami on climate change," *CAFOD*

"The atmosphere is the obvious linkage between the two biospheres."

—David Bond & Stephen Grasby
"On the causes of mass extinctions"

"Environments are as much the product of organisms as organisms are of environments."

—Richard Lewontin and Richard Levins
"Organism and environment"

"The era of global warming has ended. The era of **global boiling** has arrived. The earth is unbreathable, the heat is unbearable and the level of fossil fuel profits and climate inaction is unacceptable."

—António Guterres
Secretary General of the UN, 2023

4

Climate change forms the most obvious global bridge between ecosystems today, though its cause differs from any of the potential sources of the "big five" mass extinctions. Instead of bursting forth from the great rock spines and magma channels of volcanoes, or landing like a hammer from the stars, the engine of this process is found in land scoured by machines, in factories, and in fossil fuels.

Atmospheric carbon concentration, the largest chemical contributor to this process, stood at over 423 parts per million (ppm) in January 2024.[1] Prior to the industrial revolution, it stood consistently at around 280ppm. In consequence, global temperatures have already risen over 1.2°C since 1850. Not only does this rise not reflect the full weight of the greenhouse gasses already emitted as carbon takes a considerable period to realise its full warming impact,[2] the process is accelerating. The 2023 annual report of the World Meteorological Organization predicts that there is a 66% chance the planet will emit enough carbon for 1.5°C of

1 Statista, "Average monthly carbon dioxide (CO_2) levels in the atmosphere worldwide from 1990 to 2024" (2024).

2 "In a recent letter, Ricke and Caldeira estimated that the timing between an emission and the maximum temperature response is a decade on average. In their analysis, they took into account uncertainties about the carbon cycle, the rate of ocean heat uptake and the climate sensitivity but did not consider one important uncertainty: the size of the emission. Using simulations with an Earth System Model we show that the time lag between a carbon dioxide (CO2) emission pulse and the maximum warming increases for larger pulses. Our results suggest that as CO2 accumulates in the atmosphere, the full warming effect of an emission may not be felt for several decades, if not centuries." Kirsten Zickfield and Tyler Herrington, "The time lag between a carbon dioxide emission and maximum warming increases with the size of the emission," *Environmental Research Letters 10(3)* (2015).

warming between now and 2027, an estimated remaining carbon budget of only 250 billion tonnes before this milestone and annual emissions at 54 billion tonnes, a figure still rising year on year.[3]

The scale of this process represents a transition to fundamentally new climatic conditions which many have called the "anthropocene." Though initially coined in the 1920s by the Soviet geologist Aleksei Pavlov,[4] most modern accounts take the term's origin to be Paul J. Crutzen and Eugene F. Stoermer's short article, "The Anthropocene," published in 2000. The fundamental argument in this piece—that humanity has emerged as a geological force, with a "central role" in the future development of the climate and global ecology—is not new, its development dating at least as far back as 1867.[5] What Crutzen and Stoermer add is twofold. Firstly, that this development is the result of a growth in human population and activity.[6] This is the *anthropo* in anthropocene—"an argument in a word," as put by Jason W. Moore in a 2017 paper.[7] Secondly, that the beginning

3 World Meteorological Organization, "WMO Global Annual to Decadal Climate Update, 2024-2028" (2024) and World Meteorological Organisation, "Global temperature is likely to exceed 1.5°C above pre-industrial level temporarily in next 5 years" (2024).

4 Discussed in John Bellamy Foster, "Marxism in the Anthropocene: Dialectical Rifts on the Left," *International Critical Thought 6(3)* (2016), pp.393-394: "The word "Anthropocene" itself, and the notion of a new Anthropocene (or Anthropogene) epoch, were first introduced in the 1920s (and into English in the early 1970s, in a translation from the Russian) in the analysis of the Soviet geologist Aleksei Pavlov. Working in line with Soviet geochemist Vladimir I. Vernadsky, who wrote his great work *The Biosphere* (1998) in this same period, Pavlov insisted that humanity in the twentieth century was more and more becoming a geological force altering the entire biosphere."

5 To their credit Crutzen and Stoermer do acknowledge this longer conceptual development, referring GP Marsh and Stoppani as early articulators of the concept that humanity is a geological force. Crutzen and Stoermer, "The Anthropocene," *Global Change Newsletter 41* (2000).

6 Crutzen and Stoermer (2000).

7 Jason W. Moore, "The Capitalocene Part I: on the nature and origins of our ecological crisis," *The Journal of Peasant Studies 44(3)* (2017).

Unfortunately, our engagement with Moore's work in this film is quite small. This is due to an attempt to avoid delving too deeply into the different elements of ecosocialist thought in the film, in exchange for a focus on concrete material. Moore's concept of the "capitalocene" aligns with much of what we are arguing, however, and we encourage readers to engage with it. We have also produced an episode of *Approach-*

of this "anthropocene" should be dated during the industrial revolution. It is this framing which has gained widespread consensus across scientific literature, political formations and media outputs. The political connotation is clear. Just as Cowie, Bouchet, and Fontaine locate the force driving the sixth mass extinction as humanity per se, this formulation of the "anthropocene" considers all humanity the motor behind the climate crisis.

The beginning of an answer to such charges rests in an understanding of the development and application of industrial technology, and particularly prime movers reliant on fossil fuels, as the product of specifically capitalist relations of production. Setting aside his earlier contention that steam-engines produced "society with the industrial capitalist" in *The Poverty of Philosophy*,[8] Marx outlines such a critique in his discussion of machinery in *Capital*, particularly its first volume, and the notebooks written in preparation for this work, published together as the *Grundrisse*.

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ing Marxism on the clash over the theory of the metabolic rift between Moore and Bellamy Foster, with a contribution from Moore himself. It is best watched alongside the preceding episode, which gives an introduction to the clash between modern first and second wave ecosocialist thought. We recommend viewing both together. See Prolekult, "Marx and Nature," *Approaching Marxism* (2023) and Prolekult, "The Metabolic Rift (ft. Jason W. Moore)," *Approaching Marxism* (2024).

In the second part of For Land, we intend to engage with Moore's work a lot more, particularly the view of Marxist crisis theory put forward in *Capitalism in the Web of Life* (2015).

8 "In acquiring new productive forces men change their mode of production; and in changing their mode of production, in changing the way of earning their living, they change all their social relations. The hand-mill gives you society with the feudal lord; the steam-mill society with the industrial capitalist.

The same men who establish their social relations in conformity with the material productivity, produce also principles, ideas, and categories, in conformity with their social relations.

Thus the ideas, these categories, are as little eternal as the relations they express. They are *historical and transitory products*." Karl Marx, "Abstracts from chapter two," *The Poverty of Philosophy* (1847).

Marx is here articulating a crude version of his view of the relationship between "economic base" and "ideological superstructure." In relation to that framework, this is mechanistic and expansive (see Prolekult, "Base and superstructure," *Approaching Marxism* (2022) for a general discussion of this kind of problem). From a developmental perspective, it is somewhat self-contradictory as the framework somewhat excludes the development of means of production it treats as motive.

That machinery is a social product can be seen even in a purely technical sense. Handicraftsmen were first grouped together in individual capitalist enterprises. Where they had previously constructed the entirety of a given commodity, this new concentration allowed for a division of labour to bolster productivity, each labourer taking a single, isolated part of the labour process.[9] This isolation of labour processes further allowed for the specialisation of tools and their recombination in the working machine.[10]

As Hans-Dieter Bahr points out in his essay 'The Class Structure of Machinery,' such a view can only be considered controversial in relation to contemporary technology. Archaeological approaches frequently analyse prior societies' social formations on the basis of their tools.[11]

9 "The mode in which manufacture arises, its growth out of handicrafts, is therefore two-fold. On the one hand, it arises from the union of various independent handicrafts, which become stripped of their independence and specialised to such an extent as to be reduced to mere supplementary partial processes in the production of one particular commodity. On the other hand, it arises from the co-operation of artificers of one handicraft; it splits up that particular handicraft into its various detail operations, isolating, and making these operations independent of one another up to the point where each becomes the exclusive function of a particular labourer. On the one hand, therefore, manufacture either introduces division of labour into a process of production, or further develops that division; on the other hand, it unites together handicrafts that were formerly separate. But whatever may have been its particular starting-point, its final form is invariably the same—a productive mechanism whose parts are human beings." Karl Marx, "Chapter fourteen: Division of labour and manufacture," *Capital, vol. One* (1867).

10 "Manufacture is characterised by the differentiation of the instruments of labour—a differentiation whereby implements of a given sort acquire fixed shapes, adapted to each particular application, and by the specialisation of those instruments, giving to each special implement its full play only in the hands of a specific detail labourer. In Birmingham alone 500 varieties of hammers are produced, and not only is each adapted to one particular process, but several varieties often serve exclusively for the different operations in one and the same process. The manufacturing period simplifies, improves, and multiplies the implements of labour, by adapting them to the exclusively special functions of each detail labourer. It thus creates at the same time one of the material conditions for the existence of machinery, which consists of a combination of simple instruments." Marx, ch.14 (1867).

11 "Bourgeois science perceives the fact that the ensemble of means of labour results from the objectification of these dialectical forms of the living relationships of labour merely as archaeology; this follows from its method of reasoning backwards from

Whilst this illustrates that technical developments themselves cannot be abstracted from social relations, it is insufficient. Crucially for Marx—and Bahr with him—social relations of production are class relations, thus fundamentally antagonistic. The development and application of industrial machinery is not only made technically possible by capitalist relations of production, it is driven forward by the struggle between capitalists and workers. Marx attends to an enormous variety of technical developments and individual struggles throughout his analysis, drawing a progression from simple machine tools to fully fledged machine systems. He identifies two connected pillars of the capitalist push to implement these new productive forces.

The straightforwardly economic impulse of this drive emerges as a response to the limitation of the working day, whether by natural causes, workers' struggle or the legislation which emerges from it. Faced with stagnating profit margins, capitalists attempt to increase productivity and profits with machines.[12] In consequence, production is fundamentally changed. Where workers previously held direct control over the instruments of labour in a practical sense, themselves driving the labour process, the machine comes to dominate. The worker is deprived of their skills and tools, reduced to being an "appendage" of a machine, and must work to its rhythm.[13] This not only secures the productivity sought by

the result, the product, to the living social formation. For example, it concludes from certain snares and fishing hooks—in contrast to hunting projectiles such as spears—that a particular tribe was on the verge of stable settlement; specific types of stone-drills, require complex and painstaking manufacture, indicate more enduring forms of the division of labour. The once-existing living form of particular social relations and structures now resides in the tangible and symptomatic form of the ensemble of nature-given materials changed by the action of social labour. That archaeology does not turn its criteria around and apply them to its own material basis but confines itself to pre-/non-bourgeois social orders is part of its brief: there shall be no archaeology of the systems of bourgeois means of production." Hans-Dieter Bahr, "The Class Structure of Machinery: notes on the value-form" in Phil Slater (editor), *Outlines of a Critique of Technology* (1980).

12 This is a summary of Marx's view of absolute and relative surplus-value production and the relationship between them. See Marx (1867), chapters seven, twelve and sixteen for Marx's conceptual overview.

13 "The implements of labour, in the form of machinery, necessitate the substitution of natural forces for human force, and the conscious application of science, instead of rule of thumb. In manufacture, the organisation of the social labour-process is pure-

the capitalists, but also lessens or removes the capacity of the workers to shut down production. The machine is "the most powerful weapon for repressing strikes,"[14] exerting capitalist control through the very means of production.

In Marx's view, this social analysis of technology applies not only to relations between humans but also between humans and non-human nature. This situates technology as a product of class relations, an embodiment of previous struggles and power relations, and a real development, which both organises labour's interaction with nature and determines its productive output.

Marx's approach is at odds with dominant accounts of the adoption of steam power in Britain and, with it, the origin of the industrial fossil fuel economy. In a 2011 paper, co-authored with Will Steffen, Jacques Grinevald, and John Mcneill, Crutzen provides a summary of the core logic in such accounts. Whilst conceding that the transition to steam likely related to "the beginnings of a new economic order that emphasised markets," Crutzen et al argue that the impetus for this process lay in overcoming an "energy bottleneck." Other energy supplies were, they argue, insufficient in productivity and supply for the continued expansion of "human numbers and activity." Fossil fuels shattered this bottleneck.[15]

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ly subjective; it is a combination of detail labourers; in its machinery system, modern industry has a productive organism that is purely objective, in which the labourer becomes a mere appendage to an already existing material condition of production. In simple co-operation, and even in that founded on division of labour, the suppression of the isolated, by the collective, workman still appears to be more or less accidental. Machinery, with a few exceptions to be mentioned later, operates only by means of associated labour, or labour in common. Hence the co-operative character of the labour-process is, in the latter case, a technical necessity dictated by the instrument of labour itself." Marx, ch.15 (1867).

14 "But machinery not only acts as a competitor who gets the better of the workman, and is constantly on the point of making him superfluous. It is also a power inimical to him, and as such capital proclaims it from the roof tops and as such makes use of it. It is the most powerful weapon for repressing strikes, those periodical revolts of the working-class against the autocracy of capital. According to Gaskell, the steam-engine was from the very first an antagonist of human power, an antagonist that enabled the capitalist to tread under foot the growing claims of the workmen, who threatened the newly born factory system with a crisis." Marx, ch.15 (1867).

15 "One feature stood out in the world that humanity left as it entered the In-

This argument is identical to that put forward by the late English historian E.A. Wrigley, drawing from the classical economist David Ricardo. Where Crutzen et al are perhaps unclear on what drives this process, Wrigley is not, adopting the English cleric Thomas Malthus' argument that populations increase faster than resource supply. A "crisis of overpopulation" thus drove the turn to steam. The combination of these arguments is known as the Ricardian-Malthusian thesis.[16] It hinges upon there having been a scarcity of other energy resources relative to steam at the time of its adoption, either in absolute terms or relative to the amount of energy required by industry.

In his masterful 2016 history, *Fossil Capital*, the Swedish Marxist Andreas Malm shows this to be an utter fantasy. The transition to steam took place in a short span of time, largely in the 1830s.[17] Prior to this pe-

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dustrial Revolution; it was a world dominated by a growing energy bottleneck. The primary energy sources were tightly constrained in magnitude and location. They consisted of wind and water moving across the Earth's surface, and, on the biosphere, plants and animals. All of these energy sources are ultimately derived from the flow of energy from the Sun, which drives atmospheric circulation and the hydrological cycle and provides the fundamental energy source for photosynthesis. These processes have inescapable intrinsic inefficiencies; plants use less than 1 per cent of the incoming solar radiation for photosynthesis and animals eating plants obtain only about 10 per cent of the energy stored in the plants. These energy constraints provided a strong bottleneck for the growth of human numbers and activity.

The discovery and exploitation of fossil fuels shattered that bottleneck. Fossil fuels represented a vast energy store of solar energy from the past that had accumulated from tens or hundreds of millions of years of photosynthesis. They were the perfect fuel source—energy-rich, dense, easily transportable and relatively straightforward to access. Human energy use rose sharply. In general, those industrial societies used four or five times as much energy as their agrarian predecessors, who in turn used three or four times as much as our hunting and gathering forebears." Will Steffen, Jacques Grinevald, Paul Crutzen and John McNeill, "The Anthropocene: conceptual and historical perspectives," *Philosophical Transactions of the Royal Society 369* (2011), p.848.

16 See Andreas Malm, *Fossil Capital* (2016), pp20-26 for a discussion of Wrigley and the Ricardian-Malthusian thesis.

17 "It is firmly established that steam galloped at a speed without precedent in the middle of the 1830s: in the key twin counties of Lancashire and Cheshire, the engine capacity in cotton mills rose by a stunning 62 percent between 1835 and 1838, amounting to an addition of 15,377 hp in three frenzied years. Subtracting this figure from the *total* figure for the cotton industry in 1838, we get a maximum potential steam power capacity of 30,932 hp—an improbably high number, since that capacity

riod, animate power in the "cottage" or "putting out" industry—workers paid piece wages to weave at home—had served to hold back mechanisation in textiles, Britain's dominant industry and the leader in the turn to fossil fuels, due to its superabundance and cheapness.[18] During the transition, another prime mover—water—stood as steam's largest competitor. It was both superabundant, with often less than 5% of the total potential of Britain's rivers utilised at the height of water-power use, and at least

naturally increased in other counties as well. What could flow and animate power have set against roughly 30,000 hp from the stock in 1835? If we take a low estimate of the number of handloom weavers and add the hp of waterpower in 1838—assuming it had ceased to grow—muscles and wheels would together have accounted for around 30,405 hp in 1835, *virtually equivalent to the power of steam engines* (on assumptions mostly working in their favour). In other words, the stock must have passed the 50 percent mark between 1834-35 and 1838, *on the heels of the mid-decade boom*. Such a chronology is based on what are, of course, controlled conjectures at best, but it fits well with other evidence and assessments. The rise of steam, we may infer, was clinched in the mid-1830s." Malm (2016), p.80.

18 "The cheaper that labour became, the less reason to replace it with machines. Even in the early 1790s, when wages were still comparatively decent, experiments with power looms resulted in commercial failure due to the high price of steam. In 1793, the proprietors of one weaving firm requested that Boulton & Watt help them dispose of the engine that they had installed to impel their looms, lamenting that the cost 'of coal in our Neighbourhood damps every idea of Benefit': it would be more profitable to revert to putting-out. The cheapness of the handloom weavers appeared in relation not only to coal, but also to the fixed capital required in a loom factory. A putter-out needed to plough his capital into a warehouse but not much else, whereas if he erected a weaving mill, he would have to fill it with his own machines—and his own prime mover. In 1818, John Kennedy of McConnel & Kennedy found that while the latter option increased productivity, 'it is still problematical whether this saving of labour counterbalances *the expanse of power and machinery*, and the disadvantage of being obliged to keep an establishment of power-looms constantly at work.' As long as weavers were thinly spread over wide landscapes, their role as prime movers inextricable from their bodily metabolism, manufacturers could move between them, enlisting one, discharging another, dancing along with market fluctuations without encumbering themselves with massive investments in machinery. Keeping the prime mover indistinguishable from the worker, then, remained rational from the standpoint of capital *even when steam-powered weaving had proved its technological proficiency* in the early years of the century. It was the *superabundance of animate power* that postponed the transition to the stock—not the nonexistence of steam-powered weaving technology, nor its comparative inefficiency, nor any lack of knowledge about it." Malm (2016), p.71.

as productive as steam.[19] No "energy bottleneck" existed and, thus, no "crisis of overpopulation" existed either. More than this, the adoption of steam did not even make raw economic sense. Whilst water wheels were often more expensive to install, they were both more durable and required negligible expenditure on fuel. Coal, in contrast, was prohibitively expensive.[20] The Ricardian-Malthusian thesis—the basis of modern conceptions of the "anthropocene"—does not explain the adoption of steam. Marx's approach does.

The turn to steam was driven by a crisis: the cotton crisis. Following a massive expansion in the production of cotton goods in the early 1820s, powered by easy credit, a rapid decline in foreign demand in the summer of 1825 led to a dramatic contraction and a collapse in both country and London banks.[21] The rate of profit relative to investment in the cotton industry collapsed to around 5% amid a glut of unsold goods, having stood at around 50% through the late 1700s. It dragged the general rate of profit in Britain down with it.[22]

Competition between capitalists became vicious and many concerns collapsed. In addition, the repeal of laws against workers' combinations in 1824 locked capital into direct struggles with workers over wage rates and hours, limiting the capacity to expand profitability by deepening exploitation with these well worn weapons. Mechanisation was deployed to bolster productivity, cut the number of workers employed and, crucially, to retain power in production[23]—as a weapon against strikes.

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19 Malm (2016), p.82.

20 See Malm (2016), pp.82-93 for a discussion on the relative costs of coal and water power.

21 Malm (2016), p.58-63. The cotton crisis will be discussed in more detail in the next part of *For Land*, in relation to Marx and Engels' development of the theory of the falling rate of profit.

22 "A curve of declining profits after 1825 encompassed most if not all of British capitalism; as for cotton, the superprofits of 50 percent from the Arkwright era were down to an average of 5 percent or lower in the decade after the panic." Malm (2016), p.59.

23 Malm illustrates the roots of mechanisation in the suppression of strikes with the example of strikes in Hyde, beginning in January 1825. Desperate for a resolution to the strike, the capitalists embroiled in the strike entreated Richard Roberts for a "self-acting" spinning mule. This was patented the same year. The power of this tool,

This struggle would last for the duration of the crisis, culminating in the general strike of 1842. Steam's rapid advance begins in its midsts, with a brief return of profitability and renewed investment between 1834 and 1836.[24] Though this explains capital's turn away from animate power directly, workers acting as prime movers exerting considerable power over production, steam's victory over water-power requires further explanation. As Marx briefly outlines and Malm shows definitively, this derives from the unique requirements of capital in time and in space.

Water-power is afflicted by drought, freezing or differences in water levels, all of which can shut down production entirely.[25] This undermines capital's need for ceaseless, or at least consistent and time-controlled, production. Equally, water-power requires that production be dispersed along riverbanks. Capital, in contrast, requires vast concentrations of workers to secure a ready supply of labour, and to force down wages with the ever present threat of unemployment.[26] Though both of these concerns could have been addressed by large-scale water engineering projects, capitalist competition undermined this utterly, individual concerns unwilling to offer capital to joint projects if they suspected their neighbours may benefit more from the works.[27] Unlike water, steam could guarantee

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however, was not revealed until fresh strikes in Preston, in 1836. As the skilled labour of the spinners was made unnecessary by the mule, it was deployed to replace this section of the workforce, leading to the strike's defeat. Malm (2016), pp.65-67.

24 Malm (2016), pp.60-61.

25 See Malm (2016), pp.165-193 for a detailed discussion of steam's advantages over water in time.

26 See Malm (2016), pp.121-164 for a detailed discussion of steam's advantages over water in space.

27 "All indications are, however, that the mill owners fell afoul of the [water-power] projects because of their unwillingness or inability to submit to the *planning, coordination and collective funding* required for expansion of waterpower capacity on this scale. Some foresaw no private benefit and so did not wish to pay. Some, prey to the constant antagonism between downstream and upstream factories, expected interruptions of their flow from other mills; some objected to the centralisation of authority. In all these cases, the opposition stemmed from the fact that river management—for the good of the mill owners as a group—demanded that they step into the shoes of their neighbours. As flowing commons, the streams could not be extended privately; rather, the manufacturer would find himself, in Hunter's words, 'caught up in a complex network of institutional relationships that left him considerably less than a free agent

a capitalist individual control of both the location and the time available for production in their concerns.

The turn to fossil fuels is unambiguously a product of capitalist relations of production. Fossil fuels secure capital's unique requirements in space and time by breaking production's reliance upon the irregular and dispersed forces of nature, allowing capitalist machinery to dominate the real process of production. Workers understood this from the start, viewing steam as a demon and deploying mass sabotage against engines in the strike of 1842,[28] which nearly brought capital's satanic mills to a close.[29] Only brutal force stopped this.

From the summer of 2023 to the early months of 2024, all previous temperature records have been broken.[30] The scale of temperature increases is so substantial, it suggests we may have passed a tipping point. Already, this has forced Antarctic sea ice into rapid decline during its winter season, an event not seen in millions of years.[31] Brutal deoxygen-

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in matters relating to power supply.' The starting and stopping of machinery would have to be matched against other mills and schedules adhered to, regulations respected and commissioners welcomed, arbitration accepted and meetings attended; individual plans for larger power capacities needed to be harmonised with common undertakings. The rates to be paid might very well deviate from the exact benefit reaped by the enterprise. Indeed, reservoir systems represented a form of *collectivised prime movers*, the res communes of water precariously imposing its logic on wary manufacturers." Malm (2016), p.119.

28 See Malm (2016), pp.223-248 for an outline of the general strike and steam demonology among the working class. Though it isn't remotely concerned with steam power, see Mick Jenkins, *The General Strike of 1842* (1980) for the only full scholarly account of the strike.

29 The severity of the 1842 general strike is hard to understate. Not only did the strike mark the first general strike in history, involving over one million workers, and succeed in shutting down the vast majority of Britain's industrial centres, it also saw early working class attempts at revolutionary governance. For example, the "Chartists' council" in Stockport was able to command the area's magistrates. Though permanently on a war footing and short-lived, and thus unable to enact social policy or reorganisation, these examples make plain that Britain was close to revolution in this period, closer than it has ever been since.

30 See University of Maine and Climate Change Institute, "Climate Reanalyzer" for up to date statistics around this.

31 NASA Earth Observatory, "Exceptionally Low Antarctic Sea Ice" (2023).

ation events and coral bleaching in the ocean, and wildfires, droughts and rapid flooding on the land followed—climate uniting oceanic and terrestrial ecosystems in extinction's mutual ruin.

The capitalist relations driving fossil fuel use seems to close the case as to the force behind this process. However, there remain important questions. Firstly, whilst this accounts for industrial machinery and its byproducts—for example, plastic pollution, which both compounds the problem of warming and offers another potential global bridge between ecosystems[32]—it does not, at first glance, explain national differences in emissions. A 2022 paper by Jason Hickel, Daniel W O'Neill, Andrew L Fanning, and Huzaifa Zoomkawala illustrates the emissions of the US, Europe, Canada, Australia, New Zealand, Japan and Israel dwarf the emissions of Africa, the rest of the Americas and Asia—perhaps excluding China and Russia.[33] Any account attempting to understand this process at a global scale must explain this.

Secondly, though it is unavoidable that the climate crisis is now coming to bear as a primary driver of the sixth mass extinction, both the relations which have led to its formation and this extinction process itself predate it. Rapid changes in land use formed the dominant driver of this

32 "Diverse impacts caused by ingestion of microplastic due to particle and chemical-related toxicity have been reported, including physical injury, changes in physiology, and impaired feeding, growth, reproduction, and oxygen consumption rates. In sediments, concentrations of macro- and nanoplastics above 0.5% were found to affect macroinvertebrate abundance. Additives leaching from plastic can also contribute to (eco)toxicological effects. One example is the concern about phthalate esters added to polyethylene mulches that are taken up in grains destined for consumption by humans and livestock. Another is the recent discovery that a phototransformation product of a ubiquitous antioxidant used in tire rubber causes acute mortality of coho salmon (Oncorhynchus kisutch) after stormwater runoff events." Matthew MacLeod et al, "The global threat from plastic pollution," *Science 373* (2021).

33 Hickel et al's own data shows that China accounts for 15% of the "share of global overshoot," second only to the US, the only other nation with a double digit percentage in this indicator. Carving out a category for it on its own seems somewhat absurd. The exclusion of Russia seems equally ridiculous given the nation's reliance on fossil fuel and industrial fertiliser markets, the majority of its economy. Both of these positions can only be arrived at by considering income in isolation from the broader characteristics of an economy.

Hickel et al, "National responsibility for ecological breakdown: a fair-shares assessment of resource use, 1970–2017," *The Lancet* (2022).

process until recent history.[34] Each of these problems of analysis points in the same direction: to situate the sixth mass extinction, fully, as a product of capitalist relations of production requires an analysis of capital's relationship to the land and its spread as an economic relation across the globe.

34 "'Land-use change'—read: deforestation—accounts for a fourth of all CO_2 released since 1870, but its share is secularly diminishing, now standing at around 8 percent of current emissions, fossil fuels taking up virtually all the rest." Malm (2016), p.11.

5

An unmarked plane lands on a strip of dirt, carved into Yanomami forest. Supplies in its cargo hold are unloaded, then replaced by gold. The metal is bound for the city of Boa Vista on the banks of the Branco river. From there, it will travel through a network of smugglers across the globe.[1]

> "Many merchants **justify** themselves by saying they only buy 'scrap' gold and we often have no way of proving it came from **illegal** mining."
>
> 'The illegal Brazilian gold you may be wearing,' *BBC News*

Depending on the nation, between 28% and 90% of gold mining in the Amazon is illegal.[2] Despite this, it is easy to sell once procured. The

1 Manuela Andreoni et al, 'The Illegal Airstrips Bringing Toxic Mining to Brazil's Indigenous Land,' *The New York Times* (2022), reprinted by *Pulitzer Center*.

2 In Brazil, around 17 to 28% of gold produced is illegal. In Venezuela, around 90% is—a reflection of the Bolivarian revolution's attempts at land law and conservation, but also the strong criminal undercurrent working against it. See Jasmine Arnould, Barbara Kuepper and Stefanie Geurts, 'Gold supply chain: From Brazil to the world,' *Profundo* (2022), p.3. and Amazon Aid, 'Gold mining in Amazon countries: an overview.'

Further overview: "Even though global gold prices have gradually decreased in recent years, organized criminal groups have continued to drive the expansion of illegal

only requirement for gold to enter the legal market in Brazil, for example, is a handwritten certificate specifying the ore's origins. One prosecutor described regulatory efforts as akin to "trying to stop ice from melting."[3] Gold thus plays a crucial role in laundering other criminal proceeds into more viable investments. By 2016, gold exports from Peru and Colombia—the largest producers of cocaine globally—eclipsed drug exports.[4] Of course, gangs are not the only beneficiaries of this trade.

A gold refinery. Owned by the Royal Canadian Mint, 1.4 million ounces of gold were processed here in 2021, leading global bullion sales and generating $179.4 million in profit alongside silver sales—a 27% return on average investment.[5] Though the Mint does not publish information on the source of its materials, Canada is the largest importer of Brazilian gold.[6] The Amazon's innards are among the ores melted down in these machines.

Refineries across the globe exploit gold from the Amazon in much the same manner as the Mint, purchasing unprocessed ore then selling it at enormous profit as jewelry, bullion, or raw material for industry. The scale of this predatory, extractive relationship and its reliance on illegal mining can be illustrated by export statistics. For example, in 2020, the National Mining Association of Brazil calculated annual legal gold production at 62 tons; in the same year, the foreign trade ministry registered 98 tons in gold exports.[7] After Canada, the largest importers of Brazilian

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gold mining. The region is now unique in the high percentage of gold that is mined illegally; about 28% of gold mined in Peru, 30% of gold mined in Bolivia, 77% of gold mined in Ecuador, 80% of gold mined in Colombia and 80-90% of Venezuelan gold is produced illegally." Global Initiative Against Transnational Organised Crime (2016), p.vi.

3 Arnould et al (2022), p.8.

4 "The change of strategy by the drug trafficking groups proved so successful that in Peru and Colombia—the largest cocaine producers in the world—the value of illegal gold exports now exceeds the value of cocaine exports." Global Initiative Against Transnational Organised Crime (2016), p.vi.

5 Royal Canadian Mint, "Annual Report" (2021), p.0 and p.29.

6 Arnould et al (2022), p.7.

7 Ibid., p.8.

gold are Switzerland and Britain.[8] This predation is not confined to unequal trade relations. Five companies account for 70% of the legal gold market in Brazil. One of these is owned by Britain, and another by Canada. Three of the four refineries operating in Brazil are owned by foreign companies.[9]

The dynamics driving gold production provide a glimpse of the fundamental relations driving the destruction of the Amazon: production for the market, dominated by foreign capital. The historical development of industrial agriculture in the Brazilian rainforest provides another clear example.

Following a US-backed coup against the social democratic government of João Goulart and the installation of a military dictatorship in 1964, attempts to draw Brazil's share of the region—which represents roughly 60% of the nation's landmass—into its economy became a focus of government policy.[10] The initial phase of this push aimed to gather corporate investment and resettle families engaged in small-scale agriculture in the rainforest. Financial measures in support of this, including waiving corporate tax for 10 to 15 years and exemptions on both export and import taxes, were launched in 1967 and an organised resettlement scheme began in 1972 with the construction of the Trans-Amazon highway.[11] Investment in infrastructure, particularly transport, followed.

8 Ibid., p.7.

9 Ibid., pp.8-p.9.

10 "In the 1960s and 1970s, the military government began to promote rural colonization of the Amazon in order to populate and to integrate it to the Brazilian economy. Several public policies were implemented to accelerate immigration and economic development in the region and have contributed to the appearance of large-scale deforestation. Construction of major transport infrastructures began and ambitious colonization programs (both private and state sponsored) tried to attract smallholders in the region under the motto 'Lands without men for men without lands.' Tritsch and Le Tourneau (2016).

11 Moran et al (2005): "The major road at the center of this program was the Trans-Amazon Highway, running east to west across the Brazilian Amazon. In a short period of three years, the military government was able to build this road and to settle thousands of families along the main trunk of the road and on side roads. The central question guiding the research was understanding how the different migrating groups would adapt socially and environmentally to life in a tropical rain forest ecosystem, particularly to farming in a largely unfamiliar habitat and cultivating soils of below-av-

Though thousands of families relocated to take advantage of land

erage fertility."

"Between 1971 and 1974 the process of settlement proceeded at a very rapid pace, as the government selected farmers from throughout the country for the project, bringing them by plane, boat, and bus at government expense (and with a guarantee of a return trip if they did not find the area acceptable). Selection criteria used by the government, when examined carefully, were overwhelmingly driven by the size of families. The larger the family, the more likely they were to be selected—a process that resulted in an older than average age for heads of household and a substantial dependency ratio. Agricultural experience was an official criterion, but there was no verification carried out to establish whether statements were true, nor did the criterion distinguish between experience as an owner, a rural wage laborer, or a share-cropper. Upon arrival, settlers were given certificates of occupation, which allowed them to obtain year-to-year loans for agricultural production (but not long-term loans). They were promised land titles, but this process proved to be very slow and difficult for most of them. A few settlers familiar with the process undertook expensive trips to distant towns where they could make their land claim and obtain title, but fewer than 5 percent undertook this process. Even after several years, fewer than 30 percent of the people had received the promised titles. The certificates of occupation could not be passed on through sale. The titles could be reissued to someone who bought a property, but because the process was slow and expensive, most people who bought land from someone simply kept the old title and some rather informal document from the seller to establish ownership. Over time, more complex arrangements have evolved, but the lack of a rigorous titling process has been one of the factors that has prevented a stable land market from emerging, and it may also have influenced the tendency not to fragment properties, as it would be even harder to establish rights to fragments than to entire properties. Inheritance of property has not been seen to be a problem, except in those cases in which several children wish to have land, and resolution of these cases is usually informal rather than legalized through titling."

"In the 1960s, the dominant government strategy for the region was based on road construction and human settlements around the newly built highways (Belem-Brasilia, Transamazonica). It was called PIN (Plan for National Integration). One of the main objectives of the Amazonian development programmes launched in 1967 by the military régime was to attract private enterprises to the region.

"This was to be achieved through increased public expenditures on infrastructure (roads, airports, telecommunications) and special fiscal incentives and credit lines for enterprises willing to invest in the region.

"The package of fiscal benefits was extensive. It included holidays from the corporate income tax for 10 to 15 years, as well as exemptions from export taxes and import duties. Additional fiscal incentives were extended in 1967 to firms located in western Amazonia (Mahar, 1989). The strategy was to "occupy" the region rapidly, with the state providing support and incentives for investors and settlers willing to participate." Antonio Carlos Diegues, 'The Social Dynamics of Deforestation in the Brazilian Amazon: An Overview,' *United Nations Research Institute for Social Development, Discus-*

redistribution, it became clear that resettlement based on small-scale agriculture had failed by the end of the 1970s. Many families found this approach unsustainable due to a number of factors, including lack of experience in farming, lack of understanding of Amazonian soils and, crucially, lack of access to markets for produce.[12] Large corporations,

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sion paper 36 (1992).

For more detail on Brazilian economic development see Yoshinori Ōhara, 'Brazilian economic development since 1956: a study on policies reflecting the stages of growth.'

12 "In short, Amazonian natives outperformed migrants in yield per hectare, in use of technology, and in overall well-being—contradicting government expectations. Soils proved to be highly variable—not invariably acid and nutrient-poor, and Amazonian natives were more often able to identify better soils, thereby obtaining higher yields per hectare than newcomers. The role of soils in shaping the path of land use has proven to be very important in subsequent research, with farms on good soils being more resistant to turnover of ownership than those on poor soils, and they tend to have a more diversified production portfolio. Previous agricultural experience as managers of a farm property resulted in rapid success in the Amazon frontier and in capital accumulation, both in use of credit and in acquiring local knowledge and applying it to production goals—and these management skills were not geographically concentrated in migrants from the south and southeast, as stated in planning documents. Those who were landless before coming were very likely to become landless again after a short time through farm failure and inability to pay bank loans, and previous high rates of migration were associated with low incomes and farm failure in the new frontier. Those who were most dependent on government institutions were most prone to fail, given the difficulty for state institutions of reliably delivering services in a timely fashion and with a technology appropriate for the local environmental conditions." Moran et al (2005).

"Organized settlement schemes in Amazonia started in 1972 with the construction of the Transamazon highway under the Programme of National Integration. These were inspired by geopolitical reasoning during the military régime. The plans were to settle 70,000 families from the over-populated north-east where severe land tenure problems exist. Despite a large amount of subsidies and financial aid, at the end of the programme (1974), only 5,700 families had been effectively settled, and only 40 per cent of the settlers were from the north-east. By the end of the 1980s, some 8,000 families had been settled but later on many of them left the area because of difficulties in marketing their products, soil erosion and malaria. Extensive stretches of the Transamazonian road had to be abandoned and were invaded by forest.

"Native Amazonians cleared less forest per year than newcomers but they cultivated more of the land that they cleared. It was not uncommon for new immigrants to clear 10 hectares but plant only four or five, because the land had not been adequately burned or because the labour of weeding large fields had been underestimated. Gradu-

however, were successful, with masses of land converted to pasture for cattle ranching—the cheapest way to legally lay a claim—then sold on at an inflated price.[13] This speculation raised the price of land in settled areas to a prohibitive degree, economically entrenching one form of the low population-high deforestation settlement trend identified by Tritsch and Le Tourneau as today driving Amazonian deforestation. This process continued through the 1980s, outliving the military dictatorship which birthed it following its collapse in 1985.

Following a spike in soybean prices and the development of new technologies, soybean production and large-scale cash crops began to spread through the Brazilian Amazon.[14] This not only added a new form

ally newcomers have learned to clear smaller fields, to manage them intensively, to rely more on manioc and bananas and less on corn and beans." Diegues (1992).

13 "In the 1980s, forest conversion to pasture continued to expand because of land speculation: creating pasture in forest areas was a cheap way to create "productive land," to claim land titles and to sell the new properties with high profits in a context of rapid rise of land prices. This system of extensive, low-input cattle ranching motivated by land speculation resulted in creating large areas of degraded land with few human settlements. Indeed, large-scale ranching has contributed to the evolution of the human settlement pattern with the emergence of large areas with relatively low population density and high deforestation." Tritsch and Le Tourneau (2016).

"It is clear that large agricultural and cattle raising projects (combined with land speculation) were responsible for most of the deforestation if one compares them with the deforestation caused by small farmer settlement projects, as in Rondônia. Very often, the large projects have expanded their holdings by buying out or expelling small farmers from their lands. Frequently, small farmers were used by large companies to clear the forest, to plant food crops for one or two agricultural seasons and then to plant pasture." Diegues (1992).

14 "In the 1990s, soybean began to expand into the Amazon thanks to the development of new adapted technologies and to the rise of soybean prices on the international market. With the growing international demand for soybean, large-scale mechanized agriculture expanded into the southern and eastern extent of the Brazilian Amazon and modified the rural dynamics of the region. The soybean industry expansion contributed to a new valorization of land, leading ranchers to sell their properties and seek new areas further north where land prices were lower, participating to the land use frontier advance and to a trend toward depopulation of the rural areas. Thus large-scale crop production has added a new pressure on the forest due to direct deforestation for cropland implantation and to intensified use of lands previously cleared for cattle ranching. Thereby, the human settlement pattern consisting in low population density and high deforestation has been expanding through the Amazon frontier." Tritsch and Le Tourneau (2016).

of low population-high deforestation settlement pattern to complement that embodied by cattle ranching, it further raised land prices, leading many ranchers to sell up and seek cheaper land deeper in the rainforest, hastening the expansion of existing forces on the frontier. Combined with the further development of transport infrastructure, this process rapidly grew cities along export corridors.[15] The fruit of this process is that the Brazilian economy is reliant on exports derived from the most damaging agricultural practices in the Amazon with, for example, soybeans accounting for 14% of total exports in 2021. Despite this dependence, only 36% of profits from soybean exports were reaped by Brazilian

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This sped up considerably in the 2000s:

"The rapid expansion of soybean production in the Santarém study area has been dramatic. The area under soybean production expanded from only a few experimental plots in 2002 to 7,000 hectares in 2003, and it is projected to expand to 30,000 hectares in 2004. The construction of the port combined with the high levels of demand for soybeans in Europe and Asia have been a trigger event for rapid change in land use, as Redman defines the term. This event fundamentally changed the economic and political environment in which land use (and sale) decisions are made. This event shows the difficulty of predicting change when external forces, such as the aggressive actions of a multinational to reduce its transportation costs, are so important. This is a good example of that category known as "surprises" in global change dynamics." Moran et al (2005).

15 "Urban growth in the Amazon is tied to access to both resources and export facilities. In nearly every case of rapid growth a city was closely positioned to a production or extraction point for food or natural resources. Additionally, in these cities the principal, rent generating resource was primarily consumed externally. Not coincidentally, it follows that each of these cities is also located along one of the Amazon's export corridors. In Mato Grosso, the fastest growing agricultural cities are positioned along the state's principal highway corridors, with (relative to the region) adequate access to export ports on the Atlantic coast. In Pará, the iron rich city of Parauapebas is connected by rail to deep water ports on the Atlantic, while the rest of its fast growing cities are located along the framework of federal highways that continue to represent the state's principal export corridors. In contrast, the river cities of the Amazon, scattered along the highway of times past, have grown at slower rates. The one exception to this rule is the city of Oriximiná, which, however, is somewhat exceptional in its ability to leverage its combination of bauxite reserves and deep water port access to capture and sustain its population and economic growth." Peter Richards and Leah VanWey, "Where deforestation leads to urbanisation: how resource extraction is leading to urban growth in the Brazilian Amazon, *Annals of the American Association of Geographers 105(4)* (2015).

companies in 2020, the majority going to the US, Europe and China.[16]

The development of market relations in the Amazon and the settlement pattern driving the destruction of the rainforest are inextricable. They are one and the same motion. The direct force of already formed capitalist forces—primarily imperialist capital, wielding either the state or gangs in the examples given—has laid the basis for a self-expanding system of extraction and spoliation. On the agricultural frontier, subsistence farms and smallholdings clear the way for cattle ranching and land speculation which, in turn, clear the way for industrial cash crops. Gold mines strike out ahead of this, cutting new roads into the forest for settlers and industry to follow, terrorising the populations already living in these areas into submission or flight by bullet and by blight. This begins to illustrate the expansionist character of the process at play. However, we must go further to illustrate the dominance of market relations over the rainforest.

The development of cities provides a useful example. Urban centres in the Brazilian Amazon were developed by government intervention through the 1970s and 80s as part of the military dictatorship's efforts to draw the region into the nation's economy.[17] Rather than developing from an accumulation of rural capital or concentration around industry, they served as administrative centres through which capital, populations and goods could pass to fuel the swelling frontier.[18] This dynamic shifted

16 World Bank, "Brazil Trade Summary 2021," Stockholm Environment Institute, "Connecting exports of Brazilian soy to deforestation" (2022) and WWF, "Most of the profit from soybean production in Brazil goes abroad," *Technical Note* (2023).

17 "Urbanization in the Amazon can be described as occurring in three phases: (1) the rubber period of the turn of the 20th century, in which cities served as catchment points for latex flowing downstream to international markets, and as supply points for labor and material resources moving upstream in support of extractive activities in the inner reaches of the basin; (2) the public colonization projects of the 1970s and 1980s, when Brazil's ruling generals, under the premise that occupying the region was of key national, if not economic importance, hurled a succession of colonization and occupation projects at the Amazon; and finally, (3) the globalization turn of the last two decades, and the emergence of commodity producing cities such as Lucas do Rio Verde and Primavera do Leste, in Mato Grosso." Richards and VanWey (2015).

18 "In Rainforest Cities, Browder and Godfrey conceptualized the geopolitical occupation of the Amazon through the lens of disarticulated urbanization, a framework they developed and employed to explain the plurality of spatial, institutional,

with the completion of infrastructure projects and the increasing dominance of monopoly agriculture through the 1990s, private investment becoming the largest driver of urban growth. This reversed the flow of wealth—goods and capital flowing from the rainforest into the cities, then out of the Amazon through export corridors. As Dr Peter Richards and Dr Leah VanWey argue in a 2015 paper, the role of cities changed from "administering space" to "extracting capital and value" with the development of market relations, and the urban regions upon which rural settlements depended on became dependent upon the plunder of the rainforest for global export markets.[19]

The rainforest populations pushed from the land by force, speculation and environmental destruction, alongside those drawn to the region from elsewhere, have been concentrated in these export corridors

and historical forces that underlie the urban development of the Amazon. Urban growth in the Amazon was neither reliant on the movement of local rural labor to urban centers, nor on the production of rural capital (for example through agriculture). Rather, urban growth was tied directly to the largesse or prescriptions of state or federal governments. Government development programs, rather than the organic economic potential of their surroundings or their citizens, they argued, were keeping the cities of the Amazon economically sustainable and maintaining its populations. Fundamentally, per this conceptualization, urbanization in the Amazon was the economically irrational, environmentally destructive legacy of the military government's designs for the region." Richards and VanWey (2015).

19 "We argue that the globalization of the basin's resources has brought about a shift in the utility of urban areas in the Amazon, namely from merely administering space (as during the era of military governorship), to extracting capital and value, and facilitating the movement of prized resources and products to external consumers. In a process that echoes the boom and bust cycle of past urbanization periods, we argue that urban growth is once again concentrated in those cities that are best positioned to both extract capital from the region's resources, those that can provide institutional support and lifestyle amenities, and those that are capable of facilitating the movement of raw or lightly processed commodities to export. However, a principal difference between the present day commodity boom and the boom and bust cycles of time past resides in the relative spatial concentration of extractable value and capital investments in the region, as well as the complexity and magnitude of the support sectors to the extractive and production processes. Thus whereas factor scarcity and mobility once inhibited investments during the rubber era, today the relative permanence and clustering of agricultural production, or of the scale of the mining sector, combined with the maturation of a generation of colonists, now validates longer term community investments." Richards and VanWey (2015).

in the hope of accessing jobs and services. They are often forced to sell their labour at low rates with, for example, over 41% of the population of Manaus—the largest city in the Amazon—in acute poverty in 2022.[20] This logic extends still further. As Tritsch and Le Tourneau identify, the rural population is increasingly concentrated in large villages to gain access to services, infrastructure and jobs. This has resulted in a dwindling capacity for subsistence agriculture and hunting as these villages expand. Consequently, they too are rendered reliant upon the market, subsistence crops substituted with imports.[21] Even those indigenous populations attempting to continue their long-held practices of living

20 MercoPress, 'Brazil's cities have more poor people' (2022). For more detail on poverty in Manaus see Marta Castilho, Marta Menendez and Aude Sztulman, 'Poverty and Inequality Dynamics in Manaus: Legacy of a Free Trade Zone?,' *Working Papers (Développement, Institutions et Mondialisation)* (2015).

21 "This concentration of rural population in some big growing villages reflects the trend toward rural Amazon 'villagization,' defined by Eloy, Brondizio, and Do Pateo (2015) as a process of demographic growth and spatial expansion of the main rural villages. This 'discrete urbanization' of the Amazon occurred especially in downstream areas near state capitals and roads and around the secondary education poles. On the one hand, in remote areas, the displacement of people toward more densely populated areas may reflect the lack of infrastructures and the importance of transportation costs (especially on rivers). Nowadays, most families feel the need to go to town at least one time a month in order to receive social benefits from cash transfer programs (ex. *Bolsa família* and rural retirement), or even more frequently in case there are youngsters studying at the college. On the other hand, in rural areas situated close to the main road network, the improved access to road facilities has simplified rural mobility.

Such shifts greatly change the profile of the Amazon region, currently mainly viewed by public policies as a rural region with only two big metropoles, Belém and Manaus. The multiplication of small towns and second-order cities modifies the needs and should provoke a major overhaul in policies in order to respond to them. For instance, water treatment and waste collection are failing in most Amazonian cities, turning them into emitters of different types of pollution which, in turn, will threaten the environment of vast regions surrounding them.

Finally, the shortening of fallow lengths around these growing villages, due to higher population densities and scarcity of available land, challenges the land use sustainability in these areas since agricultural systems are still mainly based on extensive slash and burn agriculture. The question of subsistence hunting in these rural areas of higher population densities is also complicated. In consequence, more and more households stop their subsistence agricultural activity and local food (ex. Cassava) tends to be substituted by imported food (congealed chicken and food made from wheat), threatening local food independence." Tritsch and Le Tourneau (2016).

with the rainforest are, to a certain extent, being captured by this web of exchange, as evidenced by the attraction of gold mines and their paltry wages, reliance upon towns for services, healthcare and commodities, or the work of NGOs in preparing these communities for integration into this economy.

The market cuts across everything, standing behind every force at play in the Amazon's destruction, pulling every population into its orbit. And through this ensnaring web, it tenders its most fundamental product: waged labour.

6

Marx defines capitalism as generalised commodity production or, perhaps more simply, as the dominance of exchange over production. By this he means that goods and services in a capitalist economy are produced not for their real function, or use value, but for the price they garner on the market, their exchange value.[1] This makes capitalism historically unique.

Whether feudal, antiquarian or tributary, all prior modes of production were premised upon the production of use values.[2] For example,

1 "As use values, commodities are, above all, of different qualities, but as exchange values they are merely different quantities, and consequently do not contain an atom of use value.

If then we leave out of consideration the use value of commodities, they have only one common property left, that of being products of labour. But even the product of labour itself has undergone a change in our hands. If we make abstraction from its use value, we make abstraction at the same time from the material elements and shapes that make the product a use value; we see in it no longer a table, a house, yarn, or any other useful thing. Its existence as a material thing is put out of sight. Neither can it any longer be regarded as the product of the labour of the joiner, the mason, the spinner, or of any other definite kind of productive labour. Along with the useful qualities of the products themselves, we put out of sight both the useful character of the various kinds of labour embodied in them, and the concrete forms of that labour; there is nothing left but what is common to them all; all are reduced to one and the same sort of labour, human labour in the abstract." Marx, ch.1 (1867).

2 "We have one close at hand in the patriarchal industries of a peasant family, that produces corn, cattle, yarn, linen, and clothing for home use. These different articles are, as regards the family, so many products of its labour, but as between themselves, they are not commodities. The different kinds of labour, such as tillage, cattle tending, spinning, weaving and making clothes, which result in the various products, are in themselves, and such as they are, direct social functions, because functions of the family, which, just as much as a society based on the production of commodities, pos-

feudal lords took rent from the peasants who worked their land in kind to fill their larders and furnish their armies. In contrast, the capitalist invests to produce goods for the market, with the aim of securing a profit. Underlining the ecological significance of this in his 1999 book, *Marx and Nature*, Paul Burkett argues that this represents a shift to a "quantitatively unlimited" motivation for production, capital accumulation representing a "limitless expansionist tendency" which "contradicts all limiting factors imposed on human production by its natural environment" as it requires an equally limitless exploitation of natural resources.[3]

As such, capitalist production must be able to move beyond the limits imposed by any given ecosystem. This elasticity is not derived from any particular form capital adopts—money, for example—but from the source of profit in a capitalist economy: the commodity form of labour, labour-power. As Marx argues in the first volume of *Capital*, the value of any commodity is determined by the amount of human labour it takes to produce on average. The value of a workers' capacity to work is thus

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sesses a spontaneously developed system of division of labour. The distribution of the work within the family, and the regulation of the labour time of the several members, depend as well upon differences of age and sex as upon natural conditions varying with the seasons. The labour power of each individual, by its very nature, operates in this case merely as a definite portion of the whole labour power of the family, and therefore, the measure of the expenditure of individual labour power by its duration, appears here by its very nature as a social character of their labour." Marx, ch.1 (1867).

"One of the most obvious peculiarities of the movement in circuits of industrial capital, and therefore also of capitalist production, is the fact that on one hand the component elements of productive capital are derived from the commodity-market and must be continually renewed out of it, bought as commodities; and that on the other hand the product of the labour-process emerges from it as a commodity and must be continually sold anew as a commodity. Compare for instance a modern farmer of the Scotch lowlands with an old-fashioned small peasant on the Continent. The former sells his entire product and has therefore to replace all its elements, even his seed, in the market; the latter consumes the greater part of his product directly, buys and sells as little as possible, fashions tools, makes clothing, etc., so far as possible himself." Marx, ch. 4, *Capital, volume two* (1885).

3 "The limitless expansionary tendency contained in capital as a social form of wealth contradicts all limiting factors imposed on human production by its natural environment. This is reflected in capitalism's tendency to overcome particular and local natural boundaries by expanding the natural limits of production—the pressure of production on ecosystems and other natural resources—to the global, biospheric level." Paul Burkett, *Marx and Nature: a red and green perspective* (1999), p.88.

determined by what it takes to reproduce. Profit is derived from the fact that workers can create more value in a day than they consume in order to work[4]—in a crude example, a worker can bake more bread in a day than they need to eat. As such, capitalist accumulation may occur wherever this curious, value creating commodity can be found on the market.

This is the source of capital's profits and the elasticity which enables it to utilise resources from across the globe, transcending the limits imposed by local ecosystems. It is not, however, without requirements. For capitalists to take hold of this capacity, they require a world market in the commodity form of labour and the fruits of the land. This does not exist whilst the majority of workers remain tied to the land and markets limited only to excesses in production above what was required for use

4 "The value of a day's labour-power amounts to 3 shillings, because on our assumption half a day's labour is embodied in that quantity of labour-power, *i.e.*, because the means of subsistence that are daily required for the production of labour-power, cost half a day's labour. But the past labour that is embodied in the labour-power, and the living labour that it can call into action; the daily cost of maintaining it, and its daily expenditure in work, are two totally different things. The former determines the exchange-value of the labour-power, the latter is its use-value. The fact that half a day's labour is necessary to keep the labourer alive during 24 hours, does not in any way prevent him from working a whole day. Therefore, the value of labour-power, and the value which that labour-power creates in the labour-process, are two entirely different magnitudes; and this difference of the two values was what the capitalist had in view, when he was purchasing the labour-power. The useful qualities that labour-power possesses, and by virtue of which it makes yarn or boots, were to him nothing more than a conditio sine qua non; for in order to create value, labour must be expended in a useful manner. What really influenced him was the specific use-value which this commodity possesses of being *a source not only of value, but of more value than it has itself.* This is the special service that the capitalist expects from labour-power, and in this transaction he acts in accordance with the "eternal laws" of the exchange of commodities. The seller of labour-power, like the seller of any other commodity, realises its exchange-value, and parts with its use-value. He cannot take the one without giving the other. The use-value of labour-power, or in other words, labour, belongs just as little to its seller, as the use-value of oil after it has been sold belongs to the dealer who has sold it. The owner of the money has paid the value of a day's labour-power; his, therefore, is the use of it for a day; a day's labour belongs to him. The circumstance, that on the one hand the daily sustenance of labour-power costs only half a day's labour, while on the other hand the very same labour-power can work during a whole day, that consequently the value which its use during one day creates, is double what he pays for that use, this circumstance is, without doubt, a piece of good luck for the buyer, but by no means an injury to the seller." Marx, ch.7 (1867).

or luxuries, as was so in all prior forms of production. The market in labour-power and resources had to be created, as Marx puts it, by blood and fire.

In the early 1500s, the majority of England's population lived on the land. By the end of the 1800s over 80% lived in cities.[5] Scotland and Wales suffered a similar fate. Capitalist industry, agriculture, and markets had usurped feudal systems of farming and the common lands used for cattle rearing, foraging, hunting, or gathering firewood. The general processes behind this transformation are set out clearly in Ian Angus' 2023 book, *The War Against the Commons*, Christopher Hill's 1967 book, *Reformation to Industrial Revolution*, and the final section of the first volume of *Capital*, "So-Called Primitive Accumulation."

Feudal power in England was severely weakened by the end of the 1400s, peasant resistance ending hereditary serfdom in all but name, forcing landlords to put in place fixed rents and installing the right to the commons in law.[6] Faced with the need to lower rents to attract or retain tenants, some landlords opted to evict them, instead leasing larger parcels of their land at increased rents to commercial sheep farmers producing wool for a growing Flemish market. This marked the beginning of widespread enclosure and depopulation, with complaints of villages declining in population or disappearing as early as 1483.[7] As people were

5 Romola Davenport, 'Mortality, migration and epidemiological change in English cities, 1600-1870,' *International Journal of Paleopathology 34* (2021).

6 "Suffice it to say that by the early 1400s in England, the feudal aristocracy was much weakened. Peasant resistance had effectively ended hereditary serfdom and forced landlords to replace labor-service with fixed rents, while leaving common field agriculture and many common rights in place. Marx described the 1400s and early 1500s, when peasants in England were winning greater freedom and lower rents, as 'a golden age for labor in the process of becoming emancipated.'" Ian Angus, *The War Against the Commons: dispossession and resistance in the making of capitalism* (2023).

7 "Organized resistance and reduced population, following the Great Plague of the mid-1300s, allowed English peasants to win lower rents and greater freedom in the 1400s, but they didn't win every fight. Rather than cutting rents and easing conditions to attract tenants, some landlords forcibly evicted their smaller tenants and leased larger farms, at increased rents, to well-off farmers or commercial sheep graziers. Sheep required far less labor than grain, and the growing Flemish cloth industry was eager to buy English wool.

"Local populations declined as a result, and many villages disappeared entirely.

expelled, not only were the farms they worked lost to pasture, so too were the commons. This movement of capitalists was resisted by the feudal state and the church, who correctly viewed it as an incursion against their power.

Between 1498 and 1597, fifteen anti-enclosure laws were brought to bear by the crown. This utterly failed. A Commission on Enquiry found 1,361 illegal enclosures had occurred between the first anti-enclosure legislation and 1517.[8] The enclosure of the land and the siege of the commons even gained pace in this period. Driven by war expenditure, the influx of silver from the Americas via Spain, and the raising of rents behind enclosures themselves, the so-called "price revolution" or "great inflation" saw agricultural prices rise by six times between 1530 and 1640.[9] As Angus argues, this left landlords with no way to retain their income but to raise rents and invest in production for the market, as well as drawing smaller gentry and large farmers into this process.[10] It also drained the state coffers, prompting Henry VIII to disband over nine hundred monasteries and confiscate their land—around a third of all cultivated land in England and Wales.[11] This was then sold to raise money for war against Scotland and France. As Hill notes, this opened the door for the gentry and larger farmers to transform themselves into agricultural capitalists proper.

As Henry VIII's advisor Sir Thomas More famously wrote in 1516, sheep had 'become so greedy and fierce that they devour human beings themselves. They devastate and depopulate fields, houses and towns.'

"For more than a century, enclosure and depopulation—the words were almost always used together—were major social and political concerns for England's rulers. As early as 1483, Edward V's Lord Chancellor, John Russell, criticized 'enclosures and emparking … [for] driving away of tenants and letting down of tenantries.' In the same decade, the priest and historian John Rous condemned enclosure and depopulation, and identified sixty-two villages and hamlets within twelve miles of his home in Warwickshire that were 'either destroyed or shrunken,' because 'lovers or inducers of avarice' had 'ignominiously and violently driven out the inhabitants.' He called for 'justice under heavy penalties' against the landlords responsible." Angus (2023), pp.24-25.

8 Angus (2023), p.27.

9 Christopher Hill, *Reformation to Industrial Revolution* (1967), p.70.

10 Angus (2023), p.28.

11 Angus (2023), p.29 and Hill (1967), p.30.

As such, by the beginning of the 1600s, capitalist ownership of the land was consolidated. This is reflected in legislation, with pro-enclosure acts beginning in 1608,[12] and in the character of the state, with the English Civil War cementing the power of the victorious bourgeoisie over the crown.[13] By the 1700s, the process of enclosure was able to reach into Scotland, culminating in the infamous Highland Clearances. From tip to toe, Britain dispossessed its peasantry.

Dispossession alone was not enough to force the peasantry from the field to the factory. For labour-power to appear on the market *en masse*, their backs needed to be broken and urbanisation needed to be made possible. This required a long war, involving direct confrontation and increasingly punitive laws. From the resistance given to enclosures, peasants tearing down walls and opening drained fields to rivers, to the mobilisation of the radical Levellers and the early 'communist' Diggers through the English Civil War, peasants fought resolutely to retain their livelihoods. They were beaten off by the combined might of irregular forces and, later, the state.

12 "We can trace the triumph of capitalism in agriculture by following the [House of] Commons' attitude towards enclosure. Governments opposed depopulating enclosure, primarily for military reasons. But enclosure also led to loss of taxable income, and to smaller tithe payments: the opposition of parsons to enclosure may not always have sprung from purely altruistic sentiments. The famine year 1597 saw the last acts against depopulation; 1608 the first (limited) pro-enclosure act. (In 1607 there had been revolts against enclosure in the Midlands, and a state paper suggested that enclosure was necessary if the growing population was to be fed.) In 1621, in the depths of the depression, came the first general enclosure bill—opposed by some M.P.s who feared agrarian disturbances. In 1624 the statutes against enclosure were repealed. At the end of the decade there were anti-enclosure riots and risings in Dorset, Gloucestershire, Worcestershire, Shropshire and Wiltshire. This was followed, in the absence of Parliament, by Laud's Enclosure Commissions, which made a good deal of money by fining enclosers—though the crown itself was an enclosing landlord. But they did little to restore the evicted to their holdings, and indeed 'Charles I's commissions were not aimed at the prevention of enclosure, any more than his scheme for retail tobacco licensing aimed to prevent the smoking of pipes.' Enclosure fines became an irregular tax levied on one section of the landed class, and gave no adequate protection to the poor. Again the Long Parliament was a turning point. No government after 1640 seriously tried either to prevent enclosures, or even to make money by fining enclosers." Hill (1967), p.58.

13 This is tightly and clearly argued in Christopher Hill, *The English Revolution 1640* (1940) and in Hill (1967), pp.104-119.

Brutal punishments, including execution for begging, imprisonment for hunting and slave labour, tortured them into submission.[14] Urban centres enabled by the utilisation of coal for heating and cooking, something Malm refers to as the Elizabethan Leap in *Fossil Capital,*[15] and large villages near to mines or agriculture requiring seasonal labour absorbed them.[16] Enclosure created the largest single market in the world, and the first to offer commoditised labour in bulk. It provided the material basis for industrial capitalism and, with it, a development pattern eerily similar to that seen in the Amazon. Peasant agriculture gave way to pasture for livestock, which in turn gave way to industrial agriculture, mining, urbanisation, large market villages and, finally, large-scale industry.

The ecological consequences of this were devastating and unprecedented. As a 2022 report by the UK Environment Agency and a 2015 article by Ian Rappel argue, though "wild" habitats were largely lost by the time of the Roman occupation, the feudal commons provided a wide range of habitats and natural functions to support biodiversity.[17] For example, open cattle grazing played the role of ecosystem engineering, kicking up food for birds and small mammals and redistributing nutrients across the soil to the benefit of floral and fungi. In contrast, the enclosure of land for monocrops characteristic of industrial, capitalist agriculture is so profoundly detrimental to biodiversity the lands subject to it can be termed "sacrificed land," as discussed at length by Angus Wright, Ivette Perfecto and John H. Vandermeer in their 2009 book, *Nature's Matrix*.[18] Since the destruction of these common lands at capital's hand, Britain has lost around 50% of its biodiversity, 70% of its ancient woodlands,

14 See Angus (2023), pp.45-46, 126-138 and Marx, ch.28 (1867).

15 Malm (2016), pp.48-51.

16 Marx, ch.27 (1867).

17 Environment Agency, *Working with nature: chief scientist's group report* (2022) and Ian Rappel, "Capitalism and species extinction," *International Socialism 147(2)* (2015).

18 Angus Wright, John Vandermeer and Ivette Perfecrto, *Nature's Matrix: linking agriculture, biodiversity conservation and food sovereignty*, second edition (2019), pp.48-51. This offers a critique of E.O. Wilson's "half-earth" theory and the view that agricultural land is necessarily "sacrificed." Wright, Vandermeer and Perfecto will feature heavily in the second part of *For Land*, as their critique of bourgeois conservation is impeccable.

97% of its meadows and grasslands and around 90% of its wetlands.[19] So thorough and ruinous was capitalism's revolution in Britain that it could not be contained to the island. In order to consolidate its power over production, capital set out to devour the earth.

The role played by colonial exploitation in the consolidation of industrial capitalism can be expressed as two distinct functions. On the one hand, the plunder of colonial territories laid a financial and organisational basis for industrialisation in Britain; on the other, the resources extracted provided Britain both means of life and raw materials for production beyond the limits of its national ecology. The example of British sugar plantations in the West Indies, discussed by Angus alongside the pillage of India, is illustrative of the first function.

First established in the 1640s, these plantations grew to an immense engine of capital accumulation. Not only were sugar crops immensely profitable, the labour to grow them fuelled a vast trade in African slaves and, to secure them, a huge market for British arms and textiles producers. By 1770, these three industries alone accounted for between 21 to 35% of Britain's gross fixed capital composition.[20] There can be little

19 For overall biodiversity loss see *State of Nature 2023*. For loss of wetlands see Natural England, 'Wetland restoration: for people and planet' (2024), for grasslands and meadows see English Heritage, "Conserving England's meadows," and for woodlands see Woodland Trust, "Ancient woodland."

20 "Over four centuries, some 12.5 million Africans were shipped across the Atlantic in conditions so horrendous that 1.5 million died on route. Another 1.5 million died after less than a year of labor in the New World. The European slave trade started as small coastal operations by Portuguese bandits in the 1400s, and became very big business, growing from 370,000 people in the 1500s to 1,870,000 million in the 1600s to over 6,100,000 in the 1700s, when English ships carried over 40 percent of the total. As historian Joseph Inokori has shown, the eighteenth-century British slave trade was dominated by a few large merchant companies, and 'the best firms earned upwards of 50 percent on their investments, well above the normal profits of an easy trade.'

"While the slave trade itself was profitable, it was the combination of human trafficking and slave plantations in the Caribbean that really promoted economic growth in England. In the sugar plantations on Barbados, Jamaica, Nevis, Antigua, and other islands, hundreds of thousands of Africans planted, tended, and harvested sugarcane, and then— because cane rots quickly after harvesting—worked round the clock in the mills where it was ground and boiled to make raw sugar and molasses...

"Slaves were cheap, so plantation owners literally worked them to death. "In the century and a half before the abolition of the British transatlantic slave trade in 1808,

doubt to the role this exploitation played for British capital's capacity to invest. However, as a 2008 paper by Jacob Becker argues, its impact was not exclusively financial. The experience gained in the organisation and division of labour on the plantation was instrumental in developing the labour organisation of the factory.[21]

The second function of colonialism for British capital—securing the resources required to sustain it—is equally clear. For example, wool and cotton imported from Ireland, the colonies, and later the US, were crucial inputs for the British textile industry, the dominant pillar of early industrial capitalism. A similar relation can be seen across British industries. It is food production, however, which shows this colonial dependence to be pivotal. As a 2008 paper on the nineteenth century grain trade shows, British reliance on imported wheat increased steadily with industrialisation. Five percent of the population were reliant upon these imports between 1821 and 1831. Between 1891 and 1900, this had grown to 71.2%.[22] Even where food was produced locally, the depopulation of the

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some 2.7 million captive Africans were brought to the British West Indies. Yet by 1808, the total British Caribbean slave population was barely a third that number—about 775,000.... Slaves died faster than they could reproduce.

"Millions of African lives were expropriated to enrich plantation owners and sugar merchants. That genocidal policy was precisely why Adam Smith could write: 'The profits of a sugar-plantation in any of our West Indian colonies are generally much greater than those of any other cultivation that is known either in Europe or America." As the Archbishop of Canterbury said in a 2007 sermon, Britain's historic prosperity—that is, the prosperity of Britain's ruling elite—"was built in large part on this atrocity.'

"Robin Blackburn estimates that in 1770 the so-called triangular trade—guns and textiles from Britain to Africa, slaves from Africa to the West Indies, sugar from the West Indies to Britain—accounted for between 21 and 35 percent of Britain's gross fixed capital formation. Economic power and political power went hand in hand: in the second half of the eighteenth century, about fifty Members of Parliament had connections to Caribbean plantations. Known as the 'West Indian Interest,' they consistently voted against proposals to weaken or abolish the plantation slavery system." Angus (2023), pp.87-89.

21 Jacob Becker, 'The Atlantic Crossing: foundations of the industrial revolution,' *Iowa Historical Review* (2008).

22 Mette Ejrnæs, Karl Persson, and Sören Rich, 'Feeding the British: convergence and market efficiency in the nineteenth-century grain trade,' *The Economic History Review* (2008).

countryside undermined its basis. Instead of being returned to the soil, the nutrients fixed in crops were taken to the city, then flushed away to sea. As detailed in David R. Montgomery's 2007 book, *Dirt: the erosion of civilisations*, the management of this problem required a vast industry in natural fertilisers, gathered from colonial exploitation and wars.[23]

The combined effect of this wealth and resource extraction was the systematic underdevelopment of oppressed and exploited nations, explaining the historic disparity in emissions from industry identified by Hickel, et al. Without this resource pool in its colonies, capitalism would have been stillborn.

It is no exaggeration to say that colonialism represented a global holocaust. As Jason Hickel and Dylan Sullivan calculate in a 2023 paper, in the century from 1492 the population of Latin America fell from between 40 to 100 million to just 4 million, Central and Eastern Africa saw a population crash of around 15% between 1890 and 1920 alone, China lost 18.6% of its population—81.9 million people—between 1852 and 1870, and Britain wiped out 165 million people in India between the 16th and 17th Century.[24] Direct violence, disease and unrelenting economic exploitation combined to enact the most profound slaughter in human history.

Though many advocates of Malthusian interpretations of the "Anthropocene" argue that this slaughter can be partially accredited to the resource requirements of growing populations, citing the central role of famine in this slaughter, this is straightforwardly absurd. As Hickel and Sullivan point out, such an approach cannot explain why, for example, the pre-Hispanic population of Mexico, up to 18 million people, could be sustained on the land but the population of 1800, fallen to 5 million people, could only secure the most basic degree of subsistence.[25] Rather

23 David R. Montgomery, *Dirt: the erosion of civilisations* (2007), pp.179-216.

24 Jason Hickel and Dylan Sullivan, 'Capitalism and extreme poverty: A global analysis of real wages, human height, and mortality since the long 16th century,' *World Development* 161 (2023).

25 "Mexican wages fell to subsistence levels in 1800, when the population hit 5 million people. But pre-Hispanic Mexico had a population of up to 18 million people. If in 1800 the land could only support 5 million at bare subsistence, it was because the colonial economy was geared towards elite accumulation rather than local food needs. We should not ignore the relationship between population growth and ecology, but

than population pressures, capitalism's colonial enclosures and limitless ecological exploitation are the culprit.

Franz Broswimmer provides a powerful illustration of the role of this process in relation to species extinction in his discussion of the slaughter of the American bison. When Europeans first arrived, between 40 to 75 million Bison roamed North America; by 1891, only 541 remained.[26] Hunting for industry, combined with the clearance of ecosystems for cash crops, livestock or resource extraction produced a global catastrophe. A 2023 paper by Gerardo Ceballos and Paul Ehrlich estimates 34,600 species and 74 genera have gone extinct since 1500, with species extinction for all vertebrates has roughly doubled each century since this date.[27] Though they conclude that this is the result of population growth—Ehrlich is a leading advocate for Malthusian theory—their own statistics place this exponential growth of species extinction entirely within the capitalist epoch of production. Whilst correlation alone leaves room for doubt, the mechanics of this process do not.

As production for profit gobbled the land, expelling its peoples and snuffing out its non-human populations in Europe, colonialism brought the world to capital's service. The ceaseless plunder of resources and

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we must not treat these as operating in a social and political vacuum." Hickel and Sullivan (2023).

26 Broswimmer (2002), pp.66-67.

27 "Our analysis shows that two orders, 10 families, and 73 genera of tetrapods (i.e., mammals, birds, reptiles, and amphibians) have gone EX since 1500, representing a major loss of branches of the tree of life. Genera have disappeared in all vertebrate classes. Most recorded extinctions have occurred in birds, followed by mammals, amphibians, and then reptiles. The EX orders are two of giant birds, the elephant birds (Aepyornithiformes) of Madagascar and the moas (Dinornithiformes) from New Zealand. The ten EX families include six of mammal such as the sloth lemurs (Order Primates, Palaepropothecidae) from Madagascar, and four of birds, such as the Hawaiian moho honeyeaters (Order Passeriformes, Mohidae; SI Appendix). Although the data are scanty, most of the generic losses have occurred in the last two centuries. Some genera such as the Steller sea cow (Hidrodamalis; EX in 1768) disappeared long ago, while many more such as the passenger pigeon (Ectopistes, 1914), Tasmanian tiger (Thylacinus, 1936) and the Yellow river dolphin (Lipodes, 2002) have departed since modern science began to pay attention (SI Appendix)." Gerardo Ceballos and Paul R. Ehrlich, 'Mutilation of the tree of life via mass extinction of animal genera,' *Proceedings of the National Academy of Sciences* 120(39) (2023).

wealth through colonial exploitation exported this capitalist ecocide across the globe and, in doing so, also rendered oppressed nations and their populations, now dispossessed of their land, reliant on production for the market. Operating under the self-expanding logic illustrated in the British clearances and the destruction of the Amazon, capital produces its own conditions, expanding through space as it accumulates greater and greater profits. This exponential expansion is the motive force behind the rapid changes in land use which form the origins and continue to shape the sixth mass extinction.

7

Many prior modes of production were ecocidal, even inherently so. To fully counter the view put forward by Cowie, Bouchet, and Fontaine and similar accounts that the sixth mass extinction encompasses "all human-caused extinctions" thus requires an approach accounting for both the global megafaunal extinction 45,000 to 25,000 years ago and pre-capitalist ecocide following the neolithic revolutions 12,000 to 10,000 years ago.

Coinciding with the spread of the human species, the megafaunal extinction saw most large herbivores, like mammoths or ground sloths, and their predators, like sabre-toothed cats, eliminated across the globe. As Broswimmer explains in *Ecocide* or Isabella Tree and Charlie Burrell discuss in *The Book of Wilding*, the most plausible explanation for this extinction is "overkill"—bluntly, these species were hunted to oblivion, beyond any real need would suggest.[1] As Tree and Burrell emphasise,

1 "Human–animal relationships changed dramatically. Surpassing our archaic predecessors anatomically and behaviorally, modern humans of the late Pleistocene acquired unprecedented skill as big game hunters. The impressive testimony of these changes is manifest in the leitmotivs of the flourishing cave art. Leopards and hyenas, hitherto unknown in Paleolithic cave art, were depicted in conjunction with images of lions, rhinos, bears, owls, mammoths, bison, ice-age horses, Irish elk, and extinct deer with giant antlers.

"*Homo sapiens* developed a keen understanding of their new prey. As a food historian suggests, big game hunting was history's first, but not last, "war on subsistence." New technologies and socially expanded intelligence became manifest in newly created material culture and ingeniously designed weaponry for catching prey including such instruments as harpoons, fish gorges, bows and arrows, spear throwers, pit traps, dead falls, blals, and arrow poison. These devices and more tightly coordinated hunting techniques must have considerably increased food supplies. *Homo sapiens* were now socially coordinated enough to collectively dismember and carry away the remains of

this had considerable impacts on broader ecological relations. Megafauna transferred nutrients across the globe, promoting biodiversity at an incredible scale. Their extinction, therefore, had a devastating impact

large mammals such as great mastodons and woolly mammoths. They were able to encircle great numbers of animals and drive them over a cliff. This enormous wastefulness in hunting was to become a chief characteristic of anatomically and behaviorally modern humans' attitude toward their food supplies.

"Indeed, the extermination of the megafauna in the late Pleistocene should be taken as the first indicator of the greatly expanded transformative capacities of modern humans on the planet's species and ecosystems. The term "megafauna" refers mainly to large herbivores such as mammoths, mastodons, huge ground sloths, cave bears, and woolly rhinoceroses, as well as the carnivores that fed on them, such as dire wolves and saber-toothed cats. This pre-industrial form of ecocide represents a prelude to what was to evolve, under the aegis of the modern industrial era, into a collectively species-threatening pattern of global ecocide. The human-induced megafauna extinctions of the late Quaternary occurred in many different parts of the world, and involved at least 200 genera.

"For example, at Solutré, France, at the bottom of a cliff used by ice-age big game hunters to massacre stampeding animals, one can find a vast accumulation of bones estimated to contain the remains of more than 100,000 horses. Even allowing for the relatively vast time period of the Paleolithic or Old Stone Age, it seems obvious that these ancient hunters killed more game than was necessary. In the Pacific Northwest, pre-modern people created elaborate devices to drive herds of white-tailed deer into enclosures in the forest where they were slaughtered. Native American people have been recorded to have burned forests to force out elk and deer, creating gusts of hot wind, soot, and smoke powerful enough to make temperate October days feel like mid-summer. On the Great Plains, some tribes drove bison over cliffs, creating heaps of fur and meat far greater than their needs. Mounds of remains, discovered by archaeologists at the foot of cliffs, show that the animals were left to rot. There is also evidence from bones that before Bison antiquus became extinct, the species suffered stress, which may well have been caused by overhunting.

"The megafauna mass extinction of the late Quaternary is now generally acknowledged by paleontologists and physical anthropologists to have occurred largely without the impact of global catastrophes such as sudden climatic change. In most cases, the megafauna extinctions began shortly after the first arrival of prehistoric humans. If we compare the number of genera of large mammals lost on the various continents, we find that Australia lost 94 per cent, North America 73 per cent, Europe 29 per cent, and Africa south of the Sahara 5 per cent. The first humans encountered animals that had evolved in the absence of human predators, and the animals were probably easily vanquished. Therefore, the most plausible explanation is that these extinctions were caused over the course of centuries and millennia by over-exploitation of relatively few, but growing numbers of big game hunters. [Broswimmer (2002), pp.22-23]." Isabella Tree and Charlie Burrell, *The Book of Wilding* (2023), p.23.

upon the ecosystems which they fed.[2] Whilst clearly a human-induced extinction, and even a global one, to treat this as the origin of the sixth mass extinction is absurd. Though it reached further into the web of life than those creatures directly hunted, it did not unite terrestrial and oceanic ecosystems into a singular process, barely gracing the latter. More importantly, it ended.

Responding to a scarcity of big game and rising temperatures following the end of the last ice age, humans began to diversify their diets and adopt sedentary agriculture. Though these neolithic revolutions were global, beginning independently in at least China, the Middle East and the Americas, this process tied future societies to local ecologies far more than hunter-gatherers had been. This is expressed both in terms of simple subsistence and in social terms, the division of labour required by agriculture and the surpluses derived from it leading to the formation of class societies, rulers dependent upon maintaining populations in place. Such direct dependence upon the land set definite limits on their ecological impact. As both Broswimmer and Montgomery illustrate, these modes of production collapsed with ecological conditions. In Mesopotamia, agricultural production led the settled population to completely reshape the landscape, particularly through irrigation, leading to a dramatic biodiversity decline from change in habitats and hunting. However, this also resulted in the salinisation of the soil, the salt deposits accumulating as irrigation expanded gradually undermining cultivation. Combined with increased taxes to fund the growing state necessitating greater use of land, this ultimately lead to civilisational collapse.[3] The decline of Athens can

2 "Without free-roaming megafauna we have lost one of the planet's most effective systems of nutrient transfer. The movement of phosphorus (the key nutrient required by plants and trees for growth) from the alluvial floodplains of the Amazon and its tributaries into the forest interior has declined by 98 per cent since the extinction of megafauna such as giant ground sloths. Before commerical whaling, [somewhat breaking their own example—Prolekult] whales would have moved 375 million kilograms of phosphorus to the surface of the sea; today, it's 82.5 million kilograms. When the herds of mammoths, woolly rhinoceroses, bison, horses, musk oxen, elk, saiga and yaks were hunted to extinction in Alaska and the Yukon, woody vegetation and mosses took over the steppe, absorbing heat from the sun and causing and estimated 0.2-1°C warming in Siberia and Beringia. This may well have been the first human-induced global warming." Tree and Burrell (2023), p.25.

3 Montgomery (2007), pp.37-42.

partially be attributed to deforestation for cultivation, the city state ravenous for wood for military use by the mid-fifth century.[4] Similar stories can be seen in the fall of Rome, the collapse of Mayan civilisation or the fall of Chinese city states. Simply, vulnerability to collapse in conditions of ecocide prevented any of these civilisations from forming the global bridge between ecosystems required to drive a mass extinction. To see within them the origin of the sixth mass extinction, therefore, is to substitute a pessimistic teleology for history, a linear process of destruction replacing the real relations between humanity and non-human nature.

If it can be said that technologies embody social relations of production, then it is but a step further to suggest that their by-products also embody such relations. In this sense, the emissions driving the climate crisis can be taken to reflect a deeper social reality. Where carbon, methane, and other greenhouse gases unavoidably represent a bridge between terrestrial and oceanic ecosystems, as we have argued, their expulsion is rooted in something far more fundamental. Capital has today encircled the globe, leaving shattered peoples and sacrificed lands everywhere in its wake. In its ceaseless quest for profit, it has brought the inhabitants of every land and every wave under its heel, wringing gold from every vein and every tendon on the face of this fair earth. Its capacity to move beyond the limits of any given ecosystem, still pocketing coins on its poisonous course, have brought it to the limits of all ecosystems. This is to say that it—the relation of capital—is the global bridge between ecosystems driving the sixth mass extinction, *that it, capital, is an extinction event*, perhaps with even greater designs for the future of our home than meteor or volcano could muster. If we are to stand any chance of stopping it, we

4 "By the mid-fifth century BCE , the land surrounding Athens was largely deforested. Erosion depleted the mountain soils, deposited silt along the coastlines, and dried up many springs. The result was a declining agricultural production and a chronic shortage of wood and other forest products. Environmental historian Donald Hughes explains Athens' aggressive foreign policy in this way: Athenian diplomats sought advantageous timber deals in treaties with forested lands such as Macedonia. Groups of Athenian clerics or colonists were dispatched to the tree-bearing coasts of Chalcidice and Italy. Timber towns like Antadros were forced into the Athenian Empire, and the timber trade became an issue in conflicts with other maritime cities such as Corinth. As a major argument in favor of the ill-fated military expedition to Sicily, the Athenian general Alcibiades specifically mentioned access to the island's forests. By the end of antiquity Sicilian woodlands had been depleted. Thus, the decline of Athens can be correlated with its failure to maintain the forest ecosystem." Broswimmer (2002), pp.40-41.

must be clear and precise upon this. For us to undermine the terror that capital has unleashed upon the earth is not impossible once the secret of its rule is understood. That secret? The expropriation of the worker, and the maintenance of our dispossession.

Appendices

For Land
Shorts

#1
Hunting and Clearances

#2
Megafaunal Extinctions

#3
Yanacocha: A Case Study in Legal Gold Mines

Shorts #1

Hunting and Clearances[1]

The clearance of the peasantry and the conversion of the land to pasture in Britain laid the basis for the formation of industrial capitalism. Beginning in the 1400s, this process swelled the wealth of an advancing class of merchant capitalists and led to the creation of a vast class of dispossessed workers offering their labour on the market. In *For Land | Part one*, we looked at these core processes. However, as Ian Angus points out in his 2023 book, *The War Against the Commons*, a less explored element was crucial: the banning of hunting among Britain's poor.

The attempts of Britain's propertied classes to ban hunting by the poor predate the clearances, beginning with William the Conqueror's creation of Royal Forests, areas where only he and those he appointed were able to hunt, in the 1070s. By the 12th Century, up to a third of England was covered by these laws, including whole counties in some instances. Following the suppression of the peasants' revolt of 1381, which had demanded access to food via hunting among its objectives, this process gained pace. In 1390, hunting was banned across all of England's territory for anyone without land or premises to the value of forty shillings. Someone caught breaching this property clause could receive up to a year in prison. Hunting became the legal preserve of the rich.

Despite this legislation, Britain's rural poor continued to hunt as a vital component of their subsistence. Convicting poachers was incredibly difficult, owing to the lack of any law enforcement in the countryside. The hunting ban was thus a dead letter, with most local authorities

1 'For Land | Shorts #1: Hunting and clearances,' Prolekult, video available at https://www.youtube.com/watch?v=c19bE1TZRCs.

concluding that the expense of implementation was not worth the result. This remained the case until after the English Civil War of 1642-1651, which brought the capitalist class to power. In 1671, the bourgeoisie inaugurated a new era of game laws. Alongside further tightening property qualifications for hunting and raising fines, far-reaching powers including arrest, the search of homes without warrant and the use of whatever force deemed necessary were granted to gamekeepers to enforce the law. These were private policemen, hired directly by landowners, prone to the abuse of power and corruption. Still, the rural poor continued to poach, prompting further escalation. In May 1723, Parliament passed what came to be known as the "Black Act." This condemned those engaged in hunting to death, creating 350 new capital offences in a single stroke. Even being caught in disguise on an estate was punishable by hanging. This remained in force until 1823. Still, the poor continued to poach, more afraid of their stomachs than the noose.

The game laws and rural depopulation served to eliminate hunting as a subsistence activity in Britain. Though bans were breached well into the 19th Century, with pitched battles between poaching gangs and gamekeepers, by this point the character of hunting had changed. Both gangs and individuals increasingly sold their catches on the market. This serves to underline the economic significance of the bans in severing Britain's working class from any source of subsistence other than the market. This made them dependent upon the sale of their labour, the core relation of industrial capitalism. Ecologically, the change in hunting's character was devastating. Not only did market dominance introduce a limitless motivation for the activity, the property clause rendered it a sport. For example, at a shooting party in 1823, eight people killed 1088 birds in a day. None were eaten. This sport has reshaped whole ecosystems with, as Marx comments in the first volume of *Capital*, the north of Scotland turned into deer forests for the pleasure of Britain's elite. Far from preserving nature from overuse, a common refrain of those who think capitalist property amenable to natural restoration, hunting in Britain follows the core logic of capital in ecological terms, dispossessing humanity and destroying nature.

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Shorts #2

Megafaunal Extinctions[1]

Arguments which explain the sixth mass extinction as a product of human population growth and the development of technology treat the megafaunal extinctions between 45,000 to 25,000 years ago as the result of human expansion. As we discussed in our recent feature film, *For Land | Part one*, those who adopt this perspective rely on the "overkill" thesis—that humans hunted giant sloths, wooly mammoths and other such megafauna to extinction as they spread across the globe. In the film, we accepted this argument for the sake of time, instead arguing that the process cannot form part of the sixth mass extinction due to the limits of its impact. The reality is that the causes and environmental impact of the megafaunal extinctions are rather more contested than the view given in an uncomplicated "overkill" thesis.

Explanations for the megafaunal extinctions fall into three categories: "overkill," climatic change, or some combination of these two theses. The contest between these positions is already around 200 years old, though it has sharpened since the publication of Paul Martin's paper, "Prehistoric overkill," in 1967. This initial paper postulates that human hunting of megafauna was impactful as it preyed upon weaknesses in animal populations. A 2017 paper provides an example of what this means, arguing that even the killing of one juvenile per person per decade could have caused a megafaunal collapse. However, Martin's later "Blitzkrieg" model is more common in popular literature. This envisions humans extinguishing megafauna so rapidly that few or no kill sites are left behind,

1 'For Land | Shorts #2: Megafaunal extinctions,' Prolekult, video available online at https://www.youtube.com/watch?v=nqejcmKYZQI.

a convenient way of avoiding any burden of proof. Whilst this distinction is important, those who adhere to a climate model of megafaunal extinction argue that both "overkill" models are inaccurate, with arguments frequently highlighting that megafaunal extinctions seem to have begun before human arrival in many cases. Much of the scientific debate, therefore, remains rooted in complex problems of radiocarbon dating and the small scale of fossil records for this period. For example, a March 2024 paper found no evidence for a climatic impact on megafauna, while a November 2024 paper found no evidence for a human impact outside of islands.

Whilst these debates are unlikely to find any swift or definite resolution, they can still illuminate some elements of early human development. For example, a common riposte to climatic theories of megafaunal extinction is that megafauna had survived previous environmental shifts. In response, Maurício E. Graipel et al. illustrate that intense seasonality and desertification were more pronounced in the period than before. This not only provides a potential explanation for megafaunal extinction, but also a causal explanation for the onset of human migration across the earth. The impact that megafauna had on broader eco-systems provides perhaps even more insight. As a 2015 study by Elizabeth S. Bakker et al and a 2016 study by Yadvinder Malhi et al highlight, megafauna suppressed woody vegetation, potentially reducing woody species cover by up to 95% in some regions. It is not hard to see why sedentary human populations did not emerge in this context, this scale of trampling making settlements difficult to maintain. If we assume megafaunal herd migrations, this could also provide an explanation for the small number of mass grave kill sites we have uncovered, humans corralling megafauna away from vital woodland and off cliffs. Finally, the megafaunal extinctions saw a large increase in dense forests. Whilst it would be straightforwardly incorrect to consider these ecosystems "healthier," this does complicate the point of those who tie this period to the sixth mass extinction. Simply, if we accept a human hand in megafaunal extinction, then we must also accept a human hand in the formation of the eco-systems which formed the origins of the holocene. This complexity shows the real importance of rejecting narratives which treat the megafaunal extinction as part of the sixth mass extinction. Whilst "overkill" and population growth provide a simple and easy explanation, they do so by reducing human history to a

linear process of destruction, obscuring the complexity of our species and eco-systems throughout history.

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Shorts #3

Yanacocha: A Case Study in Legal Gold Mines[1]

"When there is a lack of water we have to feed our animals with the discharged water. They die of illnesses. We live in **peace** with our agriculture. But they come here only to exploit us. Exploit us and leave. For us they are worse than… I don't know what words to express it with, they are worse than **criminals**; there is no other word that we can use to name these people. Before we were exploited by the Spaniards, today they are even worse. The miners."

—Cajamarcan Subsistence Farmer

In our feature film, *For Land | Part One: Capital as Extinction*, we examined the explosion of illegal gold mines in the Amazon, the slave camps, brothels and dispossession which fuel them, and the ecological devastation which follows in their wake. In this, we were following the dominant trend of the gold industry's expansion in the rainforest, illegal mines accounting for 85% of forest lost to gold mining between 1997 and 2019 in Suriname, for example. However, this focus runs the risk of obscuring the role played by the legal mining sector in the exploitation of

1 'For Land | Shorts #3: Yanacocha—a Case Study in Legal Gold Mines,' Prolekult, video available online at https://www.youtube.com/watch?v=YVvBOPFogHc

the earth and its peoples, industrial mines positioned as a "better option" by crude comparison in much of the literature. This is a dangerous lie.

The Yanacocha mine in the Cajamarca region of the Peruvian Andes, a gateway to the Amazon, is the largest and most profitable mine in Latin America, and the fourth largest gold mine in the world. Formed as a joint investment between the US-based Newmont Mining Corporation, a subsidiary of the Peruvian Minas Buenaventura and the International Finance Corporation in 1993, a 2013 paper by Fernando M. Aragón and Juan Pablo Rud positions Yanacocha as proof that export-oriented industrial mining benefits capital and community alike. Conditions on the ground paint quite a different picture.

> "I was born here and **belong** here. My parents lived here and today I live here with my children. Without much, we get by. My sister and brother-in-law sold their land for 2000 sols and moved to Cajamarca, but since that's not a lot of money they can't live from it in the city and they're very poor."
>
> **—Migeul Garcia Hernandez**

> "We used to live off the land and the animals, and that provided us with enough food. We weren't lacking anything. But now we're **begging** our way through life. Why? Because here in Cajamarca, we have to fight from morning 'til night to be able to earn any money. We don't work, we won't have anything."
>
> **—Dispossessed Farmer**

The land into which Yanacocha is carved was acquired through the dispossession of whole communities. As Charis Kamphuis illustrates in a 2012 paper, rapid changes in Peruvian land law through the 1990s advantaged large capitalists. The Negritos communities of Cajamarca were among the first victims of these changes, the Peruvian state ending communal land rights and forcing them to market on individual terms. As these communities operated under a complex system of mixed communal and individual property rights, many did not understand what it meant to sell land as individual property or anything of its value. In 1993, Yanacocha bought 800 hectares of Negritos' land for $18,000. A month after receiving the title, this property was mortgaged for $50 million.

"All this area was made of one big lagoon. Then they came with their machines and began their work, eventually they turned this area into a **dumpsite** and began burying all kinds of metals and waste right underneath where we are standing right now."

—Subsistence Farmer

"We ask ourselves as Peruvians, why do mining companies from other countries have to come here and leave behind such a **disgraceful** situation?"

—Subsistence Farmer

"They come here just to **take** our gold and all the other riches we have in Peru but look at this oil, this waste that we are left with."

—Subsistence Farmer

"Those who remain around the pit **suffer** deeply from the pollution brought by the mine, particularly heavy metals. Though Yanacocha argues that some heavy metals were already present in the area's water supply, the mine's presence has clearly increased this problem exponentially, leading to severe sickness among the community and loss of livestock.

"We are very contaminated and sick. It is because the mine is contaminating us. The water is giving us **illnesses**. We have pain in our brains and feel dizzy. We have to bring our children to the clinics and give them medicine on a daily basis now. Because of this mine, we now have to go running into the city to try and find cures."

—Subsistence Farmer

"We live with **ailments** now, with skin rashes, stomach aches, body aches and bone pains."

—Subsistence Farmer

"The children are born **sick**, they become sick in their mama's bellies because the mama drinks this water and eats meals cooked with it. We have no other source of water, how else does this mine think we are supposed to sustain ourselves?"

—Subsistence Farmer

"From these highlands the water goes down to the city. **All** these rivers; the Rio Encajon, the Silla Negra, the Yanacocha river, the Coremayo, the Sinsi, these are all branches of the Rio Grande which reaches the water plant El Milagro."

—Subsistence Farmer

Aragón and Rud's argument that Yanacocha has benefited the community around it is based on the argument that wages and prices went up with its opening, stimulating the Peruvian economy. Whilst a 2019 paper shows both wage and price increases were temporary, it is necessary to go further. The absurd profits Yanacocha sends to its major investors in the United States, fueled by exploitation and tax evasion, have been a cataclysm for the region. Cajamarca still has the highest rate of extreme poverty in Peru—17.3%—and one of the highest unemployment rates at 9.1%. A 2007 report shows that the most common causes for falling further into poverty in the region are medical bills and the loss of livestock to pollution. Yanacocha's profiteers know the damage they cause, and deploy private military companies to spy on and repress any resistance which arises to them, as exampled high-profile murders in 2006 following opposition to the mine's expansion.

> "Because of their own **profit**, the bosses at the mine continually try to intimidate the people. But in the newspapers and the press, on the radio and on TV, the picture looks completely different. If you weren't here, they would probably write '*campesinos* attack the mine,' or god knows what kind of headline they would come up with. But you know, we're just simple people from the countryside. We're just defending our rights, our land, our water—the things that we had claim to according to the law. **Defending** our water or trying to prevent a path from being moved, that's our legal right."
>
> **—Miguel Garcia Hernandez**

The dynamics which characterise illegal gold mining in the Amazon—the expropriation of the worker, the destruction of the waters and the land, insatiable lust for profit—also characterise the legal gold mining sector, Whilst there are distinctions in the way these processes develop—legal mines are more heavily industrialised and compact, bleeding an area thoroughly, where illegal mining tends to cut land apart in broader segments, a particular problem in rainforest—they are both devastating to human and non-human life. As one of the most profitable mines in the world, touted as an example of successful development, the devastation Yanacocha has wrought shows this clearly. Legal or not, capital's mine's are the tip of extinction's spear.

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Approaching Marxism

A. Modes of Production
Sources and Study Plan

B. Marx and Nature
Sources and Study Plan

C. The Metabolic Rift (ft. Jason W. Moore)
Sources and Study Plan

A.
Modes of Production[1]

The concept of a "mode of production" is among the first newcomers to Marxism will encounter. This is for good reason, even simplified explanations provide a compelling and practical framework for situating broad stretches of history. However, whilst such simplified explanations are useful, they can become detrimental if taken as a shortcut around deeper investigation or, in the worst instances, as phraseology with which to hide poor or malicious analysis. With more advanced discussion of modes of production largely confined to academic work, these kinds of errors are common. There is a need for a more complex conversation.

Over the next few minutes, we intend to outline why, beginning with a simple explanation of the concept, then touching on Marx's own contradictory handling of modes of production and a small crucial debate surrounding the concept since. We urge you to take this conversation forward yourselves, and we've included materials to aid with an initial group discussion on the subject in the video description. Welcome to *Approaching Marxism*.

In the sense the term is most commonly deployed, a mode of production refers to an epochal phase in the development of humanity's productive forces. It is the conceptual framework by which Marxists distinguish between, for example, capitalism, feudalism or antiquity. Crucially, this framework situates production as the ultimate, though not only, deter-

1 'Modes of production | Approaching Marxism,' Prolekult, video available online at https://www.youtube.com/watch?v=RBxVeOl30IM.

mining factor in human history.

To explain this, the term is broken down further. A mode of production is composed of two elements: relations of production—that is, how production is organised, and property relations—and instruments of production—tools, raw materials and so on. Each mode of production, or epoch in the development of the productive forces, is a unity of distinct relations and instruments of production, these two factors conditioning each other. Where they come into insoluble contradiction, as in a case where the relations of production hold back the development of the productive forces—for example, when feudal relations of economic bondage held back capitalist production, tying workers to the land and capital to the crown—this produces seismic ruptures and revolutions. A mode of production is, thus, also an epoch of class struggle.

This is the simplistic explanation of the concept. It is derived from components of Marx's work—for example, *The German Ideology* and the *Preface to a Contribution to the Critique of Political Economy*—but only codified into this formulation by subsequent authors and works—for example, Stalin's *Dialectical and Historical Materialism*, or Jose Maria Sison's *Basic Principles of Marxism-Leninism*. Whilst useful in providing an orientation for further study, this introductory conception is inadequate when mobilized in an explanatory capacity. As the historian Jairus Banaji points out, doing so posits an abstract historical law which applies in all periods of history—a definite line of development—something Marx always explicitly rejected.

To begin to conceptually grasp modes of production in more depth, we need to consider Marx's own use of the term. Whilst he certainly mobilises the concept in the broad, epochal sense already indicated, this is not the only way Marx deploys it. Throughout particularly *Capital* and the notebooks written in preparation for it, known as the *Grundrisse*, Marx repeatedly uses the term "mode of production" to refer to specific, technical processes. For example, in the *Grundrisse*, Marx refers to agriculture as "a mode of production *sui generis*"—that is, defined by technical conditions peculiar to it. In just the first volume of *Capital*, he refers to handicraft, the manufacture system, the concentration of workers and many other features he considers as technical elements in the development of industrial capitalism as modes of production.

This lack of separation does not pose a problem for his analysis. Indeed, Marx's unwillingness to treat these phenomena as static concepts highlights the real focus of his approach. This is very clearly highlighted by chapters 13 to 15 of the first volume of *Capital*, where Marx outlines his view of the development of machinery. Instead of the binary contradiction posited by the notion that the relations of production holding back the development of the means of production is the source of all changes or revolutions in the mode of production, a much more dynamic picture emerges. The development of the manufacture system stems from a simultaneous and integrated change in relations and means of production, the employment of handicraftsmen by a single capitalist leading to the opening of workshops for the concentration of workers, which in turn leads to the isolation of the various functions of the handicraft labour process, providing the basis for machinery in the recombination of these isolated functions.

Marx's concern throughout this analysis, indeed throughout all of *Capital*, is not the construction of broad historical generalisations. His concern is in identifying the historically determinate laws of capitalist production. Through his analysis, it becomes clear this is not something which is reducible to a simple combination of wage labour and factories, but rather the combined result of a diverse ensemble of concrete relationships and technical processes. The epochal framework of a mode of production is an orientation toward the study of these phenomena, not a ready formed explanation of their interaction or significance.

Given the scope of the modes of production as a conceptual framework, it is understandable that it stands at the core of many debates within Marxist historiography. Many of them are drawn together and commented on in Jairus Banaji's seminal essay, "Modes of Production in a Materialist Conception of History." Whilst we will be returning to the broader range of these debates over time in this series, we want to focus on his core contention: that simplified understandings of modes of production often result in historical formalism. Though Banaji describes this vulgarisation exclusively as a product of "Stalinism"—a clearly blinkered view, given the dominance of the reductive framework outlined across tendencies—his observations on the problem remain cutting several decades later.

By historical formalism, Banaji is referring to a line of thought which treats historical material purely as a verification of an already held general formulation. He identifies a number of ways this occurs in Marxist thought, and his handling of chattel slavery and the US plantation system is particularly revealing. Here, the maintenance of historical formalism requires rejecting Marx himself. As a formalist reading of modes of production can only understand capitalism as operating through wage labour, it precludes an understanding of the plantation system as a system of capitalist exploitation. As Marx and Banaji make clear, this completely misunderstands the real processes of this system, which was organised entirely for the production of capitalist wealth under the ownership of capitalists. The path of formalism leads to the revision of history.

Whilst the importance of correctly understanding the concept of a mode of production and its ambiguities for historical analysis should now be clear, the immediate, political importance of this understanding is perhaps uncertain. On this, we can speak plainly. As we have consistently argued through the rest of our work, as is made evident by the environmental crisis and the skinning of the earth by war's foul tread, the capitalist epoch of production is today coming to a long close. To stand any chance of navigating its collapse and successfully fighting for the next mode of production—that of communism—it is a vital necessity that we are clear upon the historically concrete nature of Marxist analysis. If the social basis of this next mode of production—the proletariat and oppressed—are to rise to the challenge of its formation, then they must be adequately armed with an analytic capable of understanding dynamic changes in production, identifying new technical bases for development and the relations they imply, and consciously developing these relations into economic laws of motion. If they are instead armed with tools which blinker them to real developments in favour of old and worn myths, then the result may only be failure. This much is certain.

We hope this short piece has provided a useful provocation for further discussion on the development of these analyses. Now, it's over to you.

Sources and Study Plan

This is a short study aid to complement our *Approaching Marxism* episode on the concept of a mode of production. It includes all the materials needed to host a study session for mixed groups on the subjects covered in the episode, broken down into an annotated reading list and a short lesson plan. The materials here may also be used for more advanced study. For more experienced or confident comrades, we recommend hosting a reading group around the "Advanced" reading material listed here.

Reading List

Beginner

Required reading: Marx, K. (1977), 'Preface,' *A Contribution to the Critique of Political Economy*. Moscow: Progress Publishers.

Available at: https://www.marxists.org/archive/marx/works/1859/critique-pol-economy/preface.htm.

Though the simple definition provided in the video, and many like it, are not directly taken from this text, they are certainly derived from it to a certain extent. In this text, Marx defines modes of production as "epochs marking progress in the economic development of society," separates this concept into its component parts of relations and instruments of production, and provides a brief, one-sided discussion on how these two forces interact to produce social change: "At a certain stage of development, the material productive forces of society come into conflict with the existing relations of production or—this merely expresses the same thing in legal terms—with the property relations within the framework

of which they have operated hitherto. From forms of development of the productive forces these relations turn into their fetters. Then begins an era of social revolution."

Marx wrote this text in his mature phase, and repeatedly referred to it as a brief explanation of his fundamental approach following its publication—something unique in his works. The text will also form the key beginner's reading for the study session based on the next episode of Approaching Marxism.

Optional reading: Stalin, J. (1938), 'Dialectical and historical materialism.'

Available at: https://www.marxists.org/reference/archive/stalin/works/1938/09.htm

Though not the first text to codify Marx's light exploration of modes of production in the *Preface* into a supra-historical framework, Stalin is by far the most significant. This text outlines the simplified view of a mode of production which has come to dominate over most Marxist activist bases. It should be read in light of the critical comments offered in the video's discussion of this simplification. However, we would add that Stalin is not engaged in a distortion for the sake of distortion here. He is engaged in a mass pedagogic project as a component of state-building, and this leads out of necessity to theoretical simplification.

Optional reading: Sison, J.M. (2020), 'Chapter two: *Basic Principles of Marxism-Leninism.*' Paris: Foreign Language Press.

Available at: https://foreignlanguages.press/wp-content/uploads/2020/08/S20-Basic-Principles-of-ML-A-Primer.pdf

Sison's short explanation of modes of production in exposition of historical materialism is a clear example of both the simplistic explanation of the concept often given to newcomers to Marxism, and of the historical formalism it produces. Following Stalin and simplifying further, Sison not only reduces human history to a succession of just five(!!!) modes of production, within which any economic phenomena ever encountered may be crammed, he also repeats historical distortions—long

disproved—to maintain this formalism—for example, the idea that the Roman Empire was ended by slave rebellions. This should be read as an example of historical formalism.

Intermediate

Optional reading: Marx, K. (1982), *Capital: a Critique of Political Economy, volume one*. Harmondsworth: Penguin Books and New Left Review.

- Chapter thirteen: Co-operation
- Chapter fourteen: Division of Labour and Manufacture
- Chapter fifteen: Machinery and Modern Industry

As discussed in the video, the above chapters of *Capital* illustrate Marx's commitment to capturing the complexity of real developments in both relations and instruments of production, and how their motion relates. These sections, read in full, provide an illustration of how Marx moves through ensembles of relations to discover and expose capitalism's economic laws of motion. It also includes both technical and epochal uses of the term "mode of production," illustrating the ambiguity in his terminology, and contingent lack of concern for constructing supra-historical abstractions or frameworks.

Advanced

Optional reading: Banaji, J. (1977), 'Modes of production in a materialist conception of history,' *Capital & Class*, 3(1), pp.1-44.

Banaji's seminal essay considers a huge number of debates surrounding the conceptual framework of a "mode of production," considering debates around methodology, Marxist definitions of feudalism, chattel slavery and more. We urge advanced comrades to take in the full scope of his argument, and to consider rebuttals or criticism surrounding Banaji (for example, Leonard in *Marx & Philosophy Review of Books*, Burns in *Science & Society*, or Banaji's response to some criticism of his work here). In particular, pay attention to Banaji's discussion of historical formalism. As discussed in the video, we disagree with his view that vulgar Marxism

is an exclusively "Stalinist" phenomena. We will return to the concept of vulgar Marxism as a whole later in the series.

Additional sources on Banaji:

Banaji, J. (2013), 'Putting Theory to Work,' *Historical Materialism: Research in Critical Marxist Theory*, 21(4), pp.129-143. Available at: https://doi.org/10.1163/1569206X-12341322.

Burns, T. (2022), 'Marxism and the Concept of A Social Formation: An Immanent Critique of the Views of Jairus Banaji,' *Science & Society*, 86(1). Available at: https://doi.org/10.1521/siso.2022.86.1.38.

Leonard, S.A. (2013), 'Review: Jairus Banaji, *Theory as History: Essays on Modes of Production and Exploitation*,' *Marx & Philosophy Review of Books*. Available at: https://marxandphilosophy.org.uk/reviews/7758_theory-as-history-review-by-spencer-leonard/

Lesson Plan

This lesson plan is for mixed groups, and provides space for beginners and more experienced comrades to explore and develop the ideas expressed in the video and reading list. It is broken down into agenda items, with suggestions for focusing discussion in each section. If run to time, the meeting here should run to an hour and a half, with a ten minute break in the middle. This is timed for a group of up to six comrades. Feel free to edit this lesson plan to your own convenience.

Item one: watch the video (15 minutes)

Watch the video together. If the discussion is being held remotely, then provide comrades with a space to have a text chat as the video is playing. Those running the session should note these questions down. If the discussion is being held in person, then make sure comrades know to keep a note of their questions, or any points they want to raise.

Item two: the simple explanation (25 minutes)

Use this initial time to ensure that newer comrades understand the simple, one-sided definition given at the beginning of the video, and further illustrated by the beginner's reading list. Begin by asking comrades to try and give this simple explanation themselves, defining (a) modes of production as a whole (epochal), (b) the relations of production, (c) the means of production, and (d) the example relationship given by Marx in the *Preface*. Make sure everyone has a short period to speak on this. Once everyone has given a definition, those running the session should reiterate the simple definition, highlighting where comrades went wrong etc. Once this is done, use the remaining time to discuss any points people had or further questions on this simple definition.

Break (10 minutes)

Item three: Marx's ambiguity and more complex relations (20 minutes)

Use this time to discuss the ambiguity in Marx's use of the term "modes of production" in his work. Begin by making sure that comrades understand the distinction, with those leading on the session offering a clear explanation of the epochal and technical senses of the term, and some examples (there are some in the intermediate and advanced reading; Banaji has a section in his essay collating examples and discussing this). After taking questions, discuss Marx's explanation of the development of machinery, and how this indicates more complex relations than simplified explanations of a "modes of production" can allow for.

Item four: historical formalism versus Marxism (15 minutes)

To conclude the session, focus upon the contrast between historical formalism and Marx's approach which is discussed throughout the video and advanced reading. Keep the discussion limited to an exploration of what historical formalism is, and what is meant by "historically determinate laws" in relation to Marx. This should be a more open discussion.

Item five: feedback (5 minutes)

Use the end of the session to gather feedback from all comrades on how they feel the discussion went, and whether they still have questions or problems with the concepts discussed. If there is substantial interest in the topics discussed, then we recommend organising a reading group around Banaji's essay, spaced out over three hour and a half sessions.

B.
Marx and Nature[1]

Any theory of social development worth its salt must possess a coherent understanding of the relationship between humanity and non-human nature, and how this relationship is changed by different forms of socio-economic organisation. The present capitalist extinction makes this clear beyond doubt. Despite the importance of this, many introductory approaches to Marxism leave Marx and Marxism's view of nature by the wayside, or else confine themselves to merely stating that capital's hunt for profit leaves it unable to build an ecologically sustainable society. This is insufficient, to say the least.

It is, however, understandable: the Marxist view of nature is sharply contested. Over the next few minutes, we'll take a look at the contest between first and second wave ecosocialists over Marx's own view of nature as a window into this contest. We urge you to take this conversation forward yourselves, and we've included materials to aid with an initial group discussion on the subject in the video description. Welcome to *Approaching Marxism*.

Though ecological critiques have been interwoven into Marxist thought since its foundation, ecosocialism only came to form as a distinct tendency toward the end of the 20th Century, in the late 1980s and 1990s. Its first-wave arose out of the New Left Marxist tendency's attempts to engage with the rise of modern environmentalist movements in the west from the 1960s. Perhaps unsurprisingly, this led to an approach which John Bellamy Foster, a core theorist of the second-wave,

1 'Marx and Nature | Approaching Marxism,' Prolekult, video available online at https://www.youtube.com/watch?v=-qwtey25QFo.

has described as "grafting Marxian concepts onto already existing green theory—or, in some cases, grafting green theory onto Marxism."

Whilst thinkers within this milieu produced useful work—for example, Ted Benton's work on Malthusianism, Arran Gare's recovery of early Soviet ecology, or James O'Connor's 1998 essay collection *Natural Causes*—the tendency generally put forward a reading of Marx's view of nature derived from green theory. Despite recognising that Marx makes a number of prescient observations on natural phenomena, first-wave ecosocialism holds, in general, that he does not have anything serious to say in a systematic sense on these subjects or even that he treats nature as a static, and irrelevant, object.

This view takes many forms but, as Paul Burkett—another key theorist of the second-wave—sets out in his 1999 work, *Marx and Nature*, it rests upon three core contentions. Firstly, Marx had a "Promethean" view of technology—that is, that he viewed technological development as a progressive and linear process, situating capitalist development of industry as progressive aside from it being privately owned and communism simply as collective ownership and development of these same forces of production. Secondly, Marx excludes or downgrades the role of nature in production, particularly in his labour theory of value. Thirdly and finally, Marx's critique of capitalism has nothing to do with nature or the natural conditions of production. Each of these positions derive from misinterpretations of Marx's view of both nature and capitalism.

Michael Löwy provides the clearest articulation of the first-wave's charges of "Promethean" thought against Marx in his 1997 article "For a Critical Marxism," stating that Marx has a tendency "to consider the development of the forces of production as the principal vector of progress, to adopt a fairly uncritical attitude toward industrial civilization, particularly its destructive relationship to nature." There is a reasonable basis to argue this position within Marx's writing, with the view that revolutions are driven by relations of production holding back the means of production in the "Preface to a Contribution to the Critique of Political Economy," the praise for the productive forces unlocked by capitalism in *The Communist Manifesto*, or his statement that steam-engines produced "society with the industrial capitalist" in *The Poverty of Philosophy* perhaps suggesting such a reading. However, this is a *narrow* textual basis.

If the young Marx appears to hold a "Promethean" view of technology's development, the majority of his mature writing does not. For example, in the first volume of *Capital*, Marx describes machinery as "the material embodiment of capital," an instrument of production which "strikes down the worker" and "the most powerful weapon against strikes." This analysis points towards a constructivist view of technology, as an embodiment of social relations, and can hardly suggest an "uncritical attitude" to industry, or that the development of productive forces is "a vector of progress" in any absolute sense. Rather, it situates technological development as a site of struggle. Further, the combination of Marx's view that "technology discloses man's mode of dealing with nature," his writing on capitalist agriculture's inherently destructive relationship to the soil, and his insistence that communist association will re-establish "the most intimate ties of man with the earth, since the earth ceases to be an object of huckstering" seem to make any suggestion that Marx would view the destruction of nature as compatible with communism somewhat laughable.

After setting out these criticisms and others of the first-wave's charges of "Prometheanism," Burkett's *Marx and Nature* and Bellamy Foster's *Marx's Ecology* set out a more palatable reading of Marx's view of technology and progress. Both argue that what Marx truly saw as progressive within capitalism's development of the productive forces was the development of science and social goods, like education, it opened up and, with this, the new potentials for human development that could be seized by a proletarian revolution. Though the conscious application of science to production, a phenomena Marx considers as having developed under capitalism, is further developed by industrial machinery, Marx also understands that this serves to separate intellectual and manual labour. This division, and the division between humanity and non-human nature, are developments his communism explicitly seeks to end. It is hard to square this with any interpretation of Marx as a "Promethean" proposing "limitless development" and industrial exploitation of the earth.

The first-wave of ecosocialism's view that Marx downplays the role of nature in production breaks down into two related concerns. The first is well expressed by Joel Kovel in his 2002 book, *The Enemy of Nature*. Conceding that Marx is not a "Promethean," Kovel argues that the real problem with his view of nature is that he treats it as inactive aside from where humanity acts upon it, a "natural substratum" and nothing more.

As Burkett shows through the first four chapters of *Marx and Nature*, this is absurd. Marx directly rejects it, arguing that nature's "universal metabolic process," which produces all of the materials needed for human subsistence and production, "exists independently of labour." This active process, of which humanity itself is a product and part, is the basis of all wealth. Labour, which Kovel claims Marx presents as the only active part of nature, is itself "a natural object," a process through which the worker "opposes himself to Nature as one of her own forces."

The second concern of first-wave ecosocialism in relation to criticisms that Marx downplays the role of nature is more historically specific. As a variety of its theorists—for example, Enrique Leff, Geoffrey Carpenter, and Robert Campbell—have complained, Marx's labour theory of value argues that nature does not produce value, thus denigrating its importance. This utterly misunderstands Marx's critique of capitalism. Value is not identical to wealth; it is an historic social category. All commodities possess both a use-value—what an object does—and an exchange-value—how much it may be traded for in other commodities on the market. As these categories are incomparable, exchange-value must be determined by something else. The only quantifiable thing which all commodities possess in common is that they are products of abstract, social human labour; the value of a commodity is, thus, determined by the amount of socially averaged labour it takes to produce.

In observing this, Marx is not suggesting nature plays no part in commodity production—natural products must serve as "bearers of value." He is arguing that the human labour contained in a commodity is the only way in which the market may judge commodities, excluding all other factors. As Burkett stresses, charging Marx with denigrating nature for this observation amounts to blaming him for capitalism itself. This particular failure to understand Marx's critique of capital is not only a theoretical problem. It is politically dangerous, the suggestion that nature can produce value implying that reforms might address the crisis before us by acknowledging this. In its most fundamental form, capitalist political economy denies this.

The significance of the second-wave's corrections to this problem does not, however, end here. It also forms the beginning of an answer to James O'Connor's argument that Marx's theory of capitalism cannot

account for natural crises as it has "nothing to do with the natural conditions of production." The full answer to O'Connor, however, is contained within Marx's theory of the metabolic rift. We will return to this in the next episode of this series.

In a recent and somewhat despairing article, the English socialist Jonathan Neale makes an impassioned plea to the ecosocialist movement to prioritise the climate crisis above all else. Among the challenges he lays at ecosocialists' feet is a short segment imploring his readers to stop "worrying about Marx" as the work done defending him against charges he neglected nature is "not useful in building a movement to save the world."

Whilst it is correct that understanding Marx's view of nature does not provide us a ready made toolkit to approach the extinction crisis, Neale's readiness to jettison all but a formal nod to class struggle represents an even greater extreme than such slavish adherence. The rest of his article advances a deeply reductionist approach to the climate crisis, arguing that ecosocialists ought to advance the measures contained in his 2021 book, *Fight the Fire*. This work offers a detailed overview of emissions and measures to cut them: it is a technical manual. Though Neale admits that there is, presently, no social basis which can carry this to victory in a short section on degrowth, he leaves us with no remedy.

What we are left with is an insistence upon a fetish of technical processes which will, it is to be assumed, "save the world." Though certainly not "Promethean"—Neale advocates for degrowth—the essential problems of this view are maintained. As with the explicitly "Promethean" eco-modernist tendency, the social question is left to the side, but for a concluding lament. Neale retreats from the integrated critique of nature and society offered by Marx and clarified by his defenders to an artificial separation which claims that social problems can be solved by already determined technical means, if only humanity would listen. This way lies defeatism.

We hope this discussion has provided a window into the debate between the first and second waves of ecosocialism and its continued importance. Now, it's over to you.

Sources and Study Plan

This is a short study aid to complement our *Approaching Marxism* episode on debates between the first and second wave of modern, western ecosocialism over Marx's view of nature. This is a crucial debate within the development of Marxist approaches to the environment which informs debates to this day. The study aid includes all the materials needed to host a study session for mixed groups on the subjects covered in the episode, broken down into an annotated reading list, and a short lesson plan. The materials here may also be used for more advanced study.

Reading list

Beginner

Required reading: Bellamy Foster, J. (2014), 'Paul Burkett's *Marx and Nature* Fifteen Years After,' *Monthly Review*, 66(7).

Available at: https://monthlyreview.org/2014/12/01/paul-burketts-marx-and-nature-fifteen-years-after/

This short text, written as an article then used as an introduction to reprints of Burkett's *Marx and Nature*, recapitulates the core debates between the first and second waves of ecosocialism fifteen years after the majority of the debates had been settled. It is a useful text in getting a grasp of the fundamentals of the contest. Bellamy Foster's certainty on the victory of the second-wave, both here and elsewhere, is—however—ill-founded. More recent interventions (Neale is one clear example; the ecomodernism tendency another) have rather emphatically rolled back the clock on this certainty.

Optional reading: Malm, A. (2017), 'Ecology and Marxism,' *Historical Materialism*.

Available at: https://www.historicalmaterialism.org/ecology-marxism-andreas-malm/

A short reading list with commentary on various different tendencies within ecosocialism. Includes critical comments on both the first and second waves of ecosocialism, as well as subsequent developments. Useful for gaining a broad overview of literature on Marxism and nature from a beginner's perspective.

Optional reading: Neale, J. (2023), 'The 'eco' in ecosocialism must mean climate, or we are lost,' *Climate & Capitalism*.

Available at: https://climateandcapitalism.com/2023/07/11/the-eco-in-ecosocialism-must-mean-climate-or-we-are-lost/

Neale's article is critiqued within the video's conclusion quite roundly. It represents a deeply reductionist treatment of the environmental crisis, rejecting Marx's view of nature as irrelevant and reducing the questions facing humanity to a fetish of the climate and technology. Whilst there are many grounds upon which to disagree with this—for example, it is plainly impossible to address the climate crisis without addressing the "general crisis of nature" Neale frames so disparagingly; there is an explicit retreat to Kovel's Marxism—the core of what we want to critique here is one common to many, albeit less crudely.

Bluntly, Neale treats technology as the core solution to the climate crisis, and human organisation merely as its mode of realisation. This stands the relation upon its head, and restricts the strategic terrain to demands which Neale himself admits have no social basis. If the "eco" in ecosocialism is to mean anything whatsoever, the socialism—that is, the strategic and social basis of the project—must come first.

Intermediate

Optional reading: Burkett, P. (1999), *Marx and Nature: a red and green perspective*. New York City: Monthly Review Press.

Burkett's *Marx and Nature* remains the most comprehensive treatment of Marx's view of nature published in the anglophone world to this day, and the best refutation of the first-wave's view of Marx. It covers all of Marx's writing on nature—as well as a great deal of Engels'—systematically, with the locations of each of the texts referenced in their corpus clearly indicated. Though rather dryly written and not without its difficulties (our upcoming film, For Land, will discuss Burkett's dismissal of Marxist breakdown theory at length in its second part), this is unambiguously the best book on Marx and nature, whether for beginners of more advanced comrades.

Optional reading: Bellamy Foster, J. (2000), *Marx's Ecology*. New York City: Monthly Review Press.

Bellamy Foster's *Marx's Ecology* is another seminal text of the second-wave. The volume looks at the development of natural science through Darwin and others in historical context, then situates this within Marx's thought. It does so by looking at Marx's materialism and its basis in Epicurus, his and Engels' view of Darwin's theory of evolution and other developments in natural science, and, finally, by recovering his theory of the metabolic rift. This last point will be discussed in our next *Approaching Marxism* episode.

Optional reading: Kovel, J. (2007), *The Enemy of Nature: The end of capitalism or the end of the world?* London: Zed Books.

Kovel's book is a mature work of the first-wave of ecosocialism. Whilst he does accept that Marx is not a "Promethean," Kovel argues here that Marx viewed nature as a static phenomena, save for where humanity interacts with it. The conclusion of this argument, though not as damning as those who believe Marx to view industry as the primary vector of progress, is that Marx's communism has no ecological content. It may not be an enemy of nature to Kovel, but it is by no means necessarily a friend.

Optional reading: Löwy, M. (1998), 'For a Critical Marxism,' *Against the Current*, 71.

Available at: https://www.marxists.org/history/etol/newspape/atc/832.html

Löwys article provides the clearest articulation of Marx as a "Promethean," arguing that he views technological development as the primary vector of progress in human society. As utterly baffling as this argument must be to anyone familiar with Marx's writing on machinery in *Capital*, let alone elsewhere, Löwy's writing is cogent and worth reading, touching on broader questions of method and status in relation to Marx.

Advanced

Optional reading: Bellamy Foster, J. (2016), 'Marxism in the Anthropocene: dialectical rifts on the left,' *International Critical Thought*, 6(3), pp.393-421.

Available at: http://dx.doi.org/10.1080/21598282.2016.1197787

A more recent article. Here, Bellamy Foster charts the development of more contemporary debates within ecosocialism around conceptions of a dialectics of nature from the encounter between first and second wave of ecosocialism. This sets out a considerable number of questions, but the main contest in this text is a confrontation between social monism, Cartesian dualism and dialectics over approaches to natural phenomena. For more advanced readers, who already have a grasp of the content covered here.

Optional reading: Bellamy Foster, J. and Burkett, P. (2017), *Marx and the Earth: an anti-critique*. Chicago: Haymarket Books.

In this volume, Burkett and Bellamy Foster offer responses to ecosocialist critiques of Marx offered following the publication of *Marx and Nature* and *Marx's Ecology*. As Andreas Malm has written, this book represents "perhaps the highest stage of eco-marxology," both to its credit and its detriment. Whilst the discussion offered here goes into extraordinary detail on Marx's environmental thought, it also dips into deification. Worth reading, but keep in mind that the answers to contemporary problems are not to be found, like scripture, in the *Grundrisse* as you read.

Lesson Plan

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Item one: watch the video (20 minutes)

Watch the video together. If the discussion is being held remotely, then provide comrades with a space to have a text chat as the video is playing. Those running the session should note these questions down. If the discussion is being held in person, then make sure comrades know to keep a note of their questions, or any points they want to raise.

Item two: Marx as "Promethean" (25 minutes)

First, use this time to discuss the first-wave's view that Marx was a "Promethean" thinker and the second-wave's response to this. Whilst the answer to this, in general, is quite clear in light of Marx's view that machines act as weapons against strikes and seal capitalist domination over production, the nuances around it are rather complex. Try to draw out these more complex questions—for example, what implications do the second-wave's positions have for popular views of Marxist communism as an industrial project—but do not take them in detail. Offer to run a second session around this if there is interest in these thornier elements.

Break (10 minutes)

Item three: Marx, labour and nature (25 minutes)

Use this time to discuss the first-wave's criticisms of Marx's labour theory of value in relation to non-human nature, and the defence of Marx offered by the second-wave. Again, though the answers to the first-wave are quite simple really, they throw up harder questions. It would also be useful to consider how these views of Marx's theory, by advocates who claim to understand him, is anti-thetical to Marx's writing.

Item four: the political conjecture (10 minutes)

Finish with a discussion of Neale's retreat from Marx's position and the political consequences of this (technical fetishism) in his article. From this, consider the utility of returning to Marx's view in contemporary conditions. Make sure to stress that whilst Marx does not have all the answers, the concreteness of both his social approach and the ecological approach which corresponds to it illustrates a methodological position which can never be divorced from strategy, which is what we need.

C.
The Metabolic Rift (ft. Jason W. Moore)[1]

As we tear past tipping points and climate target after climate target is missed, the inherently ecocidal nature of capitalist production has become impossible to ignore. In turn, anti-capitalist environmentalism is proliferating. Though still far from a dominant tendency, anti-capitalist rhetoric has become a firm fixture in contemporary western environmentalism, expounded by both its celebrity activists and populist organisations. Despite this, Marxist theorisations of capital's need for environmental destruction remain largely confined to the academy, with many organised communist forces recoursing to common sense liberal arguments —for example, that we cannot have "infinite growth on a finite planet."

Whilst such slogans scratch at the truth, they remain short of the critique Marxism can offer. Marx's theory of the metabolic rift provides a useful starting point in approaching such critiques. Over the next few minutes, we will explore this theory, considering its role in debates between the first and second-wave of modern ecosocialist thought, and its continued importance in contemporary debates around the dialectics of nature. We urge you to take this conversation forward yourselves, and we've included materials to aid with an initial group discussion on the subject in the video description. Welcome to *Approaching Marxism*.

As John Bellamy Foster illustrates in a groundbreaking 1999 essay,

1 'The Metabolic Rift (ft. Jason W. Moore) | Approaching Marxism,' Prolekult, video available online at https://www.youtube.com/watch?v=ULMArfBoMW4.

"Marx's Theory of Metabolic Rift" and his book, *Marx's Ecology*, the origins of the theory are found in what agricultural historians refer to as the second agricultural revolution. Often dated between 1815 and 1880, this refers to the growth of a fertiliser industry and a corresponding scientific revolution in soil chemistry. Driven by widespread concerns over soil exhaustion, natural fertiliser sources were raided with increasing ferocity throughout this period. By 1837, this scramble began to push forward scientific inquiry in a serious way, with the British Association for the Advancement of Science commissioning the German chemist Justus von Liebig to research agricultural chemistry.

The results of this study were published in 1840, providing the first coherent technical explanation of the role of soil nutrients in the growth of plants and laying the basis for the production of artificial fertiliser. The first factory for this purpose was opened just three years later. However, rather than resolving the crisis of soil fertility, these developments deepened it, with no artificial process for producing nitrogen and greater knowledge of nutrient requirements deepening competition over limited natural reserves of this key resource.

In light of this failure, Liebig began to develop an ecological critique of capitalist agriculture, arguing that agricultural production for sale gave rise to a "spoliation system" in his 1859 *Letters on Modern Agriculture*. As the crops now transported across vast distances to the market contained within them the nutrients necessary for the soil's enduring fertility, this undermined its reproduction over time. This makes agriculture for commodity markets incompatible with a rational application of soil chemistry. Liebig would go on to develop this critique further through the 1860s, notably arguing that the waste of human and animal sewage represented a similarly irrational process of soil depletion.

This latter work forms the scientific basis of Marx's theory of the metabolic rift. In volumes one and three of *Capital*, and in the notebooks kept in preparation for these works known as the *Grundrisse*, Marx builds on Liebig's understanding of agriculture by introducing his concept of social metabolism. As he explains in the first volume of *Capital* and the *Grundrisse*, Marx views humanity and non-human nature as standing in a metabolic relationship with each other—crudely put, in a constant exchange of material. Human labour "mediates, regulates and controls" this

metabolism through its social organisation. In *Capital*'s third volume, Marx explicitly references Liebig's understanding of capitalist's agriculture's depletion of the soil, the depopulation of the countryside and the concentration of populations in cities as provoking "an irreparable rift" in this metabolism. For Marx, the capitalist organisation of production has here violated "the natural laws of life itself."

The insights of the theoretical outlook developed by Marx from Liebig's span far beyond its initial basis in capitalist agricultural practice. Marx himself applies this understanding to deforestation, and Engels—his closest collaborator—to the exploitation of coal and metal reserves. More recent analysis has expanded this further with, for example, Andreas Malm arguing that the adoption of fossil fuels enabled a rift in time and space necessary for industrial capitalist production in his 2016 book, *Fossil Capital*, or Bellamy Foster arguing that the climate and extinction crises represent a planetary rift in a 2010 book, *The Ecological Rift: Capitalism's war on the Earth*.

The fundamental significance of metabolic rift theory, however, is best illustrated by debates over the first-wave ecosocialist James O'Connor's theory of the two contradictions of capitalism. As with the rest of the modern first-wave, discussed in the last episode of this series, O'Connor views Marx's critique as having nothing to say in relation to ecology. In his 1998 book, *Natural Causes*, he sets this out clearly, arguing that whilst Marx's critique of political economy provides a firm basis for understanding capitalism's propensity to economic crisis, it "has nothing to do with the conditions of production." To remedy this, he argues, Marxism requires a second theory of crisis concerned with the way in which capitalism produces natural conditions.

Luckily, this rather abstract objection is put in more concrete terms, with capitalist agriculture as an example. Whilst allowing that Marx understood capitalism's depletion of soil health, O'Connor insists that he "failed to put two and two together" and did not see how capitalist agricultural practices "might threaten economic crisis" or how so-called natural barriers "may be capitalistically produced barriers." This is utterly incorrect. The so-called "natural barrier" which necessitated a turn to fertiliser use is the product of capitalist political economy, the depletion of soil nutrients a result of the expulsion of people from the

land and their concentration in cities which Marx views as the genesis of capitalist production. This is explicitly addressed wherever soil fertility is considered across *Capital*'s volumes. Whilst less explicit, Marx's view that capital "undermines the original sources of all wealth—the soil and the worker," or his understanding that increasing capital expenditure on means of production leads to a lower amount of value producing labour employed in production—a pronounced feature in the relation between fertiliser use and dwindling rural populations—both directly conflict with O'Connor's argument that he did not understand that capitalist agricultural practices would lead to economic crisis.

As Paul Burkett argues in his 1999 book, *Marx and Nature*, O'Connor arbitrarily separates the impacts of capitalist production economically and ecologically into two contradictions. In reality, these are both symptoms of a more fundamental contradiction: the dominance of exchange over production. The theory of the metabolic rift provides a powerful tool for understanding the ways in which the symptoms O'Connor separates out relate to each other and develop from this core contradiction.

In recent years, the theory of the metabolic rift has again come under criticism in the Marxist tendency, with a focus on how the organisation of production shapes non-human nature and its relations—often termed the dialectics of nature. Perhaps the most important of these critiques argues that whilst the theory of the metabolic rift was intended to provide a conceptual device to unite Marx's critique of political economy with an ecological critique, its more recent articulations have reproduced a conceptual separation between humanity and non-human nature which undermines this. A key thinker in this vein is Jason W. Moore, author of *Capitalism in the Web of Life*, alongside numerous other books and articles, and co-coordinator of the World-Ecology Research Network. We spoke to the comrade to get this critique in his own words.

"The world-ecology conversation agrees with Foster: metabolism is crucial. Where metabolic rift theory sees a primary antagonism between society and nature, I argue for a labour theory of metabolism. This flows from Marx and Engels' philosophical insistence on what we might call a labour theory of life. Engels offered its best sound bite: 'labour created man.'

"The labour theory of life is specifically dialectical and materialist. It insists that the primary antagonism of class society is the class struggle in the web of life. Classes and above all the labour process are not outside the web of life but internal to it. Labour and classes not only produce environmental history, they are products of it. As Marx says in the *Grundrisse*: 'labour is a specifically harnessed natural force.' This does not endow labour or nature with supernatural powers, as Marx warned in the *Critique of the Gotha Programme*. A labour theory of metabolism does not mean that modes of production determine solar irradiance or volcanic eruptions. A labour theory of metabolism does allow historical materialists to explain how such geophysical events and forces have influenced the climate history of class society.

"In this perspective, labour is not a property of humanity but a relationship defined by the interpenetration of opposites. Labour is the mixing of human work through the web of life. Labour creates man. World-ecology therefore argues against both labour and nature monisms and labour and nature dualisms. As Marx puts it, a being or relational entity that does not have its essence outside itself is not a being or a relational entity. The mixing of human and extrahuman natures with consciousness, class and material life is at the heart of Marx and Engel's communist vision.

"Consciousness itself is a material force, Marx and Engels tell us, and communist consciousness forms the basis for new forms of co-operation as material forces—thus the centrality of the critique of ideology and what Lenin famously called the theoretical struggle.

"World-ecology argues that historical materialism is, above all, historical. This includes the present as a world historical moment. Historical materialism commits us to understanding revolutionary praxis in at least two historical registers. One is the present day unfolding of the class struggle; the other is the history of those class struggles. A labour theory of metabolism understands those class struggles concretely through their manifold expressions in the history of industry, imperialism, geocultures and environments.

"World-ecology therefore rejects the idealists proposition that theoretical differences can be resolved through theory. It also rejects the historicist notion that history speaks for itself. For world-ecology the proletarian standpoint must interrogate and synthesise class struggles as metabolic contradictions. The overcoming of bourgeois alienation is fundamental—not only to labour's emancipation but to the liberation of all life. For this reason, world-ecology is distinctive in its emphasis on world history.

"For a quarter century, I have argued that the origins of capitalism and the origins of planetary crisis were two sides of the same world historical coin. The capitalocene concept, for instance, contends that the rise of capitalism through a violent and epochal environment making revolution in labour-landscape relations.

"Simply put: the emergence of capitalism was an unprecedented labour metabolic revolution. From the Dutch and English enclosures, to the silver mines of Potosí, to Brazil's great sugar plantations, this first era of primitive accumulation was irreducibly socio-ecological. The new labour regimes were distinct but combined and always metabolic. Proletarianisation assumed different forms across the Atlantic, from the Andes to the low countries. Each moment generated distinctive labour metabolic contradictions and contributions to world accumulation. The outcomes were gruesome and dynamic—at each step producing new socio-ecological contradictions between what Marx called the soil and the worker on the one hand and the imperialist bourgeoisie on the other.

"This metabolic reading of capitalist history as the class struggle in the web of life shapes our understanding of planetary crisis in later eras: the labour metabolic contradictions of the plantation system, for example, directly financed the era of coal and steam power that began in earnest after 1830. Industrial capitalism's metabolic contradictions were resolved through a new global metabolic fix in the new imperialism and the rise of monopoly capitalism at the end of the 19th Century.

> "World-ecology offers these historical sketches as contributions to ecosocialist praxis. For my comrades and I, theoretical struggles conducted by revolutionaries must be adjudicated on the terrain of praxis, including the debate over world historical turning points, patterns and transitions. The irony is that Foster, in attacking the world-ecology tendency for its alleged idealism, reproduces his own form of idealism. The metabolic rift school has organised its attacks on world-ecology theoretically, rather than through an interpretative struggle over capitalism's actually existing patterns and turning points."
>
> **—Jason W. Moore**

Bellamy Foster has responded to some of these criticisms in a number of essays, most directly in a 2016 article, "Marxism in the Anthropocene: Dialectical Rifts on the Left." The core of his argument in this piece is that his theory of the metabolic rift does not reproduce a division between human and non-human nature, but separates these out for analysis alone, and that Moore's criticism is fundamentally linguistic. Rather, Bellamy Foster argues, Moore's approach renders "capitalism more real than nature," amounting to a form of social monism. Though any serious resolution to this impasse requires a great deal of work, it is worth pointing to a consequence of Bellamy Foster's position. As Moore notes, the "natural limits" fundamental to Bellamy Foster's conception of the metabolic rift invoke a Malthusian conception of earth overshoot theory which reduces human impacts on the environment to a combination of population, affluence and technology. Neither class nor the manner in which non-human nature and its laws are shaped by human systems of production feature in this framing, entailing at least a muddying of the ecological conception of Marx's critique of political economy which Bel-

lamy Foster intends to rescue across his work.

Despite the contest still surrounding the concept, Marx's theory of the metabolic rift has clarified the central questions which any movement toward sustainable social development must grapple with. Far from being reducible to the canards of liberal environmentalism, the climate and extinction crises present complex questions on the relationship between human systems of production and non-human nature, which require concrete analysis of class and the natural world. The theory of the metabolic rift provides a powerful conceptual framework for glimpsing them. This is evidenced not only by the impact it has had in contemporary Marxist approaches to these questions, but also by its enduring scientific legacy. As Bellamy Foster notes in his initial treatments of the concept at the end of the 1990s, and gives systematic treatment in his 2020 book, *The Return of Nature*, the theory has held a massive influence on contemporary ecological science, clearing the way for many concepts now fundamental to this discipline. We hope this short discussion has provided a window into the broad contours of the theory, the debates which have surrounded it in recent history, and its political importance. Now, it's over to you.

Sources and Study Plan

This a short study aid to complement our *Approaching Marxism* episode on Marx's theory of the metabolic rift, its articulation through the work of the second-wave of contemporary western ecosocialist thought (particularly in the work of John Bellamy Foster), the importance of this theory in disputes between first-wave and second-wave modern ecosocialist thought, and more recent disputes over the dialectics of nature.

The study aid includes all the materials needed to host a study session for mixed groups on the subjects covered in the episode, broken down into an annotated reading list, and a short lesson plan. The materials here may also be used for more advanced study.

Reading List

Beginner

Required reading: Bellamy Foster, J. (1999), 'Marx's Theory of Metabolic Rift,' *American Journal of Sociology*, 105(2), pp.366-406.

Available at: https://johnbellamyfoster.org/articles/marxs-theory-of-metabolic-rift/

In this early article, Bellamy Foster lays out the key components of his view of Marx's metabolic rift theory. The piece traces the development of the concept through the "second agricultural revolution," the development of soil chemistry and the work of Justus von Liebig's in this area, Marx's addition of the concept of metabolism, how this has influenced natural science and how this relates to some debates between the first and second waves of modern ecosocialist thought. A brilliant intro-

duction to the concept and its importance, which will give a grounding for newcomers in the various strains covered in the video.

Optional reading: Marx, K. (1982), *Capital: a Critique of Political Economy, volume one*. Harmondsworth: Penguin Books and New Left Review.

Marx, K. (1991), *Capital: a Critique of Political Economy, volume three*. Harmondsworth: Penguin Books and New Left Review.

Burkett, P. (1999), *Marx and Nature: a red and green perspective*. New York City: Monthly Review Press.

The key sections of Marx's writing from which Bellamy Foster derives his articulation of metabolic rift theory are found in section 10 of chapter 15 ("Machinery and Modern Industry") of volume one and in part 5 of chapter 47 ("Genesis of Capitalist Ground Rent") of volume three. As Bellamy Foster and Paul Burkett document through their work, other sections of *Capital* and large sections of the *Grundrisse* also look at the concept in more detail. For more information on all of the instances of Marx's treatment of this concept, we recommend consulting Burkett's *Marx and Nature*, which provides a comprehensive catalogue of all of Marx's writing on the natural world in its references.

Intermediate

Optional reading: Bellamy Foster, J. (2000), *Marx's Ecology*. New York City: Monthly Review Press.

This is Bellamy Foster's most rigorous treatment of Marx's work around the natural world, his relationship to science and the theory of the metabolic rift. It is a vital read for understanding Marx's relationship to Liebig's agricultural chemistry, and give context for these developments as historical developments.

Optional reading: O'Connor, J. (1998), *Natural Causes: essays in ecological Marxism*. New York City: Guilford Press.

O'Connor's *Natural Causes* is among the most advanced works of the first-wave of modern ecosocialist thought. In particular, O'Connor provides the most comprehensive treatment of Marx's critique of political economy by this tendency. The sections highlighted concern the weakest components of O'Connor's theorisation—his view that ecological crises cannot be accounted for in Marx's political economy, that a second theory is necessary as Marx's critique has "nothing to do with the conditions of production." Though we entirely disagree with this, it is worth noting that in rectifying this problem in O'Connor's theory, the second-wave throws the baby out with the bathwater, rejecting Marx's theory of capitalist breakdown outright (most explicitly in Burkett's statement that capitalism can survive any crisis short of human extinction in *Marx and Nature*). This latter rejection is something we will return in the second part of our upcoming long piece *For Land*, which considers breakdown theory and ecological crises.

Advanced

Optional reading: Moore, J.W. (2011), 'Transcending the Metabolic Rift: A Theory of Crises in the Capitalist World-Ecology,' *The Journal of Peasant Studies*, 38(1), pp.1-46.

Available at: http://dx.doi.org/10.1080/03066150.2010.538579

In this earlier article, Moore lays out the fundamental components of his critique of the theory of the metabolic rift, and works toward the theories more clearly articulated in *Capitalism in the Web of Life*. This piece particularly highlights the way in which Moore thinks that Bellamy Foster's latter expressions of metabolic rift theory deny natural phenomena an historical approach, and the need for a re-evaluation of what he views as the Cartesian dualism present in this critical framework.

Optional reading: Moore, J.W. (2015), *Capitalism in the Web of Life*. London: Verso Books.

This is Moore's fullest treatment of the Marxist approach to ecology and class struggle in the "web of life." The book considers a huge range of subjects, each of which relates back to the relationship between human and non-human nature. Alongside the critique of Cartesian dualism and

ahistoricism in Bellamy Foster, this text also provides a useful attempt to bring breakdown theory back into ecosocialist thought. A vital text in approaching contemporary debates on the ecosocialist left.

Optional reading: Bellamy Foster, J. (2013), 'Marx and the Rift in the Universal Metabolism of Nature,' *Monthly Review*, 65(7).

Available at: https://monthlyreview.org/2013/12/01/marx-rift-universal-metabolism-nature/

The first of Bellamy Foster's responses to criticism of his view of metabolic rift theory and Moore's writing particularly. Here, Bellamy Foster argues that his theory does not separate human and non-human nature for any reason other than conceptual utility, and provides a number of examples how.

Optional reading: Bellamy Foster, J. (2016), 'Marxism in the Anthropocene: dialectical rifts on the left,' *International Critical Thought*, 6(3), pp.393-421.

Available at: http://dx.doi.org/10.1080/21598282.2016.1197787

A more thorough response than the other article sourced, Bellamy Foster here gives a relatively comprehensive treatment of debates around the dialectics of nature. He also provides a more thorough response to Moore here, arguing that Moore's position is largely linguistic and charging his position with social monism. Whilst informative, Bellamy Foster's response is lacking. For example, it is hard to square the view that Moore considers "capitalism more real than nature" with Moore's own stated view, that natural relations are treated ahistorically and theoretically by Bellamy Foster's more recent articulations of metabolic rift theory, which seems to suggest a greater room for natural phenomena than Bellamy Foster's own position, let alone a social monism.

Lesson Plan

This lesson plan is for mixed groups, and provides space for beginners and more experienced comrades to explore and develop the ideas expressed in the video and reading list. It is broken down into agenda items, with suggestions for focusing discussion in each section. If run to time, the meeting here should run to an hour and a half, with a ten minute break in the middle. This is timed for a group of up to six comrades. Feel free to edit this lesson plan to your own convenience.

This lesson plan covers the metabolic rift theory itself and the relevance of this theory for debates over the first and second wave of ecosocialist thought. We recommend comrades run a separate session on the debates surrounding the dialectics of nature. If there is demand for a lesson plan for this, write to us and we will get back in touch!

Item one: watch the video (25 minutes)

Watch the video together. If the discussion is being held remotely, then provide comrades with a space to have a text chat as the video is playing. Those running the session should note these questions down. If the discussion is being held in person, then make sure comrades know to keep a note of their questions, or any points they want to raise.

Item two: Liebig and the second agricultural revolution (20 minutes)

Use this initial time to make sure that comrades understand the real scientific basis of Marx's approach to agriculture through Liebig's work. Go over the context of the second agricultural revolution (discussed in the required reading), the mechanics of soil chemistry discovered by Liebig and how these things clash with capitalist political economy.

Break (10 minutes)

Item three: metabolism (20 minutes)

Use this time to go over the concept of metabolism introduced by Marx.

Ground this out theoretically (stressing labour as a mediator, not a determinant, of the metabolic relation), use agriculture as a clear example and then conclude by discussing other examples of a metabolic rift.

Item four: unified or separate contradictions? (15 minutes)

Finally, conclude the session with a brief discussion of the fundamental question at stake in the debate between O'Connor and Bellamy Foster/Burkett. Discuss the way in which O'Connor separates the critique of political economy from natural conditions, whether this has any value, and the importance of a more unified critique.

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POLITICAL ECOLOGY / MARXISM

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Building upon Marxist ecology and political economy, the work contends that the capitalist mode of production is not merely a contributor to ecological collapse but its generative engine—structuring the destruction of biodiversity, ecosystems, and human life alike. The book traverses the Amazon, examining gold mining, deforestation, and forced labor, and situates these within broader debates on the Anthropocene, Capitalocene, and Marx's theory of metabolism.

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