A World at Tipping Point

How Bad Can It Get?

Translation: Lucy Moffatt 2020

FOREWORD

Loss of diversity, burning forests, rising oceans, storms and heat waves: some fear all this could lead to humanity's extinction. But the majority here in the privileged north seem to think that it will sort itself out and that there is little we can do about the matter anyway. We face threatening and complex problems – and a wealth of contradictory messages. But what is true, untrue and uncertain, and how does it all fit together? What do we know and what do we believe?

We face two principle challenges: constantly shrinking nature and constantly rising climate gases. Both tendencies are linked to growth in a population whose consumption is constantly growing, at both the individual and collective level. In this book, I try to present each of these problems in turn before interweaving them in the context of the great question of purpose, meaning and the future of our planet in the light of eternity. Since the literature on this topic is endless and few have read the reports of both the UN Nature Panel and the UN Climate Panel, I offer a personal conclusion: the world will not end, we humans will not die out, but we are heading towards tough times. There are no quick fixes and we cannot grow our way out of the problems. Nor will CO_2-free energy alone be sufficient because our footprint on the planet is about so much more than carbon emissions in the atmosphere.

On the threshold of the Anthropocene, we face a situation that is fundamentally new in our history – and one that we are evolutionarily, psychologically, socially and politically unequipped to deal with; yet we must. It is easy to answer *why*. There is broad consensus in this respect. *How* we are to do it is more difficult, however. In this case there are many, sometimes contradictory, answers.

This is also an existential question that reduces all the other issues we argue about to trifles. If we are to have a meaningful existence, we must be able to envisage a planet that offers both *Homo sapiens* and the five to ten million other species with which we share the Earth the potential to live full lives. The significance of the time horizon over which we observe this meaning is subjective: some people are mostly concerned about conditions on Earth during their own lifetime; for others, a thousand years ahead will seem like oceans of time, and the state of the planet in 3020 almost irrelevant. Others will think, like me, that the premise for a habitable planet must apply for the foreseeable future.

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It sounds dramatic to speak of a world at tipping point, but strong language is sometimes necessary. In fact, there are a number of potential tipping points in ecosystems and climate systems, a question we will return to in due course. It is crucial to avoid each and every one of these potential tipping points because they can, in the worst case, be triggered by one another, causing cumulative global changes that we really do not want.

At the same time, we can see that awareness of this risk is growing. In the best case, this will lead to socio-cultural, political and economic tipping points that are beneficial for the planet. However, a formidable systemic inertia must be overcome if we are to achieve something like this. And this is particularly obvious in a rich country like Norway, where few wish to give up what they perceive as almost time-honoured privileges. In all humility, the aim of this book is to give us a little shove in the right direction.

Although this cannot be said to be an especially optimistic book, it is not entirely doom-laden either. Its goal is twofold, and I acknowledge that the balance here is difficult. It is important on the one hand to state the gravity of the situation clearly, but on the other to say that we aren't "heading over the cliff". The use of tipping points as a metaphor may give the impression that the *race is run*. It is not, but the whole point is to try to prevent things from going from bad to worse. The reader must forgive me for repeating this and a couple of other central messages in the text: it is better to say this kind of thing one time too many than one time too few.

I am grateful to my editor Halvor Finess Tretvoll for his enthusiastic support and thorough reviews, and to Bjørn H. Samset for reading through the book and making helpful contributions to the chapter on climate. Although this book is based on the facts insofar as we know them, some subjective judgements are, of course, offered along the way. I would therefore stress that I am solely responsible for this content.

This book was launched just as the Covid-19 virus entered the global stage, and the pressing question, "how bad can it get?", naturally applied to the ongoing pandemic too. As with the climate, nobody can really tell. We do know that it, like all pandemics, will end within the near future, but will likely have an extended economic aftermath. It remains to be seen whether there will also be an ecological aftermath – or, more precisely, what kind of lessons can be learned.

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Clearly the corona crisis is perceived as a genuine crisis (with good reason), whereas the climate crisis, although more threatening in the long run, is apparently not. This is of course understandable; after all, there are differences in terms of speed and the risk of immediate personal suffering. However, since the origin of this and many other epidemics is related to the degradation of wildlife habitats, consumption of "bush meat" and the treatment of animals, there is a very relevant link between the corona crisis and some of the consequences of the ongoing destruction of nature. Even more relevant is the question of the likely impacts this will have on local pollution and global climate, post-corona. Air traffic and pollution have dropped dramatically, which raises the question of whether this situation could promote some sorts of ultimate tipping points towards a greener world at the other end of the epidemic, or whether we will simply shift back to coal, oil and business as usual – or even worse than usual – in order to get the economy back on track. This is perhaps a 50:50 situation, where we could tip in either direction. The financial crisis in 2008-2009 was a missed opportunity for change: the world rapidly returned to business as usual. Today the situation is different in terms of both mentality and technology, but will we be able to seize this opportunity when the global economy cracks? These topics will be covered in a new epilogue in later editions of this book.

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1. LEAVING THE IVORY TOWER

The Roar

On Friday 30th August 2019 thousands of us gathered outside the Norwegian parliament building for the *Climate Roar*. A roar may not be a sophisticated way of arguing, but many of us have been arguing in a sober, knowledge-based manner for many years without getting our message across. So now and then it is tempting to abandon restrained objectivity. Roaring offers an effective emotional outlet. It expresses a combination of frustration and anxiety.

Many people nowadays feel anxiety about what lies ahead. The Amazon and Australia are burning, the Greenland ice is melting, extreme weather and heat waves are raging. The oceans are full of plastic, while insects, birds and amphibians – indeed most animals – are in sharp decline. All these may seem like signs of the end times. As a result, adults are anxious about the future of their children, while children feel they *have* no future. Young people are doubtful about whether to have children themselves. It is in this situation that Greta Thunberg has emerged as a latter-day Messiah for the climate and the planet. Terms like *climate crisis* and *ecological collapse* dominate the agenda – for many people. But how justified are such ideas? And will this awakening last?

There is currently a broad political consensus that we must keep global temperature increases below 1.5 or 2 degrees to avoid dangerous, self-reinforcing feedback in the climate systems. However, the timeframe until these thresholds are exceeded is short. Will we manage to communicate this in a way that creates the *political*, *social* and *technological* tipping points necessary to achieve it?

Some people, of course, think that the main problem we are facing is mass hysteria; that we are being subjected to fear-mongering and doomsday prophecies, and that the climate activists are staking our welfare society on some extremely uncertain environmental gains. After all, isn't the world constantly progressing? Haven't environmental pessimists from Thomas Robert Malthus onward been debunked time after time?

As Hans Rosling points out in *Factfulness* (2018), the world has clearly become a better place for most of us.[1] We live richer, longer lives today than ever before. We

[1] Rosling (2018).

have better health, greater freedom and much less gruelling lives than our forebears or even our grandparents. In our part of the world we also seem to enjoy a cushioned and almost risk-free existence. We have found a recipe for success: economic growth. If we are still concerned about the environment, people often claim that economic growth may also provide the *solution* to the problem. How else can we afford the green shift? After all, solar cell technology and wind turbines don't grow on trees... This book is a response to those who automatically respond "more growth" to all the complicated questions about the future environment.

The growth optimists' argument that our lives are constantly improving is probably true for large parts of the world's population. However, the argument is based on some problematic assumptions, such as that humanity is the ultimate purpose of everything. This assumption bears challenging. If all other life forms on Earth, with the possible exception of our dogs, cats and other privileged domestic animals, were able to express their views, *they* would be unlikely to conclude that the world has become a better place. For most other life forms on our planet, growth – our growth – has, on the contrary, made *their* existence worse.

Besides, no growth is infinite. That applies to ours too. Human society draws sustenance from a nature that is shrinking and that is why it is far from a foregone conclusion that continued growth will lead to a better life ad infinitum – for us either. On the contrary: there is much to suggest that people in our corner of the world long ago reached a level where the recipe for a joyful and meaningful life no longer lies in increased purchasing power. Continued growth has instead become a means of sustaining the economic system. As long as we cling onto the expectation that growth is something akin to a law of nature and that, in addition, today will resemble yesterday, it is difficult to imagine that tomorrow will be dramatically different. At the same time, dissatisfaction is linked to expectations rather than actual standards of living. The gap in expectations between desired and possible growth is one of the many disparities we need to overcome.

Until recently, these seemed like abstract problems to most of us. And even now, despite the bombardment of climate news, not all of us accept the argument that a non-toxic, invisible, odourless gas that accounts for less than 0.05 per cent of the air around us could be a threat to our existence either. As climate change sceptics are fond of pointing out, all plant growth depends on CO_2 – and we, of course, depend on plants. By this logic, more CO_2 is therefore good news. And to tell the truth, who

would turn their nose up at the prospect of a bit less cold and frost in this barren country in the north? At the same time, it is notoriously difficult to engage both sides of the brain with curves and numbers that link temperature rises to increased CO_2 concentrations in the atmosphere, no matter how irrefutable the underlying data is. We see the whole world through our personal, and often also ideological, lens. Since there are plenty of alternative truths to choose from, some people end up with an understanding of reality that conflicts with the findings of science. We filter everything we read and hear, just as our politicians cherry-pick science when they argue for one cause or another. This happens in most political debates and with most people more or less consciously. If you are surrounded only by people who think the same way you do, this reinforces your conviction that other people are the ones who have failed to understand how the world fits together. Nowadays, the digital echo chamber is a safe haven for anybody seeking confirmation of their own world view. This enables us to avoid any conflicting opinions or challenging truths.

Yet I would be the first to admit that the environmentally concerned can also find themselves in echo chambers, and that neither the climate system nor natural diversity are areas where clear and unambiguous answers are always to be found. We do know a lot, but we also believe a lot. This book is an attempt to offer an expert assessment of the status quo – and what lies ahead of us. Put briefly, the following urgent question presents itself: How bad can it get?

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Research shows that …

In summer 1988 the US was plagued by an unusual heat wave. It was like a forewarning of a state that would soon become increasingly common. The crops withered, the forests burned, the mighty Mississippi shrank to an average-sized river and crisis was declared in half of the US. In parallel to this, NASA scientist James Hansen reached the conclusion that we were seriously in the process of altering the planet's climate.[2]

Hansen's theory was not based on a single summer of drought but on data he had been working with for years. The heat and drought nonetheless came at an opportune moment because they assured the scientist a pass into the senate where he testified at a congressional hearing. The date itself was chosen to coincide with a forecast temperature spike in Washington. 28th June 1988 proved to be the ideal date: it was 38 degrees Celsius when Hansen appeared before a sweating Senate Committee for Energy and Natural Resources and 15 TV cameras to present his message, with no beating about the bush. He pointed out that 1988, the extreme year, was the hottest year on record; at the same time, he forecast that extreme years would start to occur with increasing frequency. The extremes would also become increasingly extreme he said. There was a logical reason for this: the dramatic temperature fluctuations were caused by our CO_2 emissions.

Hansen's testimony was courageous beyond belief. It brought a full measure of seriousness to the climate debate. Nobody had expected such tough talk from a NASA scientist and that hot June day proved to be a watershed. We had known for 120 years that burning fossil fuel caused temperature increases. For a long time, however, this "we" consisted solely of a limited circle of scientists. From the early 1960s, the knowledge was supplemented by concrete readings that demonstrated an actual increase in CO_2 levels – this, too, accompanied by ever-clearer warnings – and, eventually, a broader acceptance by more people. In 1988, it was no longer possible to shut one's eyes to it.

The year before Hansen's testimony, the Brundtland Commission's more general United Nations' report on sustainability was published. It was less "dangerous", than the NASA scientist's testimony to the Senate, not least because it assured world leaders that continued economic growth was the solution to the

[2] Hansen (2011)

problems – although it was otherwise clear that "the time has come to break out of past patterns". However, the change of course envisaged still fell within familiar parameters. Former Norwegian prime minister Gro Harlem Brundtland's own domestic policy mantra was to *steer a steady course*. This has, in essence, been the very hallmark of Norwegian environmental policy: broadly speaking, Norway's contribution has involved an active foreign policy stance – spending billions on the rainforests and adopting a combative line in international climate negotiations – but at home, it has tended to carry on as usual or to buy its way out of unpleasant choices. Indeed this has been the main line of approach in most other countries. In the past 30 or so years – in other words the years since Hansen's testimony – people have repeated "we know enough to act" ad nauseam. And a certain amount of action has undoubtedly taken place too, but it has so far been half-hearted compared with all the other activity that has contributed to the implacable, continued rise in CO_2 levels.

The NASA scientist's warnings have since been adjusted slightly, but time has shown that his analyses were, by and large, correct. Nowadays, his concern is shared by most others who are active in climate science. So why haven't more people taken to the barricades? What could conceivably be a more important use of one's life than protecting the planet and humanity from devastating climate change? There is no lack of scientific articles about the link between CO_2 emissions and rising temperatures. A quick search on Google Scholar yields 40,000 academic articles about the climate, almost all related to climate change. The majority probably also contain implicit or explicit warnings. Yet few have followed Hansen's example – until fairly recently at any rate. Perhaps the experiences of Hansen – and Michael E. Mann as well – have deterred so many from raising their voices.

Mann was the climate scientist responsible for the famous hockey stick graph, which showed a rapid temperature rise in modern times, in stark contrast to a more stable and much lower temperature in earlier times. The storm and harassment that Mann and his colleagues met when they published their finding could have provided material enough for a separate book – and indeed it did: it is well worth delving into Mann's *The Hockey Stick and the Climate Wars* as a science history account of the "the climate war".[3] Even the comparatively mild breeze Norwegian climate scientists experience if they stick their necks out can be so unpleasant that people opt to avoid

[3] Mann (2012)

the public spotlight. I have no idea how many hours of my own scientific life I have spent on debates with creationists and climate change sceptics (not that I am putting them in the same basket), but there have been *plenty*. Taking to the barricades on important issues is part of our duty as academics too, sometimes our most important duty. Disagreement is also in the spirit of science – as long as it involves expert and objective disagreement and debate.

At the same time, there is a culture of caution in academia. This culture should not be interpreted as cowardice, since climate systems *are* complex and nobody commands a full overview. When it comes to prognoses, moreover, uncertainty is multiplied by two unknown factors: how will society respond and how will nature respond? In this messy terrain, many feel that yelling out a confident message is at odds with the nature of science. Nonetheless, it seems fairly obvious today that certain roars are necessary – even from scientific quarters.

A rather telling comic strip shows a young scientist eagerly talking about possible climate change in the 1980s. Ten years later – in the next panel – the same scientist appears again, saying that the development is a fact, that time is short and that it is now a matter of "rolling up our sleeves and getting to work". A further ten years go by and a somewhat older scientist confirms that little has happened in the intervening time, other than that the world has followed precisely the route he warned against. So something needs to happen quickly. After ten more years, a greying scientist with a somewhat resigned expression says that time is short unless we act immediately.

Authors and artists often provide the sharpest and bleakest depictions of the future. In their work, we sometimes encounter a post-apocalyptic dystopia in which shabby people have retreated to the world we laboriously struggled to escape. In these dystopias, the planet is devastated and people fight over the scarce remaining resources. The veneer of our civilisation has crumbled. All that lies beneath it is the law of the jungle: the principle that might is right.

Of course these sorts of portrayals have no weight of obligation. They are artistic expressions of worst-case scenarios and their mission is to be just that. They may be wake-up calls but they don't scare people out of their wits, or make them lose any sleep or their vital spark, because we know they are only fiction. Although it is in the nature of these cultural expressions to exaggerate, it is unfortunate if the message is perceived as pure fantasy, while science is only communicated in subdued tones in

closed fora, at conferences or in weighty academic journals in technical accountancy-speak. Because if we hold a steady course, science will eventually verge on science fiction.

Might it not be the case that scientists are consciously restrained? Are they – or we, I should say — sparing the world from the grim truth? Or is it conceivable that the picture isn't quite as pitch black as one might be led to believe, and that the world offers more in the way of "both this and that" than "either/or"? In her recent book, *Discerning Experts*, Naomi Oreskes and her co-authors claim that scientists consciously understate the gravity of the situation currently facing us.[4] In other words, their conclusion is the polar opposite of what climate sceptics generally assert: that scientists notoriously exaggerate because they are seeking attention and research funds or because they are locked into their echo chambers and impervious to counter-arguments. Oreskes has reviewed a series of research-based forecasts and found that scientists generally express themselves too conservatively and cautiously.

Part of the reason for this caution is the need for consensus about the material presented. This applies, in particular, to studies with several co-authors – which are, after all, common these days. It also applies to the IPCC reports, which involve a large number of authors from extremely different backgrounds. It is easier to reach consensus about a toned-down conclusion than about one that is bold and forthright. Where the majority assume that an estimate is between 0 and 10, while some think it could be 50 or even 100, consensus quickly becomes a unanimous 0–10. The long tail of more extreme estimates tends to be eliminated in processes like this.

For a scientist, there is clearly also a greater risk attached to using strong language that is usually the preserve of interest groups, lobbyists or dystopian artists. If there is one thing scientists want to avoid, it is being labelled "alarmists". This is precisely why people often speak with inside voices even when outside voices would be more appropriate.

[4] Oppenheimer, Oreskes et al (2019)

Down from the Ivory Tower

Scientists as a group are at least as heterogeneous as any other professional grouping and even an unswerving principle of scientific neutrality cannot entirely compensate for the fact that scientists are also influenced by personal opinions. This applies, at any rate, when there is room for nuances and interpretations – which there pretty much always is. And that is precisely why it is worth taking note of near-unanimous agreement over how profoundly worrying the state of the world's nature and climate has become. Nowadays the variations lie in the way people communicate rather than in their understanding of the underlying gravity.

Even in circles of sober scientists, desperation is spreading about how little is happening and the fact that the suggested solutions are so often of a kind that cause environmental problems other than those they were introduced to solve. A few are now doing what James Hansen did. Others demonstrate their concern in different ways. The prestigious journal *Nature*, for example, published a piece by lawyer Farhana Yamin in autumn 2019[5]. Although she is not a natural science climate researcher, she is very familiar with the climate issue.

Much of her article was reproduced as part of an appeal in the case against Extinction Rebellion, of which Yamin is also a member, and which took place at Oslo District Court in late September 2019.

> My name is Farhana Yamin. I am a British citizen living in London. I am an international climate change lawyer, an activist and am associated with the Royal Institute of International Affairs at Chatham House in London. I have been the lead author on three of the five main reports by the UN's Climate Panel and I have been a consultant for the UN's climate negotiations for nearly 30 years. I was legal adviser to the Alliance of Small Island States for the Kyoto Protocol and adviser to the Republic of the Marshall Islands in the work leading up to the Paris Agreement in 2015. I am also the founder of Track-Zero, a charitable organisation that promotes the aim of achieving net zero emissions by 2050 at latest. I am addressing the court on the question of the extent to which non-violent civil disobedience is required to secure

[5].Yamin (2019)

> sufficient efforts from governments to combat the civilisation-threatening results of human-induced global warming and ensuing climate change.

Yamin wrote this after herself taking part in a protest in which she literally glued herself to the pavement outside the headquarters of Shell Oil Company.
"Why did I break the law when I am an international lawyer in the field of environmental law?" she asks in the text, before answering herself: "After three decades of failing to get governments to focus their attention on the climate crisis by influencing decision-making at the very highest level, I felt obliged to take peaceful direct action." The demand for this kind of engagement is something that all of us now face, and all of us must adopt a position on it.

I myself am the head of a centre at the University of Oslo that studies the carbon cycle and the climate. We look at biogeochemical feedback in northern regions. We take readings and make calculations, publish in international journals and teach students from undergraduate to doctorate levels. We rarely raise our voices but do what is expected of us scientists. That is all well and good, but sometimes I feel that it is not enough. The reason for the establishment of our Centre for Biogeochemistry in the Anthropocene was to make a difference in the task of dealing with humanity's greatest challenge. This probably also requires us to step out of our academic comfort zone now and then. How far outside that zone we should go is difficult to tell. There is no simple answer.

I was, for example, part of a group of 25 scientists and cultural figures who signed a declaration in support of the first school strike for the climate.[6] The declaration was organised by Extinction Rebellion and was prefaced with the words: "A crime is being committed against life on Earth. The sixth mass extinction of species is under way, the global ecosystem is heading for collapse if we do not act immediately." It then continued:

> We also know that we can only use a fraction of known fossil fuel reserves if global warming is to be kept below two degrees Celsius. Yet Norway's oil and gas industry continues to build out new fields and explore for fossil fuel deposits in increasingly vulnerable areas. Global and Norwegian emissions of climate gases have increased since the UN Convention on Climate Change

[6] "Vi støtter skolestreiken". Aftenposten, 14.3.2019

> came into force in 1992, despite the fact that there has been consensus about efforts to combat the greenhouse effect for close to forty years. Today, Norway, with its five million inhabitants, is the world's seventh-largest exporter of CO_2 emissions.

In addition to this description of the situation, which is both sober and correct, the declaration contained some phrasing that provoked long and heated debate: "It is therefore our duty to act now, to preserve the safety and wellbeing of our children and to protect life on Earth itself. Conscience and common sense prompt us to declare a rebellion against the government as well as the jointly accountable and hamstrung institutions that threaten our shared future," the text continued, before concluding:

> We hereby declare that the social contract is broken, rendered invalid by the authorities' persistent failure to take the necessary action. We encourage all principled and peaceful citizens to engage in a non-violent rebellion alongside us.
>
> We demand to be heard; we demand that carefully-thought-out solutions to the ongoing ecological crisis be rapidly introduced. And we demand the formation of a council to oversee the execution of the measures necessary to ensure the alteration of our currently catastrophic course.

The declaration was written in an outside voice and contained some wording that people interpreted as non-democratic – if not anti-democratic. It was not intended this way, but democracy must also demonstrate that it is capable of dealing with the environmental problems we are currently knee-deep in. The president of the Norwegian Academy of Science, Hans-Petter Graver, expressed this with admirable clarity in the speech he made at the annual meeting in 2019: "We must have the courage to assert that the existing decision-making system may not be sufficient in the face of the problems raised by the climate challenge."[7]

Naturally, none of us who signed the declaration are anti-democratic. Even so, the claim that we *were* distracted the ensuing debate from the essence of our message, which was to offer support to the pupils' strikes, as well as to the underlying

[7] Speech given at the annual meeting of the Norwegian Academy of Science, 3rd May 2019.

desperation over half-hearted political action of which the strikes are an expression. A more benevolent interpretation would have shown that the declaration was an incitement to rebellion within the bounds of democracy and using the tools of democracy – in the hope that voters, too, would soon wake up. The scientific expert council whose establishment we called for was never intended to be one that would stand above democratically elected bodies but a council with authority that should be expected to be heard, of the kind that already exists in many other countries.

I have no regrets about supporting the declaration, but I would have preferred it to be formulated in such a way that attention was not distracted from the heart of the matter. At the same time, I acknowledge that there is no definitive answer to the question of how to convey the problems we are currently facing, other than that everything *must* be built on knowledge, that what we *know* and what we *believe* must be made clear – and that the communication must become more effective than it has been to date. It is obvious that unless communication engages people emotionally as well, it will fall on stony ground. This is where literature, art and culture are important allies in the battle for the environment. At the same time, scientists must also be able to communicate the gravity with a certain emotional conviction.

Nonetheless, it now seems that we may be approaching a tipping point when it comes to commitment and intensity from scientific quarters. On the occasion of the 40th anniversary of the first international climate conference that was held in Geneva in 1979, 11,000 scientists signed a declaration, which stated that the world risks "untold suffering" as a result of climate change, and that the climate change is accelerating more rapidly than anybody had foreseen.[8] *Untold suffering* is unusual wording for sober academics to use. However, the article reviews – point by point – the reasons justifying such strong language, and concludes: "To secure a sustainable future, we must change how we live. This entails major transformations in the ways our global society functions and interacts with natural ecosystems."

The article also reviewed the current "steady course" trends, with downward arrows for intact nature and species but upward arrows for the consumption of natural resources and climate gas emissions; in addition it considered the course global society needs to take in relation to carbon taxes, de-investment in businesses that destroy nature and decreasing fertility rates if we are to avoid the most severe

[8] Ripple et al (2019).

consequences. It is hardly possible to speak out more clearly, yet it is easy to feel that this, too, is a vain effort.

A Messiah for our Times

Nowadays, people other than scientists are the ones who have mostly been urging if not rebellion then at any rate action on a pretty different scale than we have seen to date.

The school strikes have rippled across the world in the past year, culminating in Greta Thunberg's intense and emotionally charged speech at the UN's climate summit in New York in late September 2019. It was a speech that some compared to Martin Luther King's famous "I have a dream" speech from 1963. Others brushed it aside as the excess emotion of a scared, manipulated child. The truth was that Thunberg communicated the facts but with a drama that created a formidable effect. She herself is clear about serving as a megaphone not only for young people but also for scientists. Yet it is correct to say that there is an apocalyptic tone to both her message and the way she communicates it.

In a society dominated by flickering news, huge headlines and a myriad of loud voices, I am often genuinely in doubt about how the gravity of the situation can be conveyed while preserving the need for nuance and uncertainty. There is as little to gain from excess pessimism as from the eternal, consoling "I'm an optimist" statement that tends to round off any committed speech about climate problems. On the other hand, harsh warnings are not necessarily synonymous with excess pessimism.

Even if neither humanity nor the planet will "perish" or "collapse", as people sometimes say, we must aim higher than mere survival on a damaged planet. That is why it will no longer do to say, "relax – it'll all work out fine." We are not evolutionarily designed to subordinate our own concerns to the good of generations to come but there is no getting away from the fact that we also have a moral duty to those who will inherit the Earth from us. Nor are we evolutionarily equipped for what one might call the *rationality of discounting*. We prefer to harvest our gains today than wait for a greater gain tomorrow. Unfortunately, we are more "here and now" orientated than is good for either the planet or ourselves.

That is precisely why a powerful message is so important, regardless of whether it comes from James Hansen or Greta Thunberg. I believe they spur more people to action. And it is no bad thing if some people are made to feel guilty for their contribution to the wretched state of the planet. There is currently a peculiar fear of pricking people's consciences through "flight shame", "meat shame" or "oil shame." Yet evolution has equipped us with a conscience to enable us to behave well towards others. There are plenty of good things to say about humans, and the fact that we are social animals first and last means that we have developed a series of moral skills as a social compass for functioning in communities.[9] Our conscience is made to be used.

Restrained, serious and fact-based communication is necessary but too many people feel that their only mandate is research and, if necessary, teaching. What's more, the increasing speed and heightened competition in academia also make it convenient to jettison what is commonly called communication but should actually be called social commitment. One crucial argument for maintaining universities as autonomous units with a considerable degree of freedom is precisely to enable them to serve as a critical corrective when necessary, without fear of reprisals from employers or other sources of financing. Are we not in just such a situation now, where academia should constitute a critical corrective? Universities have been too slow to take the lead on environmental issues and are not good enough at taking this seriously in teaching. While it is true that sustainability goals have found their way into strategic planning and now also appear in certain study materials, universities have not so far played a leading role in the battle to "save the world". Maybe this is because we, in an academia ever more driven by competition, are too busy prioritising career-promoting activities.

Knowledge has great credibility and this credibility must be exploited. Although the constant refrain of "research shows…" in political debates often takes the form of cherry-picking, where the results that are highlighted are those that best match one's own view, the situation is different in the case of the two major challenges we are facing: the destruction of the climate and of the natural world. Here, there is broad consensus about where we stand and what we must do. There is also general agreement about what we ought *not* to do. And then there is both professional and personal disagreement about what kinds of measures will be most

[9] Hessen (2017)

effective, and how far the green shift can actually help us; however, an adjustment at the speed we are currently seeing is clearly not sufficient. It is impossible to hammer it home hard enough: *time is short!*

In addition, scientists must guide people through the information jungle, because while it is true that all the information we might wish for or need is just a few keystrokes away, the difficult part is sorting out which information is valuable. Amid this surfeit of information it is always possible to find support for a claim that fits in with what one already believes. How then are we to distinguish between information and disinformation, certainty and uncertainty? How certain and unanimous are scientists in reality? What do we know and what do we believe? This is one of the great challenges of communication about the destruction of climate and nature.

Just as the UN's international climate panel (IPCC) publishes authoritative reports based on the available scientific studies, the UN's nature panel (with its clunky acronym IPBES) was established to provide an authoritative overview of the state of natural diversity in the world. The conclusions and "summary for policymakers" in the IPCC's extensive reports should suffice to convince us of the realities. In this book, we shall look at three of the recent reports in particular. Fewer people will have read the report of the UN's nature panel, which is hardly surprising since the first one is in the process of being published at the time of writing. Even so, many people received the press release in early summer 2019, which announced that a million species may disappear. Now, to call this complex is an understatement. Hardly anyone has insight into more than a limited part of the enormous problems the IPCC and IPBES deal with – not to mention the way they are interlinked through countless cogs, large and small. Nor do I wish to claim that I am in any way familiar with all the nuances, although perhaps enough to try and draw together certain broad lines. The most important thing I want to say is this: the climate and CO_2 are just part of the story of the planet's sustainability. Climate gas emissions are perhaps the most pressing issue today but solving the climate problem alone is not all it will take for us to prevent the foundations of nature, on which we humans also depend, from crumbling.

Although it has been said ad nauseam, allow me to repeat the main point: we are currently living beyond our means and well beyond the planet's capacity to deal with both waste products (including CO_2) and the extraction of both renewable and non-renewable resources. What's more, we have *far* exceeded the limits of what

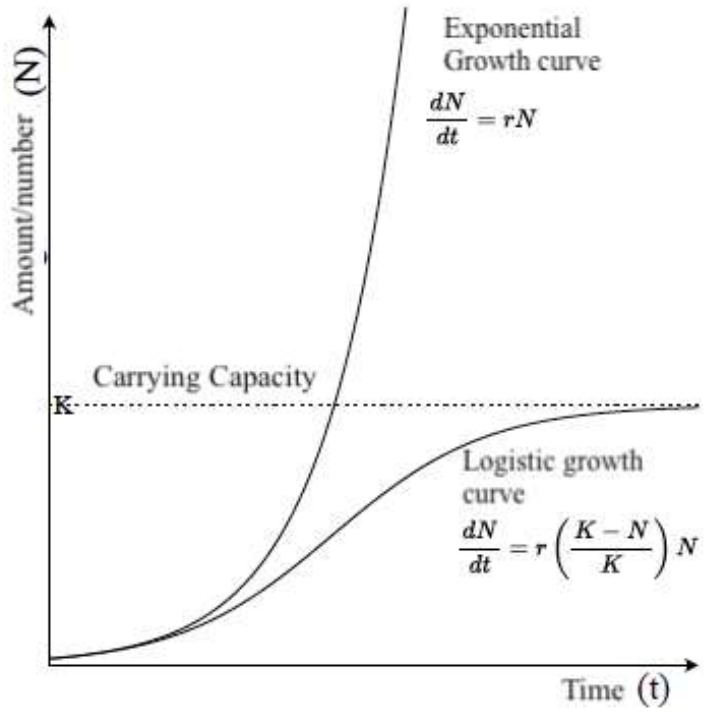
species and ecosystems can cope with. What lies behind all this is the rapidly increasing sum of all our human consumption.

This diagnosis appears to be broadly understood, but the medicine prescribed to date has mostly been cosmetic. Salves and poultices have never been an effective treatment for fever. The question now is whether we have the will and the capacity to alter the lifestyle that is the main cause of the disease, especially if we expect the treatment to be a bitter pill.

CHAPTER TWO: BEYOND OUR MEANS

Malthus and his Disciples

I will present only one diagram in this book; that said, this one diagram encapsulates the essence of the problem we face.



The diagram shows two different paths of growth and their respective mathematical expressions. In one path, unregulated growth leads to an increasingly rapid rise. This curve could, for example, depict the number of individuals in a population, or the sum of all these individuals' consumption if either were permitted unrestricted growth. In the case of the second curve, which is sigmoid (or s-shaped), an additional restriction has been applied: carrying capacity has been introduced as a component of the

equation. This implies that the growth rate will decline once the population (or total consumption) approaches carrying capacity.[10]

This is the most basic diagram used in ecology and it comes from three people: Thomas Robert Malthus, Charles Darwin and Pierre-François Verhulst. One of the key principles of Darwin's theory of evolution assumes that there will always be competition for resources as long as they are limited – which they often are. The limitation may take the form of scarcity of food or other material goods or, for example, scarcity of partners. The larger the population becomes, the more extreme the limitation of most resources. Darwin drew this insight from Thomas Robert Malthus, who published *An Essay on the Principle of Populations* in 1798.[11] Malthus stated that the world (or parts of it) is doomed to famine because the population will always outgrow food production.

Darwin realised that the principle of the birth rate outstripping growth in the resource base was also important for the development of nature in general, and this was the key that enabled him to identify the driving force behind evolution: a competition in which the best adapted individuals are the ones that will have the opportunity to continue their line. Although it may be a matter of chance who ends up with the most favourable inherited traits, it is certainly not a matter of chance who emerges victorious from the competition for resources once these traits have been distributed.

It is worth noting that this did not lead Darwin to conclude that the birth rate should be cut in order to reduce potential famines. Instead, he argued in for the benefits of tough competition – which ensured continued evolution and the development of better-adapted traits. Darwin was himself father to ten children, incidentally. In his magnum opus, he wrote: "Man, like every other animal, has no doubt advanced to his present high condition through a struggle for existence consequent on his rapid multiplication; and if he is to advance still higher he must remain subject to a severe struggle. […] Hence our natural rate of increase, though leading to many and obvious evils, must not be greatly diminished by any means."[12]

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[10] For anybody wishing to grasp the mathematics of this, the expression of the first curve is the derivative of the number over time (dN/dt), r is the growth rate, N is, for example, the number of individuals, while K, which appears in the second equation, is carrying capacity. When the number of individuals increases, the bracketed expression decreases until it becomes 0 when N= K)

[11] Malthus (1798)

[12] Darwin (1871)

Darwin used the elephant to demonstrate that even a species with a slow reproduction rate would, over a foreseeable period, achieve a population size that not even Africa could contain unless the limitation of resources led to a natural decline along the way. The period of time involved is, of course, more dramatic in the case of microorganisms, which have no need to worry about partner selection and sex or waste unnecessary energy on feeding males. This this makes them even better suited to illustrating the principle, which remains the same regardless of whether a species is big or small and reproduces quickly or slowly.

Take one of our most important allies, the gut bacteria *E. coli*, which can divide every 20 minutes in favourable conditions; or its colleague *Proteus vulgaris*, which is even speedier, being able to double itself four times an hour. If you place a bacteria like this in a nutrient medium, you will see nothing for the first hour or two, but then the contents of the petri dish will gradually start to look cloudy. After 36 hours, if their access to resources were unlimited, the bacteria would cover the entire planet in a layer 30 centimetres thick, and after 48 hours the bacteria would have a mass equivalent to that of the planet.

Anybody who knows the story of the inventor of chess – who humbly asked his king to reward him with one grain of rice for the first square, two for the second and a doubling thereafter for each of the 64 squares – will have realised what this is about. It is this same principle the bacteria follow, and this same principle that is expressed in the first of the two curves in the above diagram. For those unfamiliar with the story, 2^{64} grains of rice are required for the final square – far more rice than there is in the entire world. When Trygve Haavelmo received the Nobel Prize in Economy in 1989, he was apparently asked what he would talk about if he were able to spend a quarter of an hour with world leaders. He replied that he would explain to them the principles and consequences of exponential growth. The essential thing about exponential growth is that everything looks fine until it suddenly doesn't – by which time it is too late.

This is the core of the growth problem. Imagine for example that you have made a pond in your garden. It is immaculately clean and clear and also contains plenty of nutrient salts. One day, a pied wagtail sits on the edge of the pond bringing in its feathers a shoot of a tiny single-celled water plant from a neighbouring pond. The plant does what it and all life is designed to do: it grows and splits in two, grows and splits again – now along with its daughter cells. Let's say that they double every

twenty-four hours. After fifty days, the pond will be full. It is transformed into a vegetable soup and no light or nutrients remain. So when was it half-full, its future still seemingly bright and promising for both plants and the pond itself? On day 49…

Malthus inspired not only Darwin but also Pierre-François Verhulst. From 1838 to 1847 – in parallel to Darwin's slow labour to produce *On the Origin of Species* – Verhulst published the mathematical basis for the gloomy predictions about population development. In essence, his formulae are the ones shown in the above diagram, with its two possible paths: while the first curve describes uncontrolled growth, the second takes account of the fact that any population in the real world encounters one or more limitations.

Ideally, the growth rate will decline when a population is halfway to the carrying capacity of its environment. After that, the population will neatly ease into a stable population size consistent with the carrying capacity. However, this carrying capacity is not especially easy to determine because it consists of different components and may also vary over time. In the world we live in, carrying capacity involves more than grains of rice and water plants. For us, it's about both consumption and emissions of so many kinds, and there are both local and global carrying capacities. The problem we face is the same as the one that confronts the Russian submarine captain played by Harald Heide Steen junior in a famous Norwegian comedy sketch: the border is often invisible and that is why it is difficult to know precisely how far we currently are above the carrying capacity of our environment – which, strictly speaking, encompasses the complicated and complex natural systems of the entire planet.

Malthus has been branded the world's first environmental pessimist. His predictions were disproven because he failed to foresee the green revolution in agriculture. Or rather, he did in fact calculate that food production would increase as a result of fertilisation and better cultivation practices, but reckoned that this would still be insufficient to keep pace with population growth. Malthus could not reasonably have foreseen the emergence of an agricultural wizard – Normann Borlaug, about whom we'll hear more later in the book. Fundamentally, though, Malthus was right, in that a limit to carrying capacity will be reached at some point. The fact that more mouths were fed resulted in formidable population growth. This, in turn, required even more land to be cleared for food production. That led to an increased need for water, fertiliser and pesticides. And consequently, more and more of nature had to

give way. We may not know exactly where the limit lies but we know that it exists and it has certainly been exceeded regionally too.

This brings us to the heart of the matter: there are two sides to every coin and all advances that imply an increased need for resources have long-term consequences that can be difficult to foresee. This is, of course, a killjoy conclusion, but that's just the way it is: if we add up our collective footprint on the planet today, we have already far exceeded the globe's carrying capacity. The question is what the future path will be. Will we be able to find measures that give us an acceptable glide path back to a stable situation that respects carrying capacity – possibly continued growth that is cautious enough to ensure that any technological advances we make will be capable of absorbing our excesses and closing the gap that has arisen? Or will we see a future growth curve where we constantly exceed carrying capacity to an even greater extent – until reality reins us in with a thoroughly brutal fall? Nobody can give a definite answer to this but there is one thing we can say for sure: the combination of an increased population with increased demand for resources means that we will be living on expensive consumer credit in the future. The longer we hesitate to take action, the steeper and deeper the fall. We have already overdrawn our account and are now financing the party by taking on a constant stream of new consumer loans to service our growing debt.

Malthus also has his disciples, who convey this worldview with finely honed rhetoric. As early as 1948, the biologist William Vogt wrote his book *Roads to Survival*, whose key message was that the combination of increases in population and consumption, catalysed by a capitalist system fixated on growth, would sooner or later lead to collapse.[13] The USA's history was a march towards destruction, claimed Vogt, whose book gave rise to a neo-Malthusian movement in the mid-20th century. Vogt also criticised aspects of the green revolution, including the growing use of the insecticide DDT. This provided inspiration for books that would have crucial significance for the first green wave of modern times. Rachel Carson's *Silent Spring*[14] in 1962 and Paul Ehrlich's *The Population Bomb* from 1968[15] are good examples. Alongside a group of scientists (known as the Rome Club), whose *Limits to Growth*[16]

[13] Vogt (1948)
[14] Carson (1962)
[15] Ehrlich (1968)
[16] Meadows et al (1972)

revitalised Malthus's message in 1972, these authors launched a new debate about growth in consumption and triggered the first demands for clear "changes of course" in societal development. In the same year, Erik Dammann of Norway published a book entitled *The Future in Our Hands*. Two years later, he gathered 3,000 people in a packed sports hall in an Oslo suburb to spread the message that the ideology of growth must be abandoned. The idea that we must seek out values other than constantly increasing prosperity was – and remains – the central argument in this tradition. It is difficult to deny that it has gained fresh relevance today.

The message Vogt and his followers delivered was a gloomy one. Nonetheless, *Roads to Survival* tapped into the zeitgeist and enjoyed tremendous success. At the same time, the ideas that Vogt was expressing met strong resistance from three quarters in particular. The conservatives objected because Vogt wanted to rein in capitalism and introduce birth control. The Catholic Church objected for the same reason. Objections also came from scientific quarters, largely owing to Vogt's critique of the way science had contributed to the problems and his scepticism about its capacity to solve them. This assertion was difficult to swallow in an era when, in many ways, belief in science and technological progress was giving a direction to history and some kind of meaning to humankind. Just as Darwin's theory of evolution was naively interpreted as a natural law of improvement, so natural science seemed to be the very guarantor of eternal progress and prosperity at the time when Vogt's book came out. Yet many of his disciples assumed that we were on the threshold of a new awareness and a new era. It was optimistically assumed that the time was ripe for new thinking, and that the message would spread like ripples on water.

As we know, that is not what happened. Vogt's views still have their advocates – indeed they have probably become more numerous – but the ripple effects have been feeble at best. It would seem that there is simply a systemic inertia, like a layer of oil on the water, which prevents these sorts of waves from becoming especially strong. The message Vogt and his followers wished to sell was also a tough one. After all, increased purchasing power has more appeal for most of us than reduced purchasing power.

Since Vogt published his book, the average real global wage has close to doubled. And consumption has increased too, as have population numbers. We still see no clear flattening trend of the kind that is a prerequisite for the s-shaped curve above.

Translation: Lucy Moffatt 2020

The 2013 film *The Last Call* sums up much of the growth critique of the Rome Club and the neo-Malthusians, citing Swedish prime minister Olof Palme, who expressed the underlying political dilemma with uncommon honesty in his comment on the Rome Club's *Limits to Growth*: "I support your thoughts and conclusions wholeheartedly, but if I executed policy in line with them, I would never be re-elected." The Brundtland Commission's 1987 report was also knee-deep in the same dilemma.[17] The commission stated: "We are unanimous in our conviction that the security, well-being, and very survival of the planet depend on such changes, now." At the same time, its premise was that the change of course should – nay, *must* – be based on continued economic growth. For anybody who had read *Silent Spring*, *The Population Bomb* or *The Future in Our Hands*, the report had a half-hearted feel to it. To date, green commitment has always come up against a wall of "necessities" or "economic realities".

Vogt's critique of growth optimism took off at precisely the time that *Silent Spring* came out in 1962 – the same year that DDT production in the USA peaked at 80,000 tonnes. The poison, until then seen as a miracle agricultural product to combat pests – which it also was, for that matter – suddenly became the very symbol of the way we are poisoning the planet. That same year, David Keeling also pointed out a curious trend in his CO_2 readings from the peak of Mount Mauna Loa on Hawaii. The readings had been under way for barely four years and yet he noticed that there was already a notable increase in the CO_2 concentration in the atmosphere. The only logical cause for this was our combustion processes, in particular the burning of coal and oil. Since the principles behind the greenhouse effect were already well known, Keeling pointed out that such an increase could, over the long term, cause global warming. In the decades that followed, Keeling would issue warnings that became increasingly stark as CO_2 concentrations rose, but the response remained tepid.

Since the 1960s, new green waves have come and gone without causing any changes of truly profound significance. At the same time, it has become increasingly evident that the human footprint is in the process of becoming a life-threatening problem for much of life on Earth. One should always be cautious about using phrases along the lines of "We have ten years to reverse this trend", but conditions for both our own and all other types of life are now undergoing dramatic change.

[17] Brundtland et al (1987)

A new awareness of this is in the air. Reports of floods, fires, droughts, heat waves and melting ice pour in weekly, supported by a steadily stream of new, expert reports that underscore the seriousness of the situation. A new green wave is now rising, headed by Greta Thunberg and the young climate strikers. And while it is true that most such waves crash against the cliffs, or run out in the sand – some do leave a legacy of lasting change.

The Ultimate Purpose

It is possible that societies in every age have felt that they are facing a period of transition to something new and unfamiliar – part alluring and part terrifying. On the whole, though, the future has appeared rich in promise for the past 200 years. Life has become steadily easier, longer and better for most people, and we expect it to carry on this way. Whereas many cultures used to perceive the world's development as cyclical – like a rhythmical variation of growth and decline, as with the seasons – in the capitalist era it is experienced as linear.

The notion that we humans are on a kind of steady upward path spurs us to get up in the morning and do our bit. It quite simply makes *sense*. This is the way modern humans have resolved the yearning for a purposeful existence: life is not just about eating, surviving and reproducing but also about constantly acquiring new insights and constantly breaking new ground in knowledge and technology. Optimism about the future and technology were boundless in the 1950s and 1960s. Many still refuse to abandon the idea of continued growth in prosperity. Because if we must abandon this, what is to fill the resulting vacuum? Who wants to reconcile themselves to retreat and regression?

At the same time, we see that a different conception of the purpose of existence is gradually gaining ground. It has become increasingly difficult for young people in the West to find a purpose in life through the traditional route. When everything has been discovered, everything we truly need invented and everything from here on in is about inventing things we *don't* need any more, strictly speaking – often by creating new and artificial needs to keep the wheels turning – it doesn't feel as motivating as before. When we are satisfied, often glutted, when everything is about stage-directing one's own life – when nothing is really at stake any longer – when there is nothing to fight for; what, then, can create the sense that we are doing anything other than amusing ourselves in order to "endure the pressure of life", as

Norwegian philosopher Peter Wessel Zapffe put it? It is this powerlessness that Erlend Loe so masterfully depicts in his novel *L*, a literary exposé of a generation that grows up to the realisation that everything has already been done, everything has been discovered. They have everything and therefore undergo the painful experience of finding that it's a curse to have a wish granted.

So, two conflicting viewpoints appear to be colliding in our times. The first springs from Vogt's insights and philosopher Arne Næss's maxim of the *rich life with simple means.* In this case, people envisage a less materially oriented lifestyle that places weight on "other values" (nature, friendship, love, culture and other CO_2-free goods). The other perspective envisages a further continuation of the Western history of development over the past 200 years, in which human capacity for innovation and technology – including biotechnology – will not only solve the world's problems but will also continuously give us new goals to strive for. The attraction here is the meaning that is constantly derived from being on the way, even if we don't know quite where. Certain people also see the betterment of humanity itself as an ultimate goal. Even now we are saddled with a number of limitations that organic evolution has been unable to deal with. Isn't this what we should now overcome – realising, in the most extreme case, the dream of an almost eternal life? It is worth reminding those who nurse such dreams: it may be a curse to achieve the goal.

Although there may appear to be an unbridgeable gap between these two conflicting viewpoints, they are probably less incompatible than one might think. The rich life with simple means is, as I understand it, an ideal along the lines of the gold rule of ethics, which exhorts you to do unto others as you would have them do unto you. A rich life does not mean lying on your back in the grass watching the clouds drift past (well, not all day at least). We must have greater ambitions beyond simply eating, reproducing and dying. But self-realisation must occur in a sustainable way (and yes, the term "sustainable" is hackneyed, but we understand what it means…). It is possible to give greater weight to the non-material side of things. We can slow the revs on life's treadmill and live a rich life in a way that is more protective of nature than most of us in Western countries do today. Even so, there is no reason *not* to make use of technology, including biotechnology. So we do not need relinquish progress; it must "just" be redirected from quantity to quality.

The other meaning-bestowing possibility therefore involves defining a new project along these lines. This is where young people play the leading role. The future

project must not just be *for* the young. Young people themselves are the ones who must find their way towards something that is, today, *truly* worth fighting for. It isn't always so easy to fill out an alternative vision like this with concrete content, simply because our imagination builds on our limited experiences. Yet the commitment we now increasingly see expressed contains the seeds of a different narrative and a different identity- and meaning-bestowing tale than the one that has hitherto dominated modernity and the capitalist system.

In fifty years, many of our fundamental physical conditions will be different. Yet humanity as a species will be unchanged. We have the same pleasures and pains as we did 100 years ago, 1,000 years ago, yes, even 100,000 years ago, and will have them 50, 100 or 1,000 years from now too. Now and then, however, innovations are introduced or changes in mentality arise that lead to great and rapid social changes. Although this is principally the result of new technology, which has created opportunities for even more new technology, cultural development *can* also lead us to alter our fundamental relationship with our natural surroundings. Society has also changed because our *norms* have changed, with the emergence of new unwritten laws and rules.

I have always seen my father's lifetime as an era in which the curve of both technology and consumption took its sharpest upward turn. My father was born into a society that had more in common with the Middle Ages than the digital society he eventually left. He grew up in an island community in western Norway that was based on subsistence farming, where existence was not so very different from life in the Middle Ages or Viking times. The cultural context he belonged to was the traditional coastal culture, where fishing and a few animals in the stall sufficed for even a large family. It was a society based on manual labour, horse-drawn ploughs and the absence of fossil fuel; it was a life built on drudgery – a daily battle to put bread on the table – and from that point of view, it is not to be viewed with nostalgia. Yet at the same time, this was also a meaningful existence precisely because its goal was to work one's way out of drudgery and poverty. Paraffin lamps were replaced with electricity and my grandfather acquired the island's first telephone and motorboat. Society was on its way towards something better, most people also experienced concrete improvements in their lifetime and there were no dark clouds on the horizon. The sea was endless, the heavens likewise, and it was unthinkable that we could have a negative impact on the planet.

Translation: Lucy Moffatt 2020

Development and modernity were perceived not just as indisputable benefits but also as a meaningful project for this generation. My grandfather found the meaning of life in his daily drudgery on the steep hillside farm in western Norway. His aim was to secure an education for his children so that they would escape a life as full of drudgery as his own – and he was so successful that all of them gained an education and none of them took over the farm. My father thus belonged to the first generation to share in Norway's new modern life, with all its promise. He was the country student who moved to the city, acquiring a student loan and an education, a car and housing. In his latter years, he even absorbed the whole new, globalised world through the internet.

The idea – indeed the ideology – of continued growth and prosperity is difficult to relinquish for precisely these sorts of reasons. In addition to the psychological appeal of the thought of constant progress, we have also acquired an economic system that *demands* eternal growth. This makes it doubly difficult to picture an alternative. At the same time, the arguments for reining in growth are hampered by negative terms like *stagnation, recession, decline* – words that have an unattractive ring in the late capitalist culture, even for those of us on the margins of the financial world.

This is one of the dilemmas of the environmental movement. And this, at any rate, is where the old movement for moderation often ended up in a bind. It doesn't much matter if your organisation is called The Future in Our Hands when the prophets of growth have ownership rights on the description of reality, and moderation becomes synonymous with overly prudent rationing and regression. Part of the problem is that the people arguing against growth as the ultimate purpose of humanity have painted themselves into a rhetorical and ideological corner. "No to…" has often ended up as the standard response. If the alternative to growth appears not only to be a *no to* anything that is fun but also seems like a return to the 1960s, or worse yet the tough 1930s, few are likely to feel inclined to join in.

I do not long for a return to my father's sustainable but exhausting youth on a steep hillside farm in western Norway either, nor to an existence where we eat cold porridge in the pale beam of a stinking oil lamp clad in woollen sweaters with indoor temperatures of 12 degrees Celsius. If this caricature of an existence appears to be the sole alternative to continued growth, it is hardly surprising that most people politely decline. That is why the message about reining in growth must not be presented as a

no to but must express, to a much greater extent, what it is a *yes to*. It is a yes to more of what most of us place at the top of the list when it comes to a good life: friends, love, family, nature, time to feel that we are alive, but also reflection, long trains of thought – in fact, more quality and less quantity.

Something new *has* also happened lately. The connection between the good life and growth in prosperity is no longer as obvious, at least not in the context of Norwegian prosperity. While much of the previous drudgery was motivated by a desire for a future that would yield more leisure time, we now see leisure time itself being invaded by organised activities and tight time management. We compete in all arenas and are constantly beset by the feeling that the speed is being turned up a few notches without our having any control over it. There is little doubt that increasing numbers of us are also feeling the moral strain of living our lives far above the dotted line of carrying capacity in the diagram I showed earlier – well aware of the fact that we are defying gravity, or at least one of biology's central laws, while simultaneously conducting a raid on resources at the expense of our own children and grandchildren.

Every year, the issue reaches its apogee in the run-up to Christmas: there can hardly be a better symbol of the consumer society than "Black Friday" or the Christmas shopping that culminates in a pile of presents beneath the tree. Although many clearly feel that we long ago passed the stage where more things will make us happier, we are also prisoners of "the system" here. In late autumn 2019, on the same day the snow started to settle in the Nordmarka forest outside Oslo, the online magazine *Harvest* published a priceless illustration, which really nails this. It shows skiers past and present. Above is a skier from 1953, with one anorak, a grey rucksack, a couple of boxes of ski wax and a single pair of wooden skis. Below is a modern-day skier, with eight pairs of skis (plus four pairs of roller skis), cases crammed with waxing equipment, several pairs of boots, a wardrobe bulging with training gear, a poling machine etc.

The social anthropologist and author Thomas Hylland Eriksen and I write about precisely this quest for quantity in our book *Running on the Spot*.[18] One of the examples from the book shows how the accelerated product cycle is an expression of a "use and throw away" mentality. In parts of the consumer economy, the goods that are produced are becoming cheaper and cheaper – and simultaneously steadily

[18] Hessen and Eriksen (2013).

shoddier. Competition here is about earning the most possible money from customers who are becoming ever more price conscious and must constantly keep buying new items because the products break – or rapidly cease to be trendy. So the important thing is not to produce the most durable and beautifully made products but to make us buy more. Any parent who has ever got roped into the school band's jumble sale knows all about this: when the jumble has been sold and the time comes to throw the remaining stock away, all the leftover furniture has to be chopped up and chucked into the yawning containers parked outside the schoolyard. It's easy enough to deal with the newest laminate products: a couple of well-aimed kicks and they snap in two. It's a somewhat tougher job when it comes to products from the 1970s and 1980s. They actually contain a bit of solid wood and proper screws. When, at last, you come to specimens from the 1930s to 1950s – massive wooden furniture with insets on every corner – there's nothing for it but to give up. These pieces were made to last forever and can cope with pretty much anything. Although the product evolution evidenced by these observations may well be profitable from the point of view of business economics, it is difficult to see any sign of genuine progress.

It is precisely this sort of quantity-driving "things race" that no longer makes sense. Whereas growth and prosperity were once a means, they have, to an increasing extent, become an end in themselves. It is doubtful whether money will buy you happiness, and constantly increasing prosperity certainly does not bestow any deeper meaning. Now, of course, competition also yields better and smarter products. Few things illustrate this better than, of course, the smartphone, which has become so smart that most people feel as if it is an indispensable extension of their own self. Whether it has become so smart that it makes us stupider is another matter, but it is impossible not to be impressed by all the possibilities and services it offers. At the same time, it is another example of something we had no idea we needed just a few years back. The number of smartphones has risen from zero to 3.5 billion units in 15 years,[19] and this has not been without environmental cost either.

Yet the idea that we ought to *reduce* consumption continues to be seen as sectarian, reactionary and, above all, unrealistic – indeed, strictly speaking impossible in a growth-based economy. Since growth has been a recipe for success in the history

[19] https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/

of our development to date, many consider it rash to abandon it in favour of a vague alternative that is simply *against* growth and assures neither money in the till nor jobs.

Most advocates of growth also claim that the growth to come will be pretty different from the growth seen hitherto. It will be "green" and contribute to GDP without contributing to CO_2. But it is delusional to think that any such reality is imminent. Electrification, increased battery capacity, CO_2 storage, biofuels and wind turbines are all still in their infancy. Solar cell technology has come somewhat further but the technology is still developing too slowly to be able to both assure growth and make it sustainable. Besides, there is more at stake here than governments and others have so far incorporated into their understanding of "the green shift".

This was expressed with admirable clarity by the The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), UN's nature diversity panel, at the launch of its main findings on species diversity in spring 2019.[20] This UN panel was established to operate in parallel with the UN's climate panel, but with a mandate to protect the world's natural diversity. When the report was published, the headline in most media was: "Human activity threatens the existence of a million species."[21] There is much to be said about that headline, but it had the desired effect: the fact that nature and species were in *such* a bad state attracted deserved attention. What's more, many noted the reasons why this has happened – over-harvesting and the destruction of habitats – as well as the consequences that ensue for absolutely key ecosystem services such as carbon sequestration and pollination.

Yet the most radical conclusion that the nature panel itself presented went under the radar. The report points out that population growth and consumption are the underlying causes of habitat loss, climate change, pollution and overfishing, and said precisely this in the clearest terms: we must abandon the ideology of eternal economic growth. The more of us there are, the more important the point. This is something Norwegians and others with equivalent ecological footprints ought to take especially to heart. Although it is true that the "we" here refers to the entire population of the globe, it applies in particular to people like us who have filled the pyramid of need to the brim in our feverish quest for new objects and activities with which to fill our

[20] IPBES Press Release 6th June 2019.
[21] For example "Humans Activity Has Put a Million Species in Danger, Warns UN", The Times, 6th May 2019.

lives. For large swaths of the world's population, the desire for more prosperity and a better life is clearly justified. Higher standards of living will, over the long term, also lead to lower birth rates, even though they will initially contribute to increasing the global footprint. No matter which way we look at it, there will be a period in which both population and consumption will grow. This is one of the reasons why the situation we currently face cannot turn out *entirely* well.

The question we must pose ourselves again is therefore: *how bad can this get*? The greater the consequences, the lower their likelihood needs to be before the risk will nonetheless become great and vice versa. So what is the worst-case scenario when it comes to the planet's future? Will mankind become extinct? Will the world be destroyed? What is the status now, based purely on expert and sober assessments; and what kind of rhetoric should be used – dispassionate expertise that does not rob young people of hope and a good night's sleep? Now and then I am contacted by people who are genuinely terrified by headlines about climate change and loss of nature. Is there any point, they ask, if everything's going to hell anyway? If all the species are dying out and the planet is becoming a greenhouse inferno?

I genuinely believe that the situation *is* pretty dark, even though it is not the case that the world will "collapse". At the same time, I don't think there's anything wrong with being a bit terrified by the situation we are facing. A degree of anxiety can spur people to action. The fact that we suffer some pangs of conscience and, moreover, acknowledge our own personal responsibility is all to the good. It's true that this kind of thing varies from person to person, but unless we engage the emotions, half-heartedness and indifference will probably win the day. Current developments – in terms of climate, natural diversity and society's insufficient response to these challenges – give grounds for concern but not for panic and definitely not resignation. The acknowledgement that it *may* get very bad indeed is more like a prerequisite for the type of action we now need.

There *are* also many things that make it worth getting up in the morning and thinking that life is meaningful – for example ensuring that the situation does not end up being as bad as it *could* get. The risk that our over-consumption of the world's carrying capacity will end in a catastrophic scenario is largely linked to different *tipping points* that may occur in the planet's complex climate and natural systems in a worst-case scenario, causing developments to spin out of control.

We are familiar with such tipping points from both nature and culture: snowball effects that result in a sudden transition from one state to another. In the worst case, we'll end up with a sauna planet. That is where we absolutely *don't* want to go. But are we heading there anyway? Let's take a reality check. A check like this could start in the place where dramatic changes really are happening now – where the ice is melting, the permafrost thawing, plant and animal life undergoing change – and where it is most clearly evident what we may be in the process of losing.

Into the Anthropocene

As I peer over the edge, I see them directly below me: two adult polar bears strolling through the valley 100 meters beneath me. The wind is against me, so I can safely follow the animals' journey until they vanish around a hillock. My pulse rate is a bit faster than usual. It gets even faster when I suddenly hear an animal behind me. Fortunately, it isn't a third bear but a well-fed Svalbard reindeer that barely notices my presence. A ptarmigan and a couple of chicks scurry beneath it.

When I lift my eyes, I can see across Kongsfjorden, encircled by mountains and glaciers. On our way out here, we drove between icebergs that had calved in the fjord. The area in front of the glacier was teeming with sea birds. The world we have entered is barren and cold but nonetheless full of life. If I turn 180 degrees, I see the glaciers stretching inland towards the vast, unbroken ice sheet to the east.

It is August 2019 and we are carrying out fieldwork. Barely a soul has set foot in the place we are thinking of travelling to now. This is new land. Previously – not all that long ago – there was ice here. It has retreated sharply in the past few years. High up on the mountainsides, I can see a pale belt on either side of the glacier that shows how high it reached until recently. Kongsfjorden itself has been ice-free since the first time I came here, 25 years ago, but I am still a witness to the rapid pace of change in this region. New species, such as mackerel and mussels, have found their way to these Arctic waters as the temperature has risen.

My two colleagues, whom I can see beneath me by the blue water, are running DNA tests so that we can record what kind of new life now exists by the ice edge. How early do the pioneer species arrive? And what kind of life makes its way here?

Inland at Ny-Ålesund, where we have our base, a hole appeared in the ground not far from the buildings a while back. This hole was the result of a thawing in the permafrost, which created a water-filled hollow surrounded by shattered ice beneath the vegetation. The hole lies directly below Zeppelin Mountain. On the top of the mountain is an observatory that monitors atmospheric gases. This was the first place in the world to report readings of more than 400ppm (parts per million, i.e. 0.04 per cent) CO_2 in the atmosphere – a level the world has rarely seen in several million years and definitely not in human history. There is a stark symbolism to the permafrost hole that has appeared below precisely this mountain. We are in a corner of the world where warming has occurred at the fastest rate. Globally, a three-degree rise in the average temperature is one of the most terrifying scenarios. In Oslo, the temperature has risen at twice the average global rate since 1961, i.e. two degrees. If we travel north to Svalbard, the temperature is already 5.6 degrees higher than it was in 1961![22] At the time of writing, Svalbard has also experienced 100 consecutive months of temperatures above the previous 30-year norm. To a large extent, this is caused by a reduction in sea ice, which leads to milder winters. The winters on Svalbard have become very much warmer than they used to be, up to 14 degrees warmer at most, but the summer temperature has also risen significantly. So more permafrost holes will form up here eventually.

When you are standing by the ice edge, you can grasp the climate challenges with both halves of the brain at the same time. Dwindling glaciers and thawing permafrost become concrete, tangible facts that affect you rather differently than articles filled with numbers and graphs that tell you the same thing in a more objective way yet fail to elicit similarly strong feelings. For precisely this reason, it is always effective to bring politicians up to the ice edge in Kongsfjorden and let them "see climate change with their own eyes". The sight of a glacier calving in the water can have a greater effect than a thousand pages of reports. Of course it is perfectly natural for ice to calve like this when a glacier ends in the sea. Still, since we have time series and figures as witnesses to the truth, there's no harm in reinforcing the message by showing people the melting in this way. It makes quite an impression to watch several tonnes of ice suddenly plummeting into the fjord.

[22] https://www.met.no/nyhetsarkiv/100-maneder-med-temperatur-over-normalen-pa-svalbard

The first time I experienced it for myself, we were on the Blomstrand Peninsula, on the other side of the fjord. Since then, the peninsula has become an island because the glacier has retreated, revealing an open area of sea where we previously believed there to be a land connection. I have a presentiment that even the large mountain region where the two polar bears were may prove to be a new island awaiting discovery when the ice withdraws even further. Everything is always in a state of flux, including the climate and ice, but the changes are now occurring at a different speed, on a different scale – and for a different reason – than before. On Svalbard, this is clearer than in other places in the world.

Over our modern history, from the time when we first began to practise agriculture and live in large settlements 10,000 years ago, we have lived in an unusually stable geological epoch. The Holocene, i.e. the period since the last ice age, has been exceptional for its stable, favourable climate. This is due in large part to the fact that the Earth has followed an almost circular orbit around the sun throughout this period. In epochs where the Earth's orbit is more elliptical, the fluctuations in the climate are greater, naturally enough.

In this sense, *Homo sapiens* has been fortunate. The variations in climate have actually been fairly moderate over the *entire* course of our species' history, which stretches back over 300,000 years. That said, it is true that there have been times of climate problems – locally, regionally and globally: cold spells, storms, drought, floods and so on. There have also been crop failures as well as periods of heat and cold. Other situations were longer and more cyclical, like ice ages in which life was forced to withdraw towards the equator to await better times. Despite ice ages and other changes, both we and other species have coped reasonably well over the past 300,000 years. But it won't necessarily stay that way because we are now moving into the *Anthropocene*, the age of mankind.[23] What characterises this epoch is that our self-inflicted trials will be the most severe we, as a species, have ever experienced.

A great deal of the debate linked to the Anthropocene has been couched in terms such as *collapse* and *catastrophe*, without taking a closer look at the justification for such apocalyptic terminology. There are many examples of collapse in certain populations – herring being perhaps the best example in Norway. Thanks to careful management, those stocks have now been restored but the dramatic decline in

[23] Crutzen (2002).

sea bird populations over the past few decades shares some similar traits. It is nonetheless rare for entire *ecosystems* to collapse, and even the situation that has heralded the start of the Anthropocene, though dramatic by any standards – with climate effects and the decline in biological diversity – will not lead to planetary collapse. The Earth as such is pretty robust: life will endure, but not necessarily *the same* life.

It remains to be seen whether we will survive our own age. We probably will. But it would be an ironic twist of fate if the Anthropocene spelt the end of the species that gave the epoch its name. For now, there are no grounds to believe this, but should things turn out so badly that we go the way of the mammoth, the sabre-tooth tiger, the dodo and *Tyrannosaurus rex*, most of life on Earth will heave a sigh of relief – as Alan Weisman puts it in *The World Without Us*.[24] Although it's true that our domestic animals and food plants would be carried off with us in the backwash, a future without humans would be a liberation for a planet under pressure. This calls for a certain humility from us: we are not indispensable. Even if everything doesn't go to hell for us, some people will take the view that, all in all, humanity is a cancerous tumour on the planet and the greatest favour we can do the rest of life on Earth is to say our goodbyes. But my response to that is: we are better than our reputation – and it would be absolutely unbearable to think of the world going on without us.

Three news items from the past couple of years may illustrate why we can genuinely talk about this being mankind's epoch now: 1) We have altered the atmosphere in a way people 100 years ago thought impossible. The planet's atmospheric CO_2 concentration exceeded 400ppm in 2015. Within a few decades, we will apparently end up with a concentration double the pre-industrial level. We have also increased the concentration of methane and nitrous oxide, and we were well on the way to breaking down the ozone layer too. 2) On average, data from over 14,000 populations of 3,700 mostly "higher" species show a simultaneous population decline of 58 per cent since 1970. Even if these declines cannot all be ascribed to human activity, there is little doubt that our collective footprint, via destruction of habitats, over-hunting, emissions of environmental poisons – and climate change – is the main reason for this enormous decline in natural life on both land and sea. 3) The human population of the world continues to climb, moreover, and we are becoming an

[24] Weisman (2007).

increasingly urban population, with rising demands and expectations. *Earth Overshoot Day* – the date on which humanity's demand for ecological resources and services in a given year exceeds what Earth can generate in that year – fell on 30th July in 2019.[25] If everybody had shoes as big as the Norwegians, that day would have fallen in mid-April. The trend in recent years has been for Overshoot Day to fall increasingly earlier – which means that over the rest of the year, we borrow, or strictly speaking steal, from generations to come.

Nobody wanted the changes that now qualify this as a new epoch, but the Anthropocene is still the result of a deliberate development. The ecological consequences were an unfortunate side effect of the growth. We have striven for the growth itself. This is down to our natural penchant for material goods, catalysed by a widespread ideology of competition, and the fact that humanity has continued to grow beyond all bounds. In the hour that has passed since I sat down to write alone nearly 10,000 more people have joined us here on Earth. In the course of a year, the world's population will grow by 82 million. The problem is therefore not just that we use and consume more, nor that we consume more and take up more space, but also that we are becoming so numerous. All these circumstances combined are causing the ice to melt, the rainforests to be chopped down and our almost all our fellow species to become fewer.

[25] https://www.footprintnetwork.org.