Cappelen Damm Agency *Spring 2020*

The World at the Tipping Point

70 000 years ago, there existed a species, comprised of scattered populations of a few hundred individuals each, who generally lived peaceful lives in a corner of Africa. Today, that species consists of 9 billion individuals, and it has begun to fundamentally alter the planet. The species in question is us.

What we are doing to the earth, can be registered on a geological timeline showing hundreds of thousands of years. So extensive are the emissions of climate gases and the reduction in biodiversity that we caused, during only a brief moment in the long history of the earth.

Dag O. Hessen, professor of biology at the University of Oslo, is not one for mincing his words. Science, not fear mongering, he explains the contemporary state of nature and climate – and how badly things may turn out. The great risk factor is the different feedback loop mechanisms that will intensify the changes.

Simultaneously, human culture is constantly changing. Perhaps are we, too, standing at the tipping point? Will we be able to turn this development in time, to avert the worst possible scenarios? This book is a powerful appeal for the need to do more – and to do it quicker.

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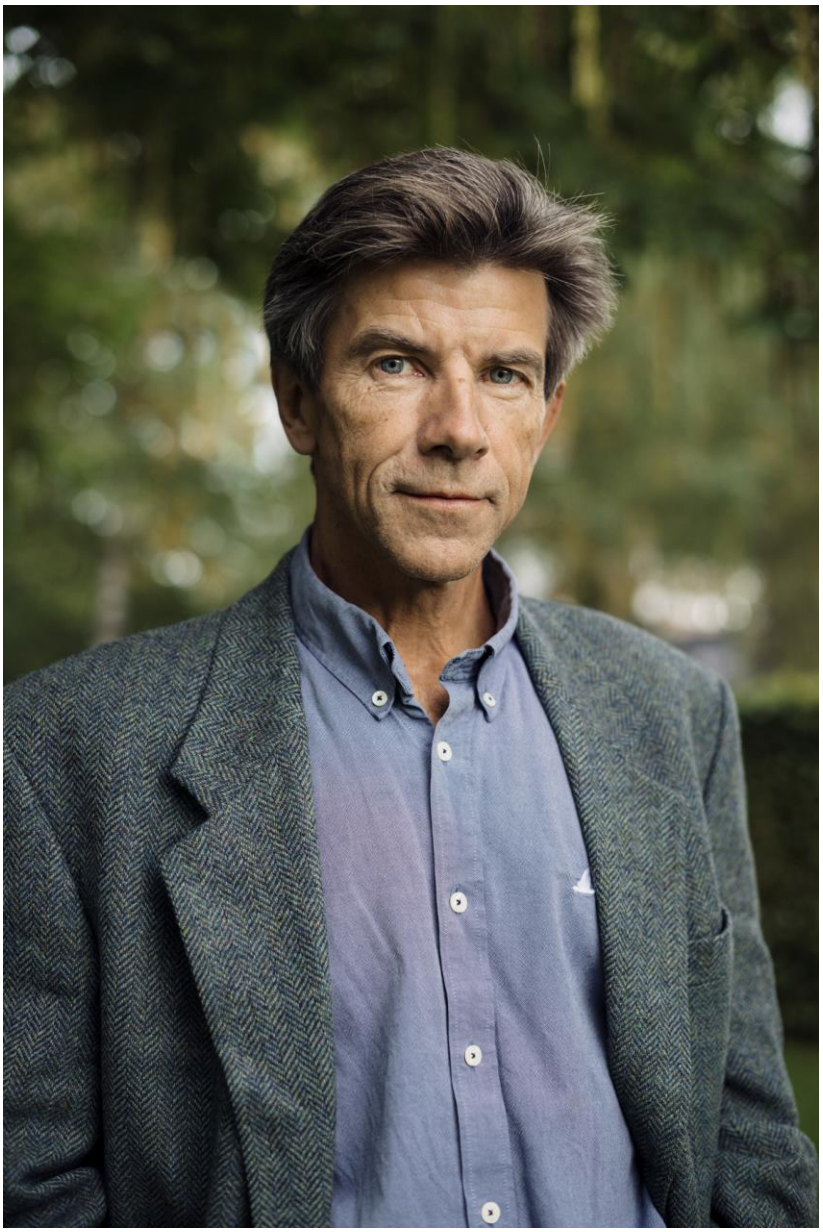
The World at the Tipping Point
Dag O. Hessen

Dag O. Hessen
b. 1956



Professor of Biology at the University of Oslo. He has written many scientific works on themes like ecology and evolution. He has also published ten popular science books about evolution, biology and the environment. His work is found at the crossroads of biology and philosophy. He has received several awards for his promotion of popular science, among them the Riksmålsprisen in 2008.

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Praise in the Norwegian press:

Scientific scream about the climate – *****
Knowledgeable, nuanced and discursive about the climate crisis.
DAGBLADET

Anything but hysterical about the climate change – *****
Because Hessen is so thorough and factual in his argumentation, the book should be read aloud to all the members of those Facebook groups that think that climate change is a hoax. The seriousness in the text is far from hysteria. This is calm, but insistent, public education.
STAVANGER AFTENBLAD

Give us more books and professors like this! For those looking for a knowledgeable and engaged rendition of the most flammable political and existentially complex problem of our time, The World at the Tipping Point *is highly recommended.*
NRK

Straight forward and knowledgeable, engaged and terrifying about the tipping points of the climate and diversity. Dag O. Hessen is a sober optimist and believes in the survival of humanity. But even a sober and scientific description of the situation may bring chills down the spine of a reader taking in the facts.
AFTENPOSTEN

Apart from other publications on the topic in later years, Dag O. Hessen comes across as resolute and calm in his enduring and scientific fight against the direction fossil based politics are taking us. And time is running out.
KLASSEKAMPEN

Factual and well founded about the challenges with climate change.
VÅRT LAND

The World at the Tipping Point *is important, wise and engaging. This is a book that everyone needs to read!*
Maja Lunde - Bestselling author of *A History of Bees.*

A World at Tipping Point – Sample translation by Lucy Moffatt

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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.

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. 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.

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 have better health, greater freedom

[1] Rosling (2018).

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?

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 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

[2] Hansen (2011)

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 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.

[3] Mann (2012)

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

[5].Yamin (2019)

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 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.

6 "Vi støtter skolestreiken". Aftenposten, 14.3.2019

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 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

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

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

[8] Ripple et al (2019).

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 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.

[9] Hessen (2017)

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.