Introduction

Welcome to the Anthropocene

> My heart is moved by all I cannot save. So much has been destroyed. I have cast my lot with those who, age after age, perversely, with no extraordinary power, reconstitute the world.
>
> Adrienne Rich

Sometimes these realisations sneak up on you, like a quiet memory – just the slightest hint that something isn't right.

When I was growing up in Eswatini, the small country in southern Africa formerly known as Swaziland, my family had a rickety old Toyota pickup – the kind that was ubiquitous in the region in the 1980s. After long drives it was my job to help clear the front grille of all the insects that accumulated there. Sometimes they were piled three deep: butterflies, moths, wasps, grasshoppers, beetles of every conceivable size and colour – dozens if not hundreds of species. I remember my dad telling me that the insects on Earth weighed more than all the other animals put together, including humans. I marvelled at this idea, and found

it somehow heartening. As a child I worried about the fate of the living world, as I think many children do – so this story about the insects made me feel that everything was going to be OK. It was comforting to be reminded of the seemingly inexhaustible abundance of life. This fact would drift to mind on hot nights while we sat outside on the porch of our little tin-roofed house, hoping for a breeze, watching moths and beetles swarm around the light, dodging the bats that would sometimes swoop through to snatch a meal. I became fascinated with insects. At one point I tried to identify all the different species around our home, running about with pen and little notebook in hand. In the end I had to give up. There were too many to count.

My dad still shares that old story about the insects from time to time – always in an excited tone, in the way that dads do, like it's a new fact he's just discovered. But these days it doesn't quite ring true. Things feel different, somehow. When I've returned to southern Africa for research in recent years, the car turns out more or less clean even after long journeys. Maybe a few flies here and there, but nothing at all like before. Perhaps it's just that the insects loom large in my childhood memories. Or perhaps there's something more troubling afoot.

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In late 2017, a team of scientists reported some strange and rather alarming findings. They had been meticulously counting insect numbers in German nature reserves for decades. This is something that very few scientists had taken the time to do – the sheer abundance of insects makes such an exercise seem unnecessary – so everyone was curious to see what would come of it. The results were devastating. The team found that three-quarters of flying insects in Germany's nature reserves had vanished over the

course of twenty-five years – due, they concluded, to the conversion of surrounding forests to farmland, followed by the intensive use of agricultural chemicals.

The study went viral, capturing headlines around the world. 'We appear to be making vast tracts of land inhospitable to most forms of life, and are currently on course for ecological Armageddon,' one of the scientists said. 'If we lose the insects then everything is going to collapse.'[1] Insects are essential to pollination and plant reproduction, they break down organic waste and turn it into soil, and they provide a vital source of food for thousands of other species. As insignificant as they may seem, they are key nodes in the web of life. As if to confirm these fears, a few months later two studies reported that falling insect populations had caused a dramatic decline of birds on farmland in France. Average numbers had fallen by a third in only fifteen years, with some species – like meadow pipits and partridges – collapsing by as much as 80%.[2] In the same year, news out of China reported that insect die-offs had triggered a pollination crisis. Eerie photographs emerged of workers going from plant to plant, pollinating crops by hand.

The problem isn't unique to these regions. Insect decline appears to be widespread. It is difficult to assess trends on continental or global scales, but the evidence does not look good. Researchers have found that the abundance of terrestrial insects has been declining by around 9% per decade,[3] and at least one in every ten species is now at risk of extinction.[4] These are alarming figures. And it raises concerns about the possibility of 'cascading extinctions', whereby the destruction of one species may trigger the decline of others, exacerbating biodiversity loss in unpredictable ways.[5] The crisis has become so severe that in 2020, scientists published a 'warning to humanity' about the fate of insects. 'With insect extinctions, we lose much more than species', they wrote. We lose 'large parts of the tree of life', and such losses 'lead

to the decline of key ecosystem services on which humanity depends.'[6] Echoing these sentiments, a recent symposium of world experts on insect biodiversity produced a report that opened with four simple but ominous words: 'Nature is under siege'.[7]

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This is not a book about doom. It is a book about hope. It's about how we can shift from an economy that's organised around domination and extraction to one that's rooted in reciprocity with the living world. But before we begin that journey, it's important that we grasp what's at stake. The ecological crisis happening around us is much more serious than we generally assume. It's not just one or two discrete issues, something that could be solved with a targeted intervention here and there while everything else carries on as normal. What's happening is the breakdown of multiple, interconnected systems – systems on which human beings are fundamentally dependent. If you're already familiar with what's going on, you may want to skim over this part. If not, brace yourself. It's not just the insects.

Living in an age of mass extinction

Perhaps it seemed like a good idea at the time: transfer land to big companies, rip up any hedges and trees and plant it all with a single crop, spray it from aeroplanes and harvest with giant combines. Beginning in the middle of the twentieth century, whole landscapes were remade according to the totalitarian logic of industrial profit, most of it for livestock feed, with the goal of maximising extraction. They called it the Green Revolution but, from the perspective of ecology, there was nothing 'green' about it. By reducing complex ecological systems to a single dimension, everything else became invisible. Nobody noticed what was happening to the insects and the birds. Or even to the soil itself.

If you've ever picked up a handful of rich, dark, fragrant soil, you'll know that it's crawling with life: worms, grubs, insects, fungus and millions of microorganisms. That life is what makes soils resilient and fertile. But over the past half-century, industrial agriculture, with its reliance on aggressive ploughing and chemical inputs, has been killing soil ecosystems at a rapid clip. UN scientists have found that 40% of the planet's soils are now seriously degraded. Agricultural soil is being lost more than 100 times faster than it is being formed.[8] In 2018, a scientist from Japan made the effort to sort through evidence on earthworm populations from around the world. He found that on industrial farms earthworm biomass had plunged by a dramatic 83%. And as the earthworms died off, the organic content of soils collapsed by more than half. Our soils are being turned into lifeless dirt.[9]

The consequences are worrying, to say the least. Crop yields are now declining on a fifth of the world's farmland.[10] If this continues, scientists warn, the Earth will be able to support only another

sixty years of harvests.[11] The very soils that have formed the foundations of human civilisation for tens of thousands of years are suddenly, in a matter of decades, on the verge of collapse.

Something similar is happening in our oceans. When we go to the supermarket, we take for granted that we'll find all the seafood we love: cod, hake, haddock, salmon, tuna – species that are central to human diets all around the world. But this easy certainty is beginning to crumble. Recent figures show that around 85% of global fish stocks are now depleted or facing collapse. Haddock have fallen to 1% of their former volume; halibut, those magnificent giants of the sea, to one-fifth of 1%. Fish catches are beginning to decline around the world, for the first time in recorded history.[12] In the Asia-Pacific, fishery yields are on track to hit zero by 2048.[13]

Most of this is due to aggressive overfishing: just as with agriculture, corporations have turned fishing into an act of warfare, using industrial megatrawlers to scrape the seafloor in their hunt for increasingly scarce fish, hauling up hundreds of species in order to catch the few that have 'market value', turning coral gardens and colourful ecosystems into lifeless plains in the process. Whole ocean landscapes have been decimated in the scramble for profit. But there are also other forces at work. Farming chemicals like nitrogen and phosphorous are flowing into rivers and ending up in the sea, creating giant algae blooms that cut off oxygen to the ecosystems that lie beneath them. Vast 'dead zones' sprawl along the coastlines of industrialised regions like Europe and the United States. Once churning with life, many of our seas are becoming eerily empty, populated more by plastic than by fish.

Oceans are also being affected by climate change. More than 90% of the heat from global warming gets absorbed into the

sea.[14] Oceans act like a buffer, protecting us from the worst effects of our emissions. But they are suffering as a result: as oceans heat up, nutrient cycles are being disrupted, food chains broken, and vast stretches of marine habitat are dying off.[15] At the same time, carbon emissions are causing oceans to become more acidic. This is a problem, because ocean acidification has driven mass extinction events a number of times in the past. It played a major role in the last extinction event, 66 million years ago, when ocean pH dropped by 0.25. That small shift was enough to wipe out 75% of marine species. On our present emissions trajectory, ocean pH will drop by 0.4 by the end of the century.[16] We *know* what's about to happen. We can see it coming. In fact, it's already beginning to play out in real time: marine animals are disappearing at twice the rate that land animals are.[17] Vast coral ecosystems are being bleached into dead, colourless skeletons.[18] Divers have reported that even remote reefs once teeming with life are now plagued by the stench of decomposing flesh.

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What begins as a vague inkling about moths and beetles, the flickers of a childhood memory, turns into a crippling realisation, like a blow to the gut. We are sleepwalking into a mass extinction event – the sixth in our planet's history, and the first to be caused by human economic activity. The rate of extinction is now 1,000 times faster than before the Industrial Revolution.

A few years ago, virtually no one was talking about this. Like my dad with his insect stories, everyone just assumed that the web of life would always be intact. Now the situation is so severe that the United Nations has set up a special task force to monitor it: the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). In 2019 it published its

first comprehensive report – a groundbreaking assessment of the planet's living species, drawing on 15,000 studies from around the world and representing the consensus of hundreds of scientists. It found an accelerating rate of global biodiversity decline, unprecedented in human history. Around one million species are now at risk of extinction, many within decades.[19]

I keep staring at these numbers, but I can't get them to make any sense. It all feels so surreal, like a fever dream where the world seems strange, unfamiliar and out of proportion. Robert Watson, the Chair of the IPBES, called the UN report 'ominous'. 'The health of ecosystems on which we and all other species depend is deteriorating more rapidly than ever,' he said. 'We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide.' Anne Larigauderie, the IPBES executive secretary, put it even more bluntly: 'We are currently, in a systematic manner, exterminating all non-human living beings.' Scientists are not known for using strong language. They prefer to write in a neutral, objective tone. But reading through these reports, one can't help noticing that many of them have felt compelled to shift registers. A recent study published in the prestigious *Proceedings of the National Academy of Sciences* – a serious, stuffy journal – described the extinction crisis as 'biological annihilation', and concluded that it represents a 'frightening assault on the foundations of human civilisation'. 'Humanity will eventually pay a very high price,' the authors wrote, 'for the decimation of the only assemblage of life that we know of in the universe.'[20]

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This is the thing about ecology: everything is interconnected. It's difficult for us to grasp how this works, because we're used to

thinking of the world in terms of individual parts rather than complex wholes. In fact, that's even how we've been taught to think of ourselves – as individuals. We've forgotten how to pay attention to the relationships between things. Insects necessary for pollination; birds that control crop pests, grubs and worms essential to soil fertility; mangroves that purify water; the corals on which fish populations depend: these living systems are not 'out there', disconnected from humanity. On the contrary: our fates are intertwined. They are, in a real sense, *us*.

It is impossible to adequately understand our ecological crisis with the same reductive thinking that caused it in the first place. This is particularly clear when it comes to climate change. We tend to think about climate change as primarily a matter of temperature. Many people are not particularly concerned about this, because our everyday experience with temperature is that a few degrees doesn't really make that much of a difference. But temperature is just the beginning – it's the loose thread on the sweater.

Some of the consequences of temperature rise are obvious, since we can see and experience them directly. The number of extreme storms that happen each year has doubled since the 1980s.[21] They now hit so frequently that even extraordinary spectacles blur together in our memories. If you remember, 2017 alone clobbered the Americas with some of the most destructive hurricanes on record. Harvey laid waste to huge swathes of Texas; Irma left Barbuda virtually uninhabitable; Maria plunged Puerto Rico into months of darkness, and wiped out 80% of the island's crops. These were Category 5 hurricanes – the most severe type. Storms like these should happen only once in a generation. But in 2017 they rolled in one after another, leaving mayhem and destruction in their wake.

Rising temperatures have also triggered deadly heatwaves. The heatwave that struck Europe in 2003 killed a staggering 70,000 people in just a few days. France was hit hardest, with temperatures soaring over 40°C for more than a week. Wheat crops declined by 10% as drought ravaged the continent. Moldova saw its whole harvest decimated. Three years later it happened again, breaking temperature records across northern Europe. In 2015, heatwaves in India and Pakistan sustained temperatures over 45°C and killed more than 5,000 people. In 2017, a heatwave across Portugal triggered wildfires that ripped through the country's forests. Roads became graveyards as people roasted to death in their cars while trying to flee. Smoke blackened the skies as far away as London. In 2020, bush fires in Australia forced people to take refuge on beaches, in scenes reminiscent of an apocalyptic film. As many as one billion wild animals were killed. Horrific images emerged of landscapes strewn with charred kangaroos and koalas.

Events like these feel real and tangible. They become media headlines. But the more dangerous aspects of climate change do not. At least not yet. So far we've only barely breached 1°C over pre-industrial levels. On our current trajectory, as of 2020, we are on track to reach a rise of up to 4°C by the end of the century. If we factor in countries' pledges to cut emissions under the Paris Agreement – which are voluntary and non-binding – global temperatures will still rise by as much as 3.3°C. These are not incremental changes. Humans have never lived on such a planet. That deadly heatwave that struck Europe in 2003? That will be a normal summer. Spain, Italy and Greece will turn into deserts, with climates more like the Sahara than the Mediterranean as we know it. The Middle East will be cast into permanent drought.

At the same time, rising seas will change our world almost beyond recognition. So far, sea levels are up about 20cm since

1900. Even this apparently small rise has made flooding more frequent and storm surges more dangerous. When Hurricane Michael smashed into the United States in 2018, it brought a 14-foot surge that turned parts of the Florida coastline into a hellscape of shattered houses and twisted metal. If we carry on with business as usual, all of this will get much worse. In fact, even if we meet the Paris goal of keeping temperature rises to no more than 2°C , sea levels are projected to go up another 30 to 90cm by the end of the century.[22] Given the damage that 20cm has caused, it's difficult to imagine what things will be like when it's up to four times higher than it is right now. The storm surges alone will be catastrophic. The wall of waves unleashed by Hurricane Michael will seem quaint by comparison. And if temperatures rise by 3°C or 4°C, sea levels will go up by as much as 100cm, and possibly 200cm. Many of the planet's coastal regions will be underwater. Much of Bangladesh, home to 164 million people, will disappear. Cities like New York and Amsterdam will be permanently flooded, as will Jakarta, Miami, Rio and Osaka. Countless people will be forced to flee their homes. All this century.

And yet, as disastrous as all of this will be, perhaps the most concerning impact of climate change has to do with something much more quotidian: food. Half of Asia's population depends on water that flows from Himalayan glaciers – not only for drinking and other household needs but also for agriculture. For thousands of years, the run-off from those glaciers has been replenished each year by new ice. But now the ice is melting faster than it is being replaced. If we hit 3°C or 4°C of warming, most of those glaciers will be gone before the end of the century, ripping the heart out of the region's food system and leaving 800 million people in trouble. In southern Europe, Iraq, Syria and much of the rest of the Middle East, extreme droughts and desertification will render whole regions inhospitable to agriculture. Major food-growing

regions in the US and China will also take a hit. According to NASA, droughts in the American plains and in the South-west could turn these regions into dust bowls.[23]

As a handy rule of thumb, scientists say that for every degree we heat the planet, the yields of staple cereal crops will decline by 10%.[24] On our present trajectory, that means losses of up to 30% this century. In some cases it will be worse: Indian wheat and US corn could plummet by as much as 60%.[25] Under normal circumstances, regional food shortages can be covered by surpluses from elsewhere on the planet. But climate breakdown could trigger shortages on multiple continents at once. According to the Intergovernmental Panel on Climate Change (IPCC), warming more than 2 degrees is likely to cause 'sustained food supply disruptions globally'. As one of the lead authors of the report put it: 'The potential risk of multi-breadbasket failure is increasing.' Add this to soil depletion, pollinator die-off and fishery collapse, and we're looking at spiralling food emergencies.

This will have serious implications for global political stability. Regions affected by food shortages will see mass displacement as people migrate in search of stable food supplies. In fact, it's happening already.[26] Many of those fleeing places like Guatemala and Somalia are doing so because their farms are no longer viable. The international system is already straining, with 65 million people displaced from their homes by wars and droughts – more than at any time since the Second World War. As migration pressures build, politics are becoming more polarised, fascist movements are on the march, and international alliances are beginning to fray. Factor in escalating displacement due to famines, storms and rising seas, plus dwindling arable farmland, and there's no predicting what conflagrations might occur.

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Ecosystems are complex networks. They can be remarkably resilient under stress, but when certain key nodes begin to fail, knock-on effects reverberate through the web of life. This is how mass extinction events unfolded in the past. It's not the external shock that does it – the meteor or the volcano: it's the cascade of internal failures that follows. It can be difficult to predict how this kind of thing plays out. Things like tipping points and feedback loops make everything much riskier than it otherwise might be. This is what makes climate breakdown so concerning.

Take the polar ice caps, for example. Ice functions like a giant reflector, bouncing light from the sun back out into space. This is known as the albedo effect. But as ice sheets disappear and reveal the darker landscapes and oceans beneath, all that solar energy gets absorbed and radiated as heat into the atmosphere. This drives yet further warming, which causes the ice to melt even faster – completely irrespective of human emissions. In the 1980s, Arctic sea ice covered an average of about 7 million square kilometres. As I write this it's down to about 4 million.

Feedback loops affect forests, too. As the planet heats up, forests become drier and more vulnerable to fire. When forests burn they release carbon into the atmosphere, and we lose them as a sink for future emissions. This exacerbates global warming, but it also has a direct impact on rainfall. Forests literally *produce* rain. The Amazon, for instance, exhales some 20 billion tons of water vapour into the atmosphere every day, like an enormous river flowing invisibly into the sky. Much of it ends up raining back down onto the forest, but it also produces rain much further afield – across South America and even as far north as Canada. Forests are critical to our planet's circulatory system; they are like giant hearts that pump life-giving water around the world.[27] As forests die off, droughts become more common, and forests in turn become yet more vulnerable to fire. The speed at which this is happening is frightening.

On our current trajectory, most rainforests will wither away into savannah before the end of this century.

In some cases, tipping points work so rapidly that whole systems can collapse in a very short period of time. Scientists worry in particular about a phenomenon known as marine ice-cliff instability. In the past, most climate models have assumed that even if global warming locks in the total melting of the West Antarctic ice sheet, the process of disintegration will stretch out over a couple of centuries. But in 2016, two American scientists – Rob DeConto and David Pollard – published an article in the journal *Nature* pointing out that it may well happen a lot faster. Ice sheets are thicker in the middle than they are around the edges, so as icebergs break off they expose taller and taller ice cliffs. This is a problem, because taller ice cliffs can't support their own weight: once they're exposed they begin to buckle, one after the other, in a domino effect, like skyscrapers collapsing. This could cause ice sheets to disintegrate not in centuries but decades – perhaps as little as twenty to fifty years.[28]

If this plays out, the West Antarctic ice sheet alone could add another metre or more to sea-level rise, in our lifetime. If the same thing happens to Greenland, it would be worse still. The world's coastal cities would be submerged so fast there would be little time for adaptation. Kolkata, Shanghai, Mumbai and London – all would be swamped, along with much of the world's economic infrastructure. It would be a catastrophe of almost unimaginable scale. And we know this can happen, because it's happened before. It happened at the end of the last ice age, in fact. Scientists who study ice-cliff dynamics have been loudly critical of governments for not accounting for this risk in their climate models.

All of this complexity opens up real questions about our ability to control global temperatures. Some scientists worry we may not be able to 'park' temperature increases at 2 degrees, as the Paris Agreement assumes. If we heat to 2 degrees, we might trigger cascades that could spiral out of control and push the Earth into a permanent 'hothouse state'. Temperatures could soar far above the target threshold, and we would be utterly powerless to stop it.[29] In light of these risks, the only rational response is to do everything possible to keep warming to no more than 1.5°C. And that means cutting global emissions to zero much, much faster than anyone is presently planning.

We used our allotted exercise time for walks, during which she would help me work through ideas and sharpen arguments and find narrative arcs, while we watched grey winter give way to the tender leaves and blossoms of spring. This book – and especially its final chapter – represents a shared intellectual journey. I am endlessly grateful for her wisdom, insight, companionship, and her unflagging ability to see through every ruse that our culture has going. She sharpens me every day.

Early in 2012, Guddi and I attended a public lecture by Paul Krugman at the LSE. It was during the Great Recession, and Krugman argued that the United States needed a massive government stimulus to get growth going again. As we walked home, Guddi wondered aloud whether the US, one of the richest nations in the world, really required more GDP, when so many nations do so much better on all the indicators that really matter, with much less. Do high-income economies really need to keep growing, forever? Toward what end? I responded with all the usual mantras – how growth is essential to a healthy economy and all that. But the question unsettled me. I still remember, during the quietness that followed, realising that I was just repeating things that had been told to me, without actually thinking for myself. That conversation was the beginning of the eight-year journey that led to this book.

There is nothing more powerful than a question.

Endnotes

Introduction: Welcome to the Anthropocene

1 Damian Carrington, 'Warning of 'ecological Armageddon' after dramatic plunge in insect numbers,' *Guardian*, 2017.

2 Patrick Barkham, 'Europe faces 'biodiversity oblivion' after collapse in French birds, experts warn,' *Guardian*, 2018.

3 Roel Van Klink et al., 'Meta-analysis reveals declines in terrestrial but increases in freshwater insect abundances,' *Science* 368(6489), 2020, pp. 417–420. The study indicated that freshwater insect abundances were increasing, although these claims were questioned in the same journal: Marion Desquilbet et al., *Science* 370(6523), 2020.

4 IPBES, *Global Assessment Report on Biodiversity and Ecosystem Services*, 2019. Some estimates indicate that as much as 40% of insect species may be at risk of extinction. Responding to these claims, Josef Settele, co-chair of the IPBES report, said: 'Forty per cent might be too high, and 10% in our global assessment is too low, but this is the range.' See Ajit Niranjan, 'Insects are dying and nobody knows how fast,' *DW*, 2020. The dearth of robust historical data makes longitudinal assessment difficult. And biomass trends may fluctuate: one study found that in Britain moth biomass increased from 1967 to 1982, and has declined steadily since then. See Callum Macgregor et al., 'Moth biomass increases and decreases over 50 years in Britain,' *Nature Ecology & Evolution* 3, 2019, pp. 1645–1649.

5 Rachel Kehoe et al., 'Cascading extinctions as a hidden driver of insect decline,' *Ecological Entomology* 46(4), 2021, pp. 743–756.

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7 David Wagner et al., 'Insect decline in the Anthropocene: Death by a thousand cuts,' *Proceedings of the National Academy of Sciences* 118(2), 2021.

8 IPCC, *Special Report: Climate Change and Land*, 2018.

9 Robert Blakemore, 'Critical decline of earthworms from organic origins under intensive, humic SOM-depleting agriculture,' *Soil Systems* 2(2), 2018.

10 Global Commission on the Economy and Climate, 'Food and Land Use,' 2018.

11 Chris Arsenault, 'Only 60 years of farming left if soil degradation continues,' *Scientific American*, 2014.

12 Daniel Pauly and Dirk Zeller, 'Catch reconstructions reveal that global marine fisheries catches are higher than reported and declining,' *Nature Communications* 7, 2016.

13 Jonathan Watts, 'Destruction of nature as dangerous as climate change, scientists warn,' *Guardian*, 2018. One might hope that we can replace declining catches with fish farms, but it's not quite so simple. Every ton of farmed fish needs as much as five tons of wild fish to be trawled up and ground into feed. And fish farms involve heavy use of medicines and chemical disinfectants, which are already a major source of marine pollution. See John Vidal, 'Salmon farming in crisis,' *Guardian*, 2017.

14 We've reached the point where we're dropping the equivalent of six atomic bombs' worth of heat into the sea every second. Damian Carrington, 'Global warming of oceans equivalent to an atomic bomb per second,' *Guardian*, 2019.

15 Marine life depends on temperature gradients that circulate nutrients from the seafloor to the surface. As oceans warm, those gradients are breaking down and nutrient cycles are stagnating.

16 Damian Carrington, 'Ocean acidification can cause mass extinctions, fossils reveal,' *Guardian*, 2019.

17 Malin Pinsky et al., 'Greater vulnerability to warming of marine versus terrestrial ectotherms,' *Nature* 569(7754), 2019, pp. 108–111.

18 Bärbel Hönisch et al., 'The geological record of ocean acidification,' *Science* 335(6072), 2012, pp. 1058–1063. Coral reefs support a quarter of all ocean life, including species that are crucial to human food systems. Half a billion people rely on coral ecosystems for food. See David Wallace-Wells, 'The Uninhabitable Earth,' *New York* magazine, 2017.

19 IPBES, *Global Assessment Report on Biodiversity and Ecosystem Services*, 2019.

20 Gerardo Ceballos et al., 'Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines,' *Proceedings of the National Academy of Sciences* 114(30), 2017.

21 According to the European Academies' Science Advisory Council.

22 IPCC, *Special Report: Global Warming of 1.5°C*, 2018.

23 NASA, 'NASA study finds carbon emissions could dramatically increase risk of US megadroughts,' 2015.

24 David Battisti and Rosamond Naylor, 'Historical warnings of future food insecurity with unprecedented seasonal heat,' *Science* 323(5911), 2009, pp. 240–244.

25 World Bank, *Turn Down the Heat: Why a 4°C Warmer World Must Be Avoided*, working paper 7445 (Washington, DC: World Bank, 2012).

26 Deepak Ray, 'Climate change is affecting crop yields and reducing global food supplies,' *Conversation*, 2019.

27 Ferris Jabr, 'The Earth is just as alive as you are,' *New York Times*, 2019.

28 Robert DeConto and David Pollard, 'Contribution of Antarctica to past and future sea-level rise,' *Nature* 531(7596), 2016, pp. 591–597.

29 Will Steffen et al., 'Trajectories of the Earth System in the Anthropocene,' *Proceedings of the National Academy of Sciences* 115(33), 2018, p. 8252–8259.

30 Timothy Morton, *Being Ecological* (Penguin, 2018).

31 Growth is not the *only* distinguishing feature of capitalism, of course. Proletarian wage labour and 'private property' (i.e., exclusive control over the means of production) are also key features. But when it comes to the question of capital's relationship with ecology, growth is the feature that matters. Of course, a number of socialist regimes in the twentieth century also pursued growth. The USSR, for instance, was utterly growth-obsessed. In this respect it had a kind of state capitalist character (being organised around surplus and reinvestment for the sake of expansion), which is one of the reasons that it does not offer a meaningful alternative to our present crisis.