***Confronting the Climate Crisis:***

***Keeping Hope Alive in Challenging Times***

**Jonathan Boston**

**Emeritus Professor of Public Policy**

**School of Government**

**Victoria University of Wellington**

**jonathan.boston@vuw.ac.nz**

**Paper prepared for the Inter-Church Bioethics Council**

**Wellington Cathedral of St Paul**

**6 October 2023**

**Abstract**

Humanity faces multiple existential threats, not least the failure to live within real, non-negotiable biophysical constraints. Of particular concern has been the inability of the international community thus far to secure rapid and sustained reductions in global greenhouse gas emissions, especially the decarbonization of global energy and transport systems. As a result, humanity will be forced to live with, and endeavour to adapt to, increasingly severe climate change-related events. These will include more extreme storms, droughts, heatwaves, fires, and floods, along with increasing ocean acidification and significant biodiversity loss, and an accelerating rate of sea level rise (e.g. from about 4 centimetres a decade currently to several times this rate by the end of the century).

Yet even with rapid global decarbonization and the achievement of net zero emissions by mid-century, the latest scientific evidence suggests that critical tipping points may be crossed over the next three-to-four decades, thus generating significant positive feedbacks. These could contribute, among other things, to multi-meter sea level rise by 2150, with severe social, economic, and ecological effects, including major impacts on human wellbeing.

Given the many projected impacts of climate change, together with multiple other ecological challenges, the following questions arise: What can humanity realistically hope for? What is the basis of that hope? And how should we respond? For instance, how should we prepare, whether individually or collectively, for the immense challenges that lie ahead?

This paper critically assesses five distinctive claims regarding what it might be realistic to hope for over the coming century and beyond. These claims are drawn from a range of theological, scientific, technological, and socio-cultural standpoints. It will be argued that each claim is open to a range of objections, some more compelling than others. Drawing upon this analysis, together with a theological perspective which recognizes evolutionary suffering and affirms the creative, sustaining, and redeeming love of God, the paper contends that the growing existential crisis demands a ‘realistic faith’ and a ‘prudent and practical realism’.

*Half of humanity is in the danger zone, from floods, droughts, extreme storms, and wildfires. No nation is immune. Yet we continue to feed our fossil fuel addiction … We have a choice. Collective action or collective suicide.*

António Guterres, Secretary-General, United Nations, 18 July 2022

*Climate change is here. It is terrifying. And it is just the beginning. The era of global warming has ended; the era of global boiling has arrived. The air is unbreathable. The heat is unbearable. And the level of fossil fuel profits and climate inaction is unacceptable. Leaders must lead. No more hesitancy. No more excuses … There is simply no more time for that.*

António Guterres, Secretary-General, United Nations, 27 July 2023

**Introduction**

There is a growing consensus in the scientific community that humanity has ushered in a new geological epoch, namely the Anthropocene (Dryzek and Pickering, 2019). Its defining feature is that human beings are now the dominant force influencing key aspects of the planet’s future, including the climate system and the extent of biodiversity (Dasgupta, et al., 2021). Unlike the so-called ‘goldilocks’ era of the Holocene, the Anthropocene has little to commend it. All the available evidence suggests that humanity’s impact on the Earth system[[1]](#footnote-1) will be mostly harmful. Indeed, there is a growing risk that humanity’s interference with the planet’s climate system will result in several critical tipping points being crossed, thereby accelerating the warming trend, and causing ever more widespread, serious, and irreversible impacts (Armstrong McKay, 2022; Kemp et al., 2022; OECD, 2022; Ripple, et al., 2022, 2023).

The multiple extreme weather events that have afflicted many parts of the world, including Aotearoa New Zealand, in recent years highlight the enormity of the challenges that lie ahead. Not only will the impacts of climate change impose ever larger economic and fiscal costs, but the extensive and often repeated damage to private property, public infrastructure, and livelihoods will also take a high emotional and psychological toll. Aside from this, there are the daunting costs and complexities of designing and implementing effective adaptative responses (see Expert Working Group, 2023). Overall, maladaptation seems more likely than pro-active and robust adaptation.

If tackling anthropogenic climate change were humanity’s only predicament, that would be hard enough. But compounding the challenge are a host of other ecological issues, above all biodiversity loss, and numerous non-ecological issues. Collectively, they constitute what has been called a ‘polycrisis’ (Lawrence, et al., 2023).[[2]](#footnote-2) As a result, the future looks bleak for many, although not necessarily all (O’Neill, 2023), aspects of human wellbeing.[[3]](#footnote-3) Unsurprisingly, across the globe, people feel helpless, powerless, and without hope. Indeed, there is much talk of a ‘loss of hope’, if not a ‘crisis of hope’. To quote the eco-theologian Timothy Robinson:

… individuals and communities everywhere are experiencing a loss of solace – an inability to take comfort in the world around them, an inability to imagine a flourishing future for themselves or their ecosystems (2020, p.2).

Reflecting the seriousness of the situation, the former Leader of the Opposition, Todd Muller, commented in his valedictory address in Parliament on 24 August 2023: ‘As we sit here today, we cannot meet the gaze of our youth on climate action and that should not sit easy with us.’[[4]](#footnote-4)

Such remarks pose numerous questions. Realistically, what is there to hope for? Is it any longer possible to avert a profound climate catastrophe with large-scale human mortality and morbidity and a mass extinction event? And even if a worst-case scenario is avoided, is it not already too late to prevent widespread economic and physical losses and unprecedented ecological damage? Is it not inevitable, for instance, that the planet’s terrestrial and marine environments will be tragically and comprehensively degraded, that large numbers of species will go extinct, and that the planet will be left far less liveable? And will not such outcomes, in effect, be forever? The planet itself, of course, will readily endure, but presumably much of the damage to natural systems and processes will be irreparable. Presumably, in other words, it will never be possible to restore, except perhaps over geological timeframes (i.e. millions of years), the planet’s former ecological integrity, biodiversity, productivity, and splendour.

Such questions are easy to pose but profoundly challenging to answer. After all, the subject matter is vast. It traverses numerous academic disciplines, not only across the physical and social sciences, but also the arts and humanities. To compound matters, the issues that arise – whether moral, theological, philosophical, or scientific – are complex and demanding. In a single talk, only a few of the relevant matters can be traversed.

There is a further problem: humanity is entering uncharted territory. While it is possible to identify key trends and risks, there remains much we do not know. This includes the so-called ‘known unknowns’ and the ‘unknown unknowns’. Almost inevitably there will be significant surprises. Many of these seem destined to be adverse and disruptive. Nevertheless, given the range and magnitude of the uncertainties, future-focused discussions require proper humility, caution, and circumspection.

How we discuss the future also warrants comment. The literature on climate change and related ecological crises – whether in the form or poetry or prose, and whether scientific or policy-oriented – is replete with grim, if not dystopian, visions. Much of the discourse is ominous, foreboding, and confronting. There is extensive reference to ‘climate emergency’, ‘climate breakdown’, ‘code red’, ‘heat-related deaths’, ‘dying oceans’, ‘existential dread’, ‘eco-anxiety’,[[5]](#footnote-5) ‘gallows humour’, ‘climate doomers’, ‘doom evangelists’, ‘climate alarmists’ and ‘defeatists’. Commonly employed words include ‘chaos’, ‘collapse’, ‘tragic’, ‘unprecedented’, ‘irreversible’, ‘irreparable’, ‘dangerous’, ‘devastating’, ‘ruinous’, ‘catastrophic’, ‘cataclysmic’, ‘calamitous’, and ‘apocalyptic’.

The titles of recent books, including various best-sellers, vividly capture the global abundance of negativity, pessimism, and angst:

* *The Uninhabitable Earth: Life After Warming*
* *Our Final Warning: Six Degrees of Climate Emergency*
* *The Water Will Come: Rising Tides, Sinking Cities, and the Remaking of the Civilized World*
* *Learning to Die in the Anthropocene: Reflections on the End of Civilization*
* *We’re Doomed. Now What? Essays on War and Climate Change*
* *The Collapse of Western Civilization*
* *Falter: Has the Human Game Begun to Play Itself Out?*
* *Field Notes from a Catastrophe*
* *The End of Ice*
* *Requiem for a Species*
* *Our Fragile Moment*

Such titles prompt inner turmoil. It is easy to feel overwhelmed.

How should we respond? In brief, we must be willing to take the available scientific evidence seriously, face the stark warnings of experts openly and honestly, and confront our fears and anxieties. The grim projections rightly cause us dread and grief; they justifiably spark moral outrage; but they should also be a spur for courageous, persistent, and effective actions.

Equally, however, we must avoid unhelpful hyperbole and embellished depictions, let alone wallowing in woe. Rather, we need level heads, practical wisdom, and faithful endeavours. There is a case for being simultaneously heartbroken and hopeful – or what the Italian philosopher Antonio Gramsci referred to in a letter from prison in 1929 as ‘pessimism of the intellect but optimism of the will’.[[6]](#footnote-6)

With these considerations in mind, in what follows I cover the following matters.

First, even with rapid global decarbonisation[[7]](#footnote-7) over the next few decades, climate change, and various related ecological crises, pose huge political, economic, and social risks. These include undermining the capacity to maintain a relatively civilized existence, not least reasonably free societies with extensive human rights and effective democratic governance. The focus of this analysis is global rather than national or local.

Second, the paper briefly discusses the nature, role, and sources of hope. In this context, I will argue that ‘keeping hope alive’ means focusing on what is possible or realistic, not what is beyond the bounds of realism.

Third, the paper critically assesses five distinctive claims regarding what it might be realistic to hope for over the coming decades and beyond. These claims are drawn from a range of theological, scientific, technological, and socio-cultural standpoints. I will argue that each claim is open to a range of objections, some more compelling than others.

Finally, based on an explicitly Christian perspective, the paper comments on the challenges of living in darker times, where much of what is valuable could be damaged, degraded, or destroyed, and where there is the realistic prospect over multiple generations of many things – but certainly not everything – getting worse rather than better. The questions here centre on how to cope with ongoing losses and vulnerability, and how to live in a ‘new normal’ characterized by grief, regret, angst, and despair. The answers at a personal level reside, at least in part, in the practice of confession, repentance, and lament, along with embracing ‘the solidarity of the shaken’, to quote the Czech philosopher Jan Patočka. At a societal level they include preparing our public institutions and policy frameworks for multi-generational adaptation and frequent emergency responses.

Underpinning and informing this analysis is a particular theological standpoint. This takes seriously the existence of God – a God who created, sustains, and loves the cosmos, but who has also bestowed on the creation a degree of freedom to evolve and become what it will.[[8]](#footnote-8) In response to the growing existential crisis, humanity is called upon to exercise a ‘realistic faith’ and a ‘prudent and practical realism’.

**The implications of climate change**

According to the Intergovernmental panel on Climate Change (IPCC, 2018, 2021, 2023), there is now incontrovertible evidence that humanity is warming the planet. Since pre-industrial times, the Earth’s mean surface temperature is estimated to have warmed about 1.2°C, with larger increases over land than over the ocean. It is on track to reach 1.5°C on a sustained basis during the 2030s, depending on the path of global greenhouse gas emissions (IPCC, 2023, p.12). Every incremental increase in global temperatures ‘will intensify multiple and concurrent hazards’ (ibid.). In all likelihood, 2023 will be the warmest year since comprehensive temperature measurements began and will be close to 1.5°C above pre-industrial levels. Given the warming impact of the current El Nino weather pattern in the equatorial Pacific, 2024 may be even warmer than 2023.

Meanwhile, despite three decades of international efforts to tackle climate change, global greenhouse gas emissions have yet to fall on a sustained basis (see United Nations, 2023). Indeed, according to the International Energy Agency (IEA), global coal and oil demand in 2023 are both at record levels.[[9]](#footnote-9) As a result, the concentrations of the main greenhouse gases in the atmosphere, such as carbon-dioxide, nitrous oxide and methane continue to rise. For instance, carbon-dioxide concentrations, at around 420 parts per million, are currently at their highest levels since the Mid-Pliocene Warm Period about three million years ago. At that time, it is estimated that the mean global surface temperature was between 2.5°C and 4.0°C warmer than the pre-industrial period.

I will discuss in more detail later what it might be realistic to hope for over the coming century and beyond. For now, let me offer some brief observations about the future for humanity based on recent scientific reports and assessments.

***Much uncertainty but growing risks***

Contemporary science provides humanity with an enormous fund of knowledge, evidence, and insights about the Earth’s climate system. Nevertheless, much remains unknown or uncertain. This uncertainty of course reflects the provisional nature of all scientific theorizing, investigation, and endeavour. Regarding climate change, key remaining uncertainties include:

* the sensitivity of the climate system – that is, how much the planet will warm if concentrations of carbon-dioxide in the atmosphere are doubled from pre-industrial levels (see Hansen, et al., 2023a; IPCC, 2021);
* the extent to which atmospheric particulate matter, and especially sulphate aerosols, have been cooling the planet since the mid-20th century, thereby masking the true amount of global warming (Hansen, et al., 2023b, 2023c, 2023d);
* the microphysics of clouds and their role in climate dynamics (see Hansen, et al., 2023a); and
* the temperature at which various tipping points in the Earth system will be crossed (see Armstrong McKay, et al., 2022; Brovkin, et al., 2021; Kemp, et al., 2022; Lenton, et al., 2008; Lenton, et al., 2019; OECD, 2022; Steffen, et al., 2018).

Technically, a ‘tipping point’ refers to a critical threshold beyond which a modest additional change causes a much bigger and/or a more abrupt response than would otherwise be expected, resulting in a ‘system’ reorganizing and moving to a different state. As such it constitutes an inflection point or turning point. In the literature on climate change, tipping points generally mean thresholds in one or other of the estimated 16 ‘tipping elements’ in the Earth system beyond which there are very likely to be system responses that are self-perpetuating, non-linear, and/or irreversible (see Armstrong McKay, et al., 2022). ‘Non-linear’, in this context does not necessarily imply that tipping elements have sharp cliff-like edges or that changes will occur very fast (e.g. over a few years), although the speed of adjustment can be expected to increase. ‘Irreversible’ means extremely difficult to stop, at least within normal human timescales (i.e. decades or centuries).

Aside from the specific scientific uncertainties just mentioned, decision-making about the future necessarily occurs in a context often characterized by ‘radical’ and ‘deep’ uncertainty (see Kay and King, 2020; Walker, et al., 2012) and frequent surprises, both positive and negative. Be that as it may, the more that scientists learn about the Earth system, the more disquieting the evidence of humanity’s impacts becomes. Several particular concerns deserve comment.

***Tipping elements, tipping points, and tipping cascades***

There is a growing understanding of the main tipping elements in the Earth system, their likely tipping points, and the risks they pose (see Figure 1).[[10]](#footnote-10) Several decades ago, it was generally believed that important tipping points would not be crossed until planetary warming exceeded 2°C above pre-industrial levels or even higher temperature thresholds (Lenton, et al., 2008, 2019). Recent research, however, suggests otherwise. In fact, several important tipping points may be crossed somewhere between 1.5°C and 2.0°C (Armstrong McKay, et al. 2022; Wunderling, et al. 2021). One of these is the shutting down of the Atlantic Meridional Overturning Circulation (AMOC) with massive implications for marine and terrestrial biodiversity, global food production, and sea levels in various parts of the world (Ditlevsen and Ditlevsen, 2023; Rahmstorf, et al., 2015; Weijer, et al., 2019).

**Figure 1: Tipping elements in the Earth System**



Source: https://www.pik-potsdam.de/en/output/infodesk/tipping-elements/tipping-elements

Another serious risk lies in triggering the irreversible melting of the Greenland and West Antarctic ice sheets (Wunderling, et al., 2021). Between them these ice sheets have the potential to raise the global sea level by at least 10 metres. Even to slow the pace of melting once the relevant tipping points have been crossed will be extremely difficult because it would mean reducing the temperature of the oceans significantly, which would take generations.

If several critical tipping points are under 2.0°C, then even with rapid global decarbonization they will likely be crossed within the next three-to-four decades. Put differently, there is a risk that 2°C of warming will generate as much long-term damage as was previously expected only with a temperature increase of perhaps 3°C to 4°C. That said, there is no *single* sharp cliff-edge in the planet’s climate system; rather, every additional warming increment (e.g. 0.1°C) increases the risk of more profound and enduring system changes.

Nevertheless, there is a growing understanding of, and concern about, the interaction between various tipping points and hence the likelihood of compounding and cascading risks (Kemp, et al., 2022; Klose, et al., 2021; Ripple, et al., 2023; Steffen, et al., 2018; Wunderling, et al., 2023). In other words, there is a significant chance of what are variously called self-reinforcing feedbacks, tipping cascades, and domino effects: crossing one tipping threshold will prompt the crossing of others. To quote Will Steffen and colleagues:

… self-reinforcing feedbacks could push the Earth System toward a planetary threshold that, if crossed, could prevent stabilization of the climate at intermediate temperature rises and cause continued warming on a ‘Hothouse Earth’ pathway even as human emissions are reduced. Crossing the threshold would lead to a much higher global average temperature than any interglacial in the past 1.2 million years and to sea levels significantly higher than at any time in the Holocene … the resulting trajectory would cause serious disruptions to ecosystems, society, and economies (Steffen, et al., 2018).

Remember, too, that rapid climate change is but one of several ecological crises afflicting the biophysical processes that regulate the functioning, stability, and resilience of the Earth system. The interdependencies between, and interactions of, these various crises will compound the likely damage to Earth’s life-support mechanisms. Related to this are concerns about global temperature increases having ‘fat tails’, namely low probability but high-impact extreme outcomes (Kemp, et al., 2022). Equally, we need to be mindful not only of the complex interactions within the climate-ecological system, but also their interactions with socio-economic and political systems. In short, the combined effect of humanity’s continuing fossil fuel dependence, poor land-use practices, and socio-economic systems pose grave risks to the wellbeing of future generations and the wider natural world.

Ocean acidification is yet another concern (IPCC, 2021). As the oceans absorb more carbon dioxide, the pH decreases, and the oceans become more acidic.[[11]](#footnote-11) The polar oceans are especially affected as cold water absorbs more carbon-dioxide than warm water. The acidity of sea water has increased about 30% over recent centuries, roughly ten times faster than at any stage in 55 million years. As acidity increases, the shells and skeletons of marine organisms made from calcium carbonate begin to dissolve. Marine experts believe that atmospheric concentrations of carbon-dioxide above about 450 parts per million, which are almost certain by 2040, will dramatically affect marine species, especially in polar regions. Reversing the damage will likely take tens of thousands of years.

***The risk of accelerating warming***

For some years, the distinguished atmospheric physicist James Hansen and various colleagues have been warning of the potential for accelerated global warming (see Figure 2; Hansen, et al. 2023a, 2023b, 2023d). The main reason lies in the reduction of human-made aerosols (i.e. fine airborne particles), and especially sulphate aerosols. It has long been known that aerosols have a cooling or dimming effect by reflecting sunlight into space, largely by increasing the brightness of clouds and extending their lifetime. But there remains an incomplete understanding of the magnitude of aerosol climate forcing, partly because the properties of clouds are not measured with sufficient precision. Nevertheless, it is generally accepted that human-made aerosols have reduced the amount of warming that might have been expected due to anthropogenic greenhouse gas emissions (Jenkins, et al., 2022).

At the same time, regulatory measures across the world over recent decades have gradually curbed the production of aerosols from energy generation, industry, and transport. Of particular importance was the decision by the International Maritime Organization (IMO) to implement new regulations (under MARPOL Annex VI) from January 2020 (Hansen et al., 2023a, 2023d). Under these regulations, the sulphur content of the bunker fuel used by ships was cut from a limit of 3.50 percent (which was in place from 2012) to 0.5 percent. Some experts believe measures of this nature will have a detectable impact on global warming over the coming years. But whether any acceleration is temporary or more protracted is uncertain (Jenkins, et al., 2022). James Hansen and his colleagues contend that there could be an increase in the rate at which global mean surface temperatures rise of up to 50 percent over the next few decades – i.e. from about 0.18°C per decade since the 1970s to about 0.27°C per decade. If this assessment is correct, then by 2050, without a dramatic reduction in global greenhouse gas emissions, the Earth will be 2°C warmer than the estimated pre-industrial level or about 0.7-0.8°C warmer than currently (see Figure 2).

**Figure 2: Global surface temperature relative to 1880-1920 average: the 12-month running mean extends through May 2023**



Source: Hansen, et al., 2023a

It is too early to conclude whether the spike in global temperatures over recent months[[12]](#footnote-12) partly reflects a reduction in human-made aerosols in the atmosphere. Other factors are almost certainly at play. One of these is the onset of an El Nino weather pattern in the equatorial Pacific. Others include an increase in solar irradiance (as the regular 11-year solar cycle approaches the solar maximum) and various positive feedbacks – the most significant being the Hunga Tonga – Hunga Ha‘apai submarine volcanic eruption in January 2022 which released an estimated 146 metric megatons of water vapour into the stratosphere (Jenkins, et al., 2023b). Be that as it may, within a few years it will be possible to ascertain whether the concerns of Hansen and his colleagues are justified.

***Large impacts already happening and will increase over time***

Even without accelerated warming, it is critical to acknowledge that climate change is already having large-scale impacts, whether in the form of more severe heat waves, more protracted droughts, more intense precipitation events, increased biodiversity loss, disruption to global food supplies, and damage to human settlements. Climate change is already contributing the displacement of millions of people globally and the magnitude of this dislocation is bound to intensify, resulting in ever larger migrations of people, both within and between states. In recent years, some weather events, no doubt worsened by climate change, have badly affected many millions of people.

Among these was the extraordinary monsoon-related flooding and heat wave in Pakistan during mid-2022.[[13]](#footnote-13) In some parts of the country, rainfall was over 700 per cent greater than the average for that time of year. Altogether, the floods affected over 30 million people, damaged millions of homes leaving at least two million people homeless, and destroyed or damaged vast amounts of physical infrastructure, including over 20,000 schools. Economic losses exceeded US$15 billion.

While events of this magnitude may not happen every year, the scientific projections are clear: globally, climate change-related impacts will become more frequent and more severe. Some of these events will be well beyond the capacity of individual communities, cities, and nations to manage. Moreover, climate change is a risk multiplier and amplifier: it exacerbates other problems. For instance, it augments existing dangers, such as fire and flood, and intensifies material hardship, insecurity, vulnerability, and injustice.

In an interdependent world, the impacts will be increasingly global in nature. They include:

* ever greater disruptions to international trade and supply chains (as witnessed during the COVID-19 pandemic) causing economic downturns and financial stresses;
* large-scale and typically chaotic involuntary migration, both within nations and across borders;
* more extensive food insecurity and large-scale hunger and malnutrition;
* an exacerbation of domestic conflicts and increased cross-border conflicts, perhaps sparked by disputes over scarce supplies of freshwater or critical raw materials;
* more extensive use of emergency powers; and
* an unravelling of democratic governance and a corresponding rise of authoritarian and dictatorial regimes.

Accelerating sea level rise as the century progresses will aggravate all these problems and tendencies, causing huge damage to coastal communities and infrastructure (see Kulp and Strauss, 2019; Lawrence, et al., 2020, 2022a, 2022b; Strauss, et al., 2021).

Those who envisage escaping to secure locations or insulating themselves from the negative financial and non-financial consequences of climate change are gravely mistaken. In due course, nowhere will be safe; no one will be immune.

***Climate change – a long, creeping, super-wicked problem***

Equally important, climate change has all the features of a ‘long problem’ (Hale, forthcoming), a ‘creeping problem’ (Boston, 2016), and a ‘super-wicked problem’ (Lazarus, 2009). To start with, it is truly multi-generational in nature. While the global challenge of achieving geological net zero emissions may be accomplished this century, and even perhaps within four-to-five decades, the problem of adaptation will continue, one way or another, for centuries if not millennia. Equally, climate change constitutes a slow-burner problem or a slow-onset catastrophe. There will not be a single future catastrophe. Instead, we face the prospect of a long-drawn-out series of damaging events. Some of these, in all likelihood, will be apocalyptic in terms of their scale, scope, and duration. At the same time, their global distribution and societal impacts will be uneven. Additionally, climate change is a ‘super-wicked’ problem. As such, it is not amenable to simple policy solutions or technical fixes. And the slower the process of decarbonization, the more complex, difficult, and costly the challenges of adaptation will become. In short, problems that are long, creeping, and super-wicked like climate change can only ever be ameliorated; complete resolution or permanent solutions are not within humanity’s grasp.

Plainly, the faster global greenhouse gas emissions can be reduced, and cost-effective methods of carbon capture and storage implemented, the better (see Gambhir et al., 2023; IPCC, 2023. But even with rapid and sustained decarbonisation, humanity will be forced to live with, and endeavour to adapt to, increasingly severe climate change-related events. In particular, the global community must prepare for extensive damage to coastal dwellings and infrastructure, and the likely need to relocate hundreds of millions of people. Aotearoa New Zealand will be among those countries most severely affected by sea level rise: we have the ninth longest coastline in the world; most of our cities and towns are located on or near the coast; and around 40% of our coastal areas are subsiding (Expert Working Group, 2023; Naish, et al. 2023). I will not address here the specific challenges of climate change adaptation, including planned relocation. But three points are worth highlighting briefly.

First, adaptation involves far more than a series of engineering or technical responses; it will entail a willingness by humanity to adapt to living in a substantively different world with major implications for land use, infrastructure, and urban form; the costs will be immense (Brown, et al., 2021; Hinkel, et al., 2014, 2018; Hino, et al., 2017; McMichael, et al., 2020). Effective adaptation will be far harder and far more protracted than the task of mitigation (i.e. emissions reductions). It poses unprecedented policy and political challenges (Expert Working Group, 2023). It will test the capabilities, resources, institutions, and governance arrangements of even the most advanced states.

Second, the risks of policy failure are high. That is to say, it is probable than many societies will fail to design and implement the policy frameworks necessary for cost-effective adaptation. As a result, the impacts of climate change, not least sea level rise, will be all the greater than otherwise.

Third, even with effective adaptation, including the planned relocation of vulnerable coastal communities, towns, and cities, humanity will face many losses, some of huge ecological, historical, and cultural significance. At the same time, the future will not be solely defined by climate change (Hulme, 2011).

**The nature of hope – some brief comments**

When I speak to audiences about climate change, it is common for someone to ask: ‘Given your analysis, is there any hope?’ Or ‘where do you find hope in this challenging situation?’

Such questions are not surprising. They reflect fundamental aspects of the human condition: our understandable fear of destruction, suffering, death, and species extinction; our widespread desire for a secure, peaceful, just, and sustainable future;[[14]](#footnote-14) a common concern for the wellbeing of our offspring, along with all future generations; and a general recognition that a sense of hope can be vital for human striving and for coping with life’s manifold struggles.

Much of the contemporary literature and discourse about climate change, and our wider environmental problems, addresses the topic of hope, whether directly or indirectly (Robinson, 2020). As noted earlier, there is often reference of a ‘crisis of hope’. Similarly, there is much talk about the need to revitalize or renew our hope in the future – or words to that effect. Comments such as those of the Cambridge University climate scientist, Professor Mike Hulme (2019), are commonplace:

… it is essential for humans to continue to seek out the sources of hope, creativity, respect and solidarity that characterize the human reflex at its best … human action in the world [should be motivated by] justice, dignity, kinship, and hope.

But what exactly is hope and what are its sources? Such matters have generated a vast literature over many millennia across multiple civilizations. Reflections on hope, for instance, are prominent within the Hebrew Scriptures and the Christian New Testament, as well as many other religious traditions. The topic has also engaged the minds of those working in a wide range of contemporary academic disciplines, not least classics, philosophy, psychology, psychiatry, and medical ethics. For our present purposes, a few brief comments must suffice.[[15]](#footnote-15)

To start with the obvious: hope is future-focussed. It involves looking beyond the present. But that future may be imminent (e.g. surviving until the dawn), medium-term (e.g. completing a course of study) or long-term (e.g. achieving one’s lifetime goals). Equally, we may have hopes about many things, including ourselves, significant others, and the state of the world. As such, hope may be individualistic or communal in its focus and orientation.

More specifically, hope typically refers to an expectation and yearning for a positive or desirable outcome. It is about both desiring and expecting that specific things will happen, especially those which are good or beneficial – whether better results, better health, or better times. To quote the great mediaeval theologian Thomas Aquinas, hope is ‘the desire for a future, difficult, yet possible good’ (quoted in Robinson, 2020, p.4). Importantly, then, hope assumes that the desired outcomes are genuinely possible to realize, notwithstanding evident difficulties or tribulations. In other words, that which is hoped for is, at least in some sense, a goal or a good that is justified, well founded and credible. As such, being hopeful is readily contrasted with a sense of hopelessness, despair, desolation, dejection or losing heart.

Rebecca Solnit puts it like this: ‘Hope locates itself in the premises that we don’t know what will happen and that in the spaciousness of uncertainty is room to act’.[[16]](#footnote-16) From this perspective, then, hope differs from optimism, confidence, idealism, or inner peace (see Higgins, 2022). Whereas optimism entails the belief that everything will work out alright, hope makes no similar conjectures or assumptions. It does not presuppose a totally positive outcome. Instead, it rests on the conviction that there are ways through the difficulties being confronted and that notwithstanding adversity, suffering or anguish, there is ultimate meaning or purpose. Václav Havel, the former Czech dissident, poet, and President, put it like this: ‘Hope … is not the conviction that something will turn out well, but the certainty that something makes sense regardless of how it turns out’.[[17]](#footnote-17)

Because it rests on a firm conviction, hope is active rather than passive; it reaches out, rather than standing back impassively; it identifies and pursues genuine possibilities rather than dwelling on impossibilities; it dares to see and grasp beginnings where others only see endings. As St Paul implies, hope involves straining or ‘stretching forward to what lies ahead’ (Philippians 3:13). In this context, St Augustine of Hippo is often quoted as saying that: ‘Hope has two beautiful daughters; their names are Anger and Courage. Anger at the way things are, and Courage to see that they do not remain as they are’. The origin of this quote is uncertain, and there is some doubt as to whether St Augustine would have commended anger. But the claim that hope entails action, not passivity, undoubtedly has merit.

Unsurprisingly, there is abundant evidence from a range of academic disciplines (e.g. medicine, psychology, etc.) that hope is a vital human motivator. It provides the impetus and stimulus for people to continue striving, to persevere through hardships and difficulties, and not give up despite repeated setbacks. Put simply, it furnishes emotional resilience and a capacity to endure. It can also help inspire, encourage, and sustain others. Accordingly, hope is particularly relevant in times of heightened risk, uncertainty, insecurity, and adversity, such as our current ecological crises.

Within the Christian tradition, hope has often been regarded as both a virtue and a gift from God. Certainly, this was the view of St Thomas Aquinas in *Summa Theologica* (Robinson, 2020). Drawing upon various New Testament passages, including St Paul’s first Epistle to the Corinthians (Chapter 13, verse 13), Aquinas argues that hope is one of the three ‘theological virtues’ – the others being faith and love. Hope, from this perspective, is a spur for moral action; it leads and directs a person’s will towards that which is good, with the ultimate good being the transcendent creator of all things, namely God. But hope can also be viewed as a gift. For Aquinas, therefore, it constitutes an infused or instilled virtue rather than a natural virtue. It is not attainable simply through human endeavour; it lies beyond mere human capacities; it relies for its power and ultimate purpose upon a transcendent source.

Yet as with other gifts, there is the option of either nurturing or rejecting the gift of hope. In other words, we have some choice in the matter. From this perspective, as Krista Tippett contends, hope can be likened to a muscle; as with other virtues it can be strengthened by regular practice and proper exercise.[[18]](#footnote-18) Likewise, St Paul draws a clear connection between a person’s character and the virtue of hope (see Romans 5:3-5).

This leads to a further point, namely the basis, ground, or source of hope. In practice, people base their hopes on many things. For those of a Christian faith, the primary source of hope lies in the triune God, revealed in the life, death, and resurrection of Jesus Christ. The incarnation and resurrection provide powerful grounds for hope, both for the present and the future. For the present, they affirm God’s love for, and solidarity with, humanity – and indeed the entire created order; they provide confidence that God knows our plight from inside-out, and that God’s Spirit is working actively and creatively in the cosmos to bring about that which is good and just (see below). For the future, they point to a time when the whole created order will ultimately be redeemed and transformed. At that juncture, all creaturely suffering, death, and decay will end.

Finally, it must be acknowledged that people can, and often do, place their hope in the wrong things. Alternatively, people risk being deliberately deceived or misled. Either way, their hopes will be ill-founded or naïve; they will be based on fictions and falsehoods. At some point, however, the truth will be revealed. At that juncture, a deep disappointment or even a terrible reckoning may await the unsuspecting.

With these considerations in mind, what do I mean by ‘keeping hope alive’ in the face of the climate crisis? I am certainly not suggesting that hope should be kept alive simply for hope’s sake. Hope should not be treated as a placebo or unfounded panacea. It cannot rest on pretence or subterfuge. The aim is not to engender more positive dispositions regardless of the grim reality of the world. Such a goal would lack a firm foundation; it would eventually fail.

Nor do I mean keeping hope alive for things which, based on the most reliable scientific knowledge and understanding, are utterly unrealistic, fanciful, bogus, unworkable, or highly improbable. Rather, I mean identifying those desirable developments and future outcomes that are plausible; that is, those things which are possible to achieve based on good reasons and the best available evidence. Put differently, the aim should be to identify, and be grasped, by realistic hopes based on a prudent and practical realism. It is those hopes which we should seek to keep alive.

Against this, it might be argued that embracing only realistic or reasonable hopes lacks ambition; it is insufficiently hopeful! To this objection my response is simple: pursuing unrealistic futures or seeking the unobtainable will likely only contribute to greater long-term disenchantment, misery, and despair. We need truthful diagnoses of the planet’s afflictions and honest prognoses, not spurious analyses, deceptive catchcries, or phoney expectations. At the same time, we have a responsibility, based on firm foundations, to be ‘hope-givers’ – to plant and nourish the seeds of hope, not deliberately quell or quash it.

**Grounds for hope for this world – what can we realistically hope for?**

What, then, can we realistically hope for over the coming decades and beyond? Here are five contemporary responses to that question:

1. there are no realistic grounds for hope: it is now too late; humanity has passed the point of no return; civilization is doomed;
2. there are realistic grounds for hope: there is no climate emergency or ecological crisis;
3. there are realistic grounds for hope: God will come to humanity’s rescue and intervene miraculously;
4. there are realistic grounds for hope: technology will save humanity and avoid a massive loss of species and other major environmental and societal impacts; and
5. there are realistic grounds for hope: positive feedbacks in our socio-cultural-political systems have the potential to generate a rapid and just transformation of the global economy, thereby guaranteeing a habitable planet and an ecologically sustainable future for humanity.

In what follows I will briefly outline and assess each approach. Note that the last three are not mutually exclusive.

***Civilization is doomed***

The first position is strongly negative. It reflects the views of ‘climate pessimists’ and ‘climate doomers’.[[19]](#footnote-19) It takes different forms (see Bendell, 2018; Higgins, 2022; Robinson, 2020). One of these is as follows: Earth’s life-support systems are on an irreversible path to destabilization and eventual collapse. It is now too late to prevent such an outcome. This is because important tipping points have either already been crossed or will inevitably be crossed within a few decades. Once this happens, a protracted tipping cascade will follow. Mass extinctions will then ensue. The result, eventually, will be a radically transformed planet, one that is largely inhospitable to human life, if not most forms of life (i.e. because it is too hot and the oceans are too acidic). More specifically, it will not be compatible with the kind of large-scale, technologically-advanced civilization to which human beings have become accustomed.

To make matters worse, humanity’s response to the forthcoming tipping cascade will witness increased armed conflict, ever more despotic regimes, and protracted economic crises, thus preventing a coordinated or effective global response to the unfolding ecological disaster. In fact, a thermo-nuclear war may well be triggered. Potentially, human beings will become extinct. But if the species survives, it will be reduced to small numbers, mostly in the high latitudes of the Northern hemisphere.

How realistic is such a scenario? As previously noted, the climate crisis poses large risks. A tipping cascade with profoundly damaging biophysical impacts cannot be ruled out (Kemp, et al., 2022). But the best available evidence suggests that such an outcome is not inevitable (IPCC, 2023). Having said this, without rapid global decarbonization and/or large-scale carbon capture and storage (CCS) over the coming decades, the risks of this eventuality will undoubtedly increase. And even without a tipping cascade, a much warmer planet will impose huge costs. It will make significant areas of the Earth which are currently heavily populated too hot for human habitation (e.g. South Asia). It will cause extensive creaturely suffering and multiple extinctions. And it will likely result in future generations being worse off than current generations in many relevant respects, possible for centuries.

One other point is worth highlighting: whenever it is suggested that it is ‘too late’, the question must always be asked: ‘too late for what’? It may well be too late for some things, but not for others. Not everything is destined to be lost. Not everything will inevitably get worse. After all, there are many kinds of ecological losses and biophysical risks, and many variants of a global catastrophe; there is a spectrum of possible damages, from lesser to greater (see Kemp, et al., 2022, p.5). For instance, it may be too late to avoid warming of at least 2°C above pre-industrial levels. Likewise, it may be too late to save most coral reefs. But it will never be too late, as Mike Hulme emphasizes, ‘to do the right thing’ – that is, to act responsibly, courageously, and compassionately to prevent large-scale harm to the natural world or social life (Hulme, 2019). Moreover, the future is not totally preordained; there will always be options even if they all have significant drawbacks.

In short, humanity may have embarked on the road towards an eventual collapse of civilization, prompted by a global ecological catastrophe. But there is no reason to believe that such a collapse is imminent or has already become inevitable.

***There is no climate emergency***

A radically different view is advanced by those whose who reject core assumptions and predictions of contemporary climate science, as for instance represented by the IPCC, along with those who think the evidence of, and risks associated with, anthropogenic climate change have been greatly exaggerated. Those adopting such views fall into various camps. Some are highly trained scientists but tend to be contrarians by disposition. Some work for major fossil fuel companies. Others are committed to specific ideological or religious presuppositions that are inconsistent with the key findings, or implications, of the mainstream science. For instance, some neo-liberals and libertarians dispute the assessments of the IPCC largely because they oppose the state regulation of markets. Acceptance of IPCC assessments would imply a willingness, if not a moral imperative, to regulate greenhouse gas emissions. But such regulations are an anathema. Alternatively, it is argued that state regulation would be too costly and/or largely ineffective.

Among religious believers, including Christians, there are many whose theological priors render anthropogenic climate change or any other kind of human-induced ecological crisis impossible. The American psychiatrist, Dr Tim Jennings, is one such person. In his blog on 26 January 2023, he made the following claims:

As long as the earth endures, seedtime and harvest, cold and heat, summer and winter, day and night will never cease (Genesis 8:22 NIV 84). God’s promise is that our climate and seasons will continue stably until the second coming of Christ—that is, “as long as the earth endures.” But the lie of Satan, the false narrative of this corrupt world, is that of “climate change,” climate disaster, the ending of human life through the destruction of the climate. And just like the antediluvians, we must decide which view we believe: the godless, the evolutionists, the pundits of this world, the same people who foisted COVID mandates upon the world, restricted our liberties, and injured our children—or our Creator? Understand this clearly:

* We are not facing a global climate disaster—we are facing a global spiritual disaster.
* We are not facing man-made global warming—we are facing man-made global coldness of heart; Jesus said, “Because of the increase of wickedness, the love of most will grow cold” (Matthew 24:12 NIV84).

Satan blinds people to reality by getting them to focus on something emotional as a distraction to what is really happening.

People holding such views are variously referred to as climate ‘contrarians’, ‘sceptics’ or ‘denialists’. In my experience, it is difficult, if not impossible, to persuade such people that they may be in error (Boston, 2010). The reasons for this include elements of self-deceit or wilful blindness – that is, a stubborn and persistent refusal to accept certain features of reality or recognize specific physical phenomena, however obvious or undeniable.[[20]](#footnote-20) All human beings, it must be acknowledged, are susceptible to such vices, along with many other cognitive biases and forms of cognitive dissonance. Aside from any wilful blindness, those who reject climate science, as for instance articulated by the IPCC, often draw on different standards (or different types) of evidence or employ assessment criteria that differ from those generally accepted within the scientific community. Put simply, they are ‘epistemic sceptics’ (Capstick and Pidgeon, 2014).

To give but one example of how particular religious presuppositions can contribute to the denial of anthropogenic climate change. The eminent American theologian, Wayne Grudem, once declared:

It does not seem to me that God would set up the world to work in such a way that human beings would eventually destroy the earth by doing such ordinary and morally good and necessary things as breathing, building a fire to cook or keep warm, burning fuel to travel, or using energy for a refrigerator to preserve food.[[21]](#footnote-21)

Over the years such claims have been endorsed in public declarations by large numbers of theologians and church leaders, especially in the United States. The Cornwall Alliance is a notable example.

Arguably, the theology underpinning such claims is fundamentally mistaken. Human actions, whether ordinary or otherwise, actually matter; they have real consequences – both good and bad. This reflects the way the world is made. It is ordered. There are physical laws. There is cause and effect. If I drive my car fast along a crowded footpath, many injuries will result. If my fridge uses chlorofluorocarbons (CFCs) as a refrigerant, I will damage the ozone layer. Humanity can be thankful that the theology embraced by Professor Grudem did not unduly influence the policy deliberations in 1987 which prompted the Montreal Protocol. Had they done so, there may have been no such Protocol, and thus no effective global action to prevent the use of CFCs. As a result, the depletion of the ozone layer would have continued, with dreadful consequences.

Be that as it may, the fact that so many people, notably in the United States, dispute contemporary climate science – on multiple philosophical, religious, and other grounds – has made it all the harder to secure effective national and global measures to mitigate the problem. The continuing growth of social media platforms and other media outlets that deliberately spread misinformation and disinformation, engage in obscurantism, and applaud populist demagogues, is deeply concerning. How can societies protect themselves and future generations from serious harm if large and vociferous sections of the voting public deny the very existence of such harm? Put differently, how can policy makers act in the public interest if there is no commonly accepted body of truth, and if the best available scientific evidence is widely and stridently rejected? Alternative facts typically are not facts at all; they are ‘nonsense on stilts’ (to use the phrase of Jeremy Bentham). The capacity of misinformation to inflame emotions and disrupt democratic processes has been vividly displayed globally since 2020 in relation to the COVID 19 pandemic.

***God will rescue humanity miraculously***

Whereas some people, whether for ideological or religious reasons, deny that humanity faces a climate emergency, let alone a wider ecological crisis, there are those who accept the mainstream climate science but who believe that God will intervene miraculously at some point in the not-too-distant future and save humanity from its peril. Hence, there are solid grounds in the here and now for hope. But how God might undertake the supposed rescue mission is rarely explained. The fact that God will do so is simply asserted as a matter of faith.

Such claims invite various responses. Let us assume that God exists, and that God has extraordinary creative, restorative, and redemptive powers. Presumably, therefore, it would not be beyond God’s capacity to change the biophysical properties of the planet, thereby halting or even reversing the process of global warming.

But is it likely that God would act in this way? The former Archbishop of Canterbury, Rowan Williams, once responded to such a question as follows:

… to suggest that God might intervene to protect us from the corporate folly of our practices is as unchristian and unbiblical as to suggest that he protects us from the results of individual folly or sin. This is not a creation in which there are no real risks; our [Christian] faith has always held that the inexhaustible love of God cannot compel justice or virtue; we are capable of doing immeasurable damage to ourselves as individuals, and it seems clear that we have the same terrible freedom as a human race (2012, p.190).

From this standpoint, therefore, there is a real risk of a ruined world, one from which no one will be spared. Nevertheless, Archbishop Williams affirms: ‘God’s faithfulness stands, assuring us that even in the most appalling disaster, love will not let go’ (ibid).

Theologically, such a perspective seems plausible, if not convincing. But it begs many difficult questions. What does it mean for love to ‘not let go’? Equally, how should we understand God’s activity within the cosmos? In what ways, if at all, does God act to prevent or minimize suffering, whether by humans or other sentient creatures? Bear in mind that the Earth’s geological record points to at least five previous mass extinction events over the past 500 million years. Plainly, God did not intervene to prevent these. So why would God avert a sixth? And if yet another mass extinction is permissible within the providence of God, what exactly might we, as humanity, hope that God will do in the here and now?

Again, there is space for only some brief responses (see Southgate, 2023, esp. pp.42-47). Regarding God working *miracles*, in the sense of actions to violate, override or temporarily suspend a natural law: we should not expect miracles of this kind to be frequent or widespread. After all, as the philosopher Richard Swinburne (2010, pp.100-121) argues, frequent miracles would undermine the good order of the cosmos and interrupt normal cause and effect processes. This would render it impossible to understand the universe and would make predictable behaviour non-viable.

At the same time, Swinburne contends that it would be reasonable to expect a God who is loving, merciful, and gracious to intervene, perhaps frequently, in *non-miraculous* ways (i.e. ones that do not constitute a violation of a natural law) in order to demonstrate love and compassion for particular people (and perhaps for other sentient creatures). Potentially, such interventions could occur at the quantum level where the flexibility of physical processes may provide scope for God to alter the course of events without breaking the laws of nature (see Southgate, 2023). Alternatively, with respect to human beings (and possibly other creatures), God presumably has the capacity to exercise providential care through various non-miraculous interventions, such as those designed to influence mental processes, brains states, imaginations, and intuitions. Such interventions may give rise to so-called ‘religious’ or ‘spiritual’ experiences. Examples would include vivid dreams, visions, and images, specific promptings or ‘callings’, and similar cognitive processes. In this regard, it would be consistent with most Christian traditions to envisage that God will be, in the current context of a climate emergency:

* stirring consciences, enlightening intuitions, and prompting the exercise of ecological concern;
* instilling hope and faith;
* inspiring innovative scientific and technical ideas to solve problems;
* providing political, business, and civic leaders with wisdom to tackle complex challenges; and
* calling specific individuals to undertake vital societal roles.

Interestingly, there is much testimony from numerous people over many millennia of occasional experiences of this nature (Swinburne, 2010). And such experiences are not limited to those who profess a specific faith or regard themselves as being particularly ‘religious’ or ‘spiritual’.

In short, it is highly doubtful that God will intervene miraculously to solve anthropogenic global warming, for example by removing large quantities of carbon dioxide and other greenhouse gases from Earth’s atmosphere, thereby cooling the planet and preventing further ocean acidification. But it is reasonable to argue that God has been working – and will continue to work faithfully over the coming decades and beyond – to encourage, cajole, and enable human endeavours to ameliorate and mitigate the crisis. Such an approach is arguably consistent with parable of the mustard seed told by Jesus (see Matthew 13:31-32) in which the Kingdom of God grows from small and humble beginnings, initially hidden and unrecognized, but eventually expanding and flowing, with ever greater potential and possibilities.

One other crucial point: Christians have long believed that Christ will return to Earth at some stage in the future. To quote the Nicene Creed: Christ ‘will come again in glory to judge the living and the dead, and his kingdom will have no end’. But the timing of this miraculous return is unknown and unknowable. Meanwhile, our moral responsibility to be wise caretakers of God’s good creation remains, as does the commandment to love our neighbours and pursue justice. Importantly, too, the affirmation that Christ will ‘come again in glory’ provides no grounds for fatalism or resignation. Nor does it justify devaluing the moral significance of our day-to-day actions or denying the incalculable value of the natural world.

Equally, however, maintaining a proper sense of, and hope for, the ‘ultimate’ – that is, the final destiny of creation, including the future blessedness of humanity, through the redeeming love and grace of God – helps ensure that we are not overwhelmed or crushed by the size and scale of the impending ecological tragedies. It is this hope in the eventual renewal and transformation of the created order that has uplifted and inspired previous generations when faced with terrible afflictions, if not existential crises, such as the Black Death (i.e. the bubonic plague) in Europe in the mid-14th century, protracted wars, or long periods of tyrannical governance. The differences now, of course, relate to the global (rather than merely local or regional) scale and irreversible nature of the threats to human civilization.

***Technology will fix the problem***

The fourth approach is founded on the hope that humanity can invent, innovate, and engineer its way out of the current climate emergency and wider ecological crisis. It reflects the proverb: ‘necessity is the mother of invention’. It is brilliantly captured by David Wallace-Wells in his book *The Uninhabitable Earth*: ‘We found a way to engineer devastation, and we can find a way to engineer our way out of it – or, rather, engineer our way to a graded muddle … that … extends forward the promise of new generations finding their own way forward’ (2019, p.30).

Techno-optimism takes numerous forms. Some of the claims are very bold; others are more modest and circumspect. But in brief, techno-optimists have advanced multiple ways through which solutions to the unfolding climate crisis might be ‘engineered’, and where necessary ‘geo-engineered’. They include, in no order of importance:

* the rapid development and large-scale deployment of technologies to remove carbon dioxide from the atmosphere – e.g. CCS, bioenergy with CCS (BECCS), and direct air capture (DAC) of carbon-dioxide from the ambient air rather than from point sources (e.g. fossil fuel power stations);
* further significant improvements in renewable energy technologies, perhaps including the large-scale deployment of nuclear fusion;
* major improvements in energy efficiency, perhaps assisted by artificial intelligence;
* major enhancements to battery technologies, thereby enabling the rapid decarbonization of most forms of transportation;
* major improvements in aircraft design and propulsion, thereby reducing aviation emissions;
* major innovations to reduce the production of methane and nitrous oxide from livestock agriculture;
* major enhancements to carbon sequestration via marine and land-based forestry, along with the extensive use of biochar and enhanced weathering;
* the implementation of solar geo-engineering or solar radiation management to reduce the planet’s temperature, such as marine cloud brightening, the placement of reflective mirrors in space, and stratospheric aerosol injection; and
* the use of ocean geo-engineering, such as ocean liming and iron fertilization.

In response various points are worth making (see also IPCC, 2018, 2023).

To start with, a vast array of existing and new technologies will undoubtedly play a pivotal role over the coming decades and beyond in helping to mitigate anthropogenic global warming and enable humanity to adapt to its multiple impacts. Internationally, massive public and private resources are already being deployed to develop and apply such technologies. For instance, unprecedented levels of investment are occurring in renewable energy technologies, along with the digital and computational revolutions. It is reasonable to be hopeful that these investments will assist in preventing the worst outcomes that can be envisaged. Aside from this, there are bound to be all manner of extraordinary scientific innovations over the coming decades which will contribute to ameliorating the climate crisis and other ecological problems. So, there is certainly some good news on the technology front.

Against this, however, the following reservations need mention:

1. The current level of global investment in renewable energy technologies, such as solar and wind, remains well below the levels required for rapid global decarbonization of electricity generation and energy systems more generally. For instance, to have a 50 percent chance of remaining anywhere close to 1.5°C above pre-industrial levels, global carbon-dioxide emissions will need to fall by around 8-10 percent per annum over the next 10 years – a fall similar in magnitude to what occurred in 2020 during the first year of the COVID-19 pandemic. But there is little prospect of such rapid reductions being achieved – whether through strategies of green growth or degrowth (Hickel, 2021; Jackson, 2009, 2022).
2. Just as there are long lags and path dependencies in the planet’s climate system, so too there can be long lags in transforming many human systems, including legislative and regulatory frameworks, planning systems, stationary energy systems, transport infrastructure, and land-use practices (Geels, et al., 2017). Equally, altering the form of our urban areas in the interests of greater energy efficiency or moving human settlements out of harm’s way are multi-decadal processes. Hence, it is one thing to develop new technologies, it is quite another to deploy them at scale and speed. Potential problems include: geo-political tensions, weak political leadership, intrenched opposition by powerful interests, governmental corruption and incompetence, information asymmetries, the scarcity of critical raw materials (e.g. cobalt, lithium, rare earth elements, etc.), supply-chain bottlenecks, and the fact that some of the natural resources required for decarbonization are environmentally and socially damaging to exploit, or are located in areas of political instability. It is for such reasons that some scholars are highly sceptical about the prospects of decoupling global economic growth from greenhouse gas emissions in absolute terms (see Hagens, 2020; Hickel, 2021; Hickel and Hallegatte, 2022; Hickel and Kallis, 2021; Jackson and Victor, 2019).
3. While CCS of various kinds will almost certainly be needed later this century on a large scale, serious questions remain over who will pay for its deployment and how it will be effectively regulated, both nationally and internationally. Moreover, even with extensive CCS deployment, it will take generations to cool the planet, especially the oceans, and thereby reduce the pace and extent of sea level rise.
4. With respect to solar radiation management, such as stratospheric aerosol injection: there is no doubt that some of the proposed methods for cooling the planet are technically feasible and potentially cost-effective, but equally there are multiple concerns and uncertainties (Tang and Kemp, 2021). Among these are the problems of ensuring adequate international supervision and control, the associated risks and negative side-effects (e.g. producing excessive cooling or altering hydrological cycles across the planet), and the possibility of a rapid and destabilizing period of global warming if and when geo-engineering is wound back or stopped. Aside from this, solar radiation management has several other drawbacks: first, unless CCS is also used on a large scale, ocean acidification and its related impacts on marine life will continue apace; and second, it may reduce incentives for rapid decarbonization, thereby increasing the scale of humanity’s climate-related challenges.
5. While technologies of various kinds will almost certainly enable humanity to avoid some bad outcomes, they cannot prevent many other bad outcomes; nor is it possible to fully restore what has been damaged across the natural world. Put differently, some problems are not amendable to technological fixes, nor can all losses be avoided merely though engineering solutions.

There is a final point that deserves emphasis: placing our primary hope in technological solutions poses deep theological, philosophical, and moral issues. Unquestionably, humanity possesses a remarkable capacity for scientific and technological progress, but the capacity to ensure adequate political and institutional control of what is invented is more limited. While humanity may seek God-like powers, it lacks God-like wisdom. In short, there is a disturbing mismatch between our technical prowess and our ability to exercise good judgement and moral responsibility.

From this perspective, therefore, the fundamental problem is not that of designing and implementing effective technical solutions to the climate emergency. Rather, as Ernst Conradie (2022, p.230) contends, the problem lies deeper, namely, in a ‘spiritual crisis’ characterized by ‘a lack of moral vision, imagination, will, and leadership’. Or to quote a ‘Declaration on the Environment’ several decades ago signed by Patriarch Bartholomew and Pope John Paul II:

The problem is not simply economic and technological; it is moral and spiritual. A solution at the economic and technological level can be found only if we undergo, in the most radical way, an inner change of heart, which can lead to a change in lifestyle and of unsustainable patterns of consumption and production (quoted in Conradie, 2022, pp.230-31).

If so, what might prompt a radical and widespread inner change of heart?

***Positive societal tipping points towards sustainability***

This takes us to a fifth and final source of hope, namely, the claim that the climate crisis and related ecological problems will eventually prompt a profound societal transformation on a global scale. This transformation will be characterized by significant changes in values, behaviours, and lifestyles, which in turn will generate self-reinforcing feedbacks in our socio-cultural systems and related politico-economic regimes. Cumulatively, these will greatly ameliorate the climate crisis and place humanity on the path to ecological sustainability.

There are various versions of this hoped-for societal transformation. Advocates of degrowth and post-growth, for instance, focus on the abandonment of economic growth as a major policy goal, certainly in developed countries (see Jackson, 2009, 2022; Hickel, 2021; Vogel and Hickel, 2023). Instead, the pursuit of human wellbeing and ecological integrity will gradually come to dominate governmental priority-setting. Degrowth advocates differ in their specific policy prescriptions, but they typically envisage there being a significant and sustained change in societal values over the next few decades which would eventually be reflected, through democratic processes, in important policy and institutional reforms. Similarly, the changes in societal values would have a major impact on both aggregate consumption levels and the pattern of consumption. Examples would include a substantial reduction in demand for resource-intensive and energy-intensive items, major changes in modes of transportation (e.g. the comprehensive adoption of carpooling rather than individual vehicle ownership), a large-scale shift to vegetarian and vegan diets, and even lower fertility rates. Alongside and reinforcing these changes in values and lifestyles would be a strong commitment, both within and between nations, to a just transition to both a zero-carbon economy and a circular economy, and a more egalitarian distribution of income and wealth.

Other versions of this hoped-for societal transformation give particular weight to the emergence and positive role of new social movements (e.g. on the part of indigenous peoples, young people, faith communities, pan-national groups, etc.), along with greater geo-political cooperation, and new models of deliberative democracy. Within the Christian tradition, for instance, there is reference in the literature to the possibility of a major spiritual awakening, a faith-based renaissance and/or an ‘ecological reformation’ (see Conradie, 2022, p.232) and their transformative potential – both locally and globally.

A different approach again has been taken by Professor Tim Lenton and his colleagues (2022). In a thoughtful article they advance the thesis that there might be various tipping points within social systems that, once crossed, will generate positive feedbacks or virtuous cycles, thereby shifting public policies, human behaviour, and the adoption of new technologies strongly favouring greater ecological sustainability. Drawing on a diverse academic literature, they explore different theories of societal transformation, identify enabling conditions, and discuss a range of possible feedback mechanisms (see Figure 3). To quote:

Actions that can create enabling conditions for positive tipping include targeting smaller populations, altering social network structure, providing relevant information, reducing price, improving performance, desirability and accessibility, and coordinating complementary technologies. Actions that can trigger positive tipping include social, technological and ecological innovations, policy interventions, public investment, private investment, broadcasting public information, and behavioural nudges (Lenton, et al., 2022, p.13).

Additionally, Lenton and his colleagues argue that: ‘Positive tipping points can help counter widespread feelings of disempowerment in the face of global challenges and help unlock ‘paralysis by complexity’’ (2022, p.1).

**Figure 3: Summary of framework for triggering positive tipping points**



Source: Lenton, et al., 2022, p.9

Is it realistic or plausible to hope that positive, self-reinforcing societal feedbacks will radically alter the trajectory of anthropogenic climate change? Obviously, such an outcome would be highly desirable. But there are good reasons to err on the side of caution. Undoubtedly, there will be positive societal feedback mechanisms in play over the coming decades, whether through increasing returns to adoption (e.g. learning by doing), network effects, information cascades or whatever. Also, it is evident that significant changes in societal values can occur relatively quickly, as has been demonstrated by shifts in attitudes on matters of gender identity and sexual practice. From a Christian perspective, too, any narrative which suggests that transformational change is impossible is inconsistent with important theological doctrines, not least the faithfulness of God and the renewing power of God’s Spirit.

But climate change is equally, if not more likely, to spark negative feedback mechanisms. Examples would include the risk of increasing cross-border migration resulting from severe climate-related impacts (e.g. major famines, heat-waves, and floods) triggering heightened ethnic and religious tensions, along with other kinds of ‘outgroup’ antagonism (Pihkala, 2018). Fears of being overwhelmed by refugees will also strengthen nationalistic and populist political parties, if not anti-democratic and illiberal social movements, not to mention the adulation of charismatic leaders (as, for instance, has been evident in parts of Europe and the US over the past decade). Nor should the power and resistance of vested interests be under-estimated. Moreover, climate-related impacts may well undermine rather than strengthen global cooperation and multi-lateral institutions. Aside from this, any perspective grounded in Christian theology will be mindful of the doctrine of sin and those forces of evil or darkness that stand opposed to all forms of goodness, peace, and justice.

In short, any approach which bases its hope for a more sustainable future primarily in increasing societal collaboration or snowballing moral virtue runs the risk of being disappointed. This is certainly not to rule out the possibility of significant and widespread changes in values and conduct over the coming decades. To date, however, there is little evidence for such a transformation.

**Some concluding perspectives on hope in challenging times**

Drawing the threads of the preceding discussion together, various matters deserve emphasis. Each of the five approaches I have briefly considered is problematic. As indicated, we can readily reject the proposition that climate change is not happening and the related claim that the negative implications of global warming have been greatly exaggerated by the international scientific community. Equally, there does not seem to be a firm theological basis for assuming that God will intervene miraculously to prevent catastrophic outcomes – but that certainly does not rule out God’s non-miraculous interventions in human affairs.

At the same time, we must also be wary of the proposition that it is already too late to avoid catastrophic warming with, for instance, large parts of the Earth’s surface becoming too hot for human habitation. To be sure, it may well be too late to prevent many extinctions or to avoid multi-metre sea level rise, but it is not too late to avert many other harms. In this regard, it is reasonable to hope that rapid technological innovation, the extensive deployment of renewable energy technologies, and the development and utilization of CCS over coming decades will substantially reduce global greenhouse gas emissions, stabilize, and then reduce carbon-dioxide concentrations in the atmosphere, thereby avoiding a ‘hot-house’ Earth. Yet caution is needed in placing undue faith in technological fixes. In some cases (e.g. solar radiation management), the downside risks could well be greater than the problem they are intended to solve.

Similarly, we should be wary of assuming that the deepening climate crisis will trigger a series of positive societal responses resulting in self-reinforcing feedbacks. It is equally likely that negative societal forces and tipping points will come into play. Put differently, while humanity has the power to shape and navigate the future, it does not exercise full control of its destiny – not least because of the many forms and influence of path dependence, including the long legacy of previous toxic policy choices. Moreover, just as there is much moral virtue, so too there is much vice. To employ a different analogy: humanity is not hopelessly imprisoned by its profligate past, but nor does it possess a free and globally available ‘get out of jail card’.

Turning finally to some brief theological reflections: what, if anything, might Christians have to say about coping with, and responding to, our current global polycrisis and the impending ecological disasters, and hence the ‘new normal’ – or rather evolving ‘new normals’ – that they herald?

To start with, living hopefully, faithfully, and courageously in challenging times requires a robust and secure theology – one that is sufficient to cope with death and destruction; one that prevents people from being overwhelmed by the magnitude of the task or paralyzed by panic, fear, and foreboding. Any such theology, in my view, must be grounded in the incarnation, cross, and resurrection of Christ – that is, first, in the God who demonstrated an unshakable commitment to the cosmos through becoming an integral part of creation in the person of Jesus Christ in first century Palestine. Next, through Christ’s crucifixion – his agony and death on a cross – God experienced the full depths of human anguish, affliction, and abandonment. In so doing, God accepted and demonstrated absolute solidarity with a suffering world. From this, we can be assured that God abides with us in our grief, loss, and sorrow, whatever its cause. Accordingly, we are never alone, never abandoned. Fundamentally, in other words, the creator and sustainer of the universe knows our creaturely plight from the inside out. Equally, through the resurrection God in Christ has overcome the forces of evil and biological death, desires for humanity to experience abundant life, and constantly seeks to transform our hearts and renew our minds – including via the gift of hope. God’s abiding faithfulness, solidarity and redemptive purposes are profoundly important and comforting, especially in the face of impending ecological disasters.

Given this theological foundation, we can and must be willing to face the uncomfortable and inconvenient facts about anthropogenic climate change and ecological loss. There is an urgent need for open eyes and ears, and responsive hearts and minds. The true nature and gravity of the climate crisis must be grasped, however painful and disturbing this might be. There is no case for turning a blind eye or for wilful ignorance. Likewise, false hopes and unfounded optimism have no place.

Next, there is a case for genuine confession, lament, and repentance. As Pope Francis has repeatedly highlighted, humanity has failed to ‘care for our common home’. Our ecological responsibilities have been neglected. We have not exercised proper kaitiakitanga. On average, our ecological footprints are far too large. We are borrowing from the future and leaving future generations with a huge, unsustainable ecological debt. Much of what is treasured risks being lost. That is rightly a cause for grief and sorrow. And our undoubted complicity in the suffering of others must necessarily prompt our repentance.

Yet we must never conclude that our efforts, however small and apparently insignificant, to conserve, heal, and restore God's creation are worthless. Doing what is right, responding to the promptings of the Spirit of God, is vitally important, regardless of the apparent outcomes. When St Paul remarks that ‘our labour in the Lord will not be in vain’ (1 Cor 15:58), he does not imply that our strivings will inevitably improve our circumstances. Rather, he means, to quote the theologian Richard Bauckham, that they ‘will have effects that will be preserved in the new creation’ (2012, p.3). The nature of these effects may never be known. But we must be faithful all the same.

In practical terms, there is much that needs doing. This includes actions at multiple levels – individual, whanau, community, iwi/hapū, national, and international – and of many different kinds, both large and small. It includes support for cost-effective mitigation (Allen, et al., 2022; Jenkins, et al. 2023a) and adaptation (Expert Working Group, 2023), ongoing scientific research, sacrificial living, and letting go of unjustified entitlements and false gods. It means using our imaginations to anticipate and prepare for the future, encourage resilience, build social capital, and mitigate risk. It means pursuing peace and justice, as well as ecological sustainability. It means efforts to protect and preserve our democratic institutions. It means committing to actions that may ultimately prove to be less effective than expected, but need to be tried all the same. It means building today for tomorrow, even if that tomorrow appears unwelcoming and uncertain. It also means being willing to stand resolutely and compassionately with those who are especially afflicted, whether globally or locally, whether indigenous peoples or recent involuntary migrants – what Jan Patočka called the ‘solidarity of the shaken’.

Lastly, we need to nourish hope. Such a task is best achieved in and through communities – that is, through collective endeavours rather than striving alone, coupled with a keen awareness of the need for adequate self-care. For such reasons, faith communities have a vital role to play. But to be effective such a role must be undergirded by a robust theology and a proper respect for findings and insights of the biophysical sciences. Equally, the hope which is nourished must be a reasonable and realistic hope, not a false or naïve hope. It must also be a hope that is big enough to accommodate all our fears, questions, anxieties, and bewilderment, and a hope that expands our imaginations and willingness to face daunting and unprecedent challenges.

**Acknowledgements**

Various people kindly commented on an earlier version of this paper or suggested relevant material. I would particularly like to thank Gavin Drew, Mary Hutchinson, David King, Martin Macaulay, John McClure, Andrew Shepherd, Adrienne Thompson, and Neil Vaney.

**References**

Allen, M. et al. (2022) ‘Net Zero: Science, Origins, and Implications’, *Annual Review of Environment and Resources*, 47, pp.49–87

Armstrong McKay, D. et al. (2022) ‘Exceeding 1.5°C global warming could trigger multiple climate tipping points’, *Science*, 377, 6611

Bendell, J. (2018) ‘Deep Adaptation: A Map for Navigating Climate Tragedy’, Institute of Leadership and Sustainability (IFLAS), University of Cumbria, Occasional Paper 2

Bouma-Prediger, S. (2019) *Earthkeeping and Character: Exploring a Christian Ecological Virtue Ethic*, Grand Rapids, Baker Academic

Bauckham, R. (2010) *Bible and Ecology: Rediscovering the Community of Creation*, London: Darton, Longman & Todd

Boston, J. (2010) ‘Evidence of denial: The case of climate change’, *Stimulus: The New Zealand Journal of Christian Thought and Practice*, 18, 3, pp.11-22

Boston, J. (2016) *Governing for the Future*, Bingley: Emerald

Boyd, A. (2023) *I want a better catastrophe: Navigating the Climate Crisis with Grief, Hope and Gallows Humous*, New York: Natural Sciences Publishing

Brown, M. (ed.) (2014) *Anglican Social Theology: Renewing the Vision Today*, London: Church House Publishing

Brown, S. et al. (2021) ‘Global costs of protecting against sea-level rise at 1.5°C to 4.0°C’, *Climatic Change*, 167, 4

Brovkin, V. et al., (2021) ‘Past abrupt changes, tipping points and cascading impacts on the Earth System’, *Nature Geoscience*, 14, 550-558

Capstick, S. and N. Pidgeon (2014) ‘What is climate change scepticism? Examination of the concept using a mixed methods study of the UK public’, *Global Environmental Change*, 24, pp.389-401

Carney, M. (2021) *Value(s): Building a Better World For All*, London: William Collins

Clough, D. (2012) *On Animals: Vol. 1: Systematic Theology*, London: T&T Clark/Continuum

Conradie, E. (2022) ‘Climate change as a multi-layered crisis for humanity’, in E. Chitando et al. (eds) *African Perspectives on Religion and Climate Change*, London: Routledge, pp.215-234

Dasgupta, P. et al. (2021) *The Economics of Biodiversity: The Dasgupta Review*, London, HM Treasury

Davey, E. (2019) *Restored Earth – Ten Paths to a Hopeful Future*, London: Unbound

Desai, B. et al. (2021) ‘Addressing the human cost in changing climate’, *Science*, 372(6548), pp.1284-1287

Ditlevsen, P. and S. Ditlevsen (2023) ‘Warning of a forthcoming collapse of the Atlantic meridional overturning circulation’, *Nature Communications*, 14, 4254

Dryzek, J. and J. Pickering (2018) *The Politics of the Anthropocene*, Oxford: Oxford University Press

Expert Working Group (2023) *Report of the Expert Working Group on Managed Retreat: A Proposed System for Te Hekenga Rauora/Planned Relocation*, Wellington: Ministry for the Environment

Fiddes, P. (1988) *The Creative Suffering of God*, Oxford: Clarendon Press

Gambhir, A. et al. (2023) ‘Adjusting 1.5 degrees C climate change mitigation pathways in light of adverse new information’, *Nature Communications*, 14, 5117

Geels, F., B. Sovacool, T. Schwanen and S. Sorrell (2017) ‘The sociotechnical dynamics of low-carbon transitions’, *Joule*, 1 (3), pp.463-79

Gregersen, N. (2001) ‘The Cross of Christ in an Evolutionary World’, *Dialog: A Journal of Theology*,40, 3, pp.192–207

Gupta, J. et al., (2023) ‘Earth system justice needed to identify and live within Earth system boundaries’, *Nature Sustainability*, 6, pp.630-638

Gushee, D. (2014) *In the Fray: Contesting Christian Public Ethics, 1994-2013*, Eugene: Cascade Books

Hagens, N. (2020) ‘Economics for the future – Beyond the superorganism’, *Ecological Economics*, 169, 106520

Hale, T. (forthcoming 2024) *Long Problems: Climate Change and the Challenges of Governing Across Time*, Princeton: Princeton University Press

Hansen, J. et al. (2023a) ‘Global warming in the pipeline’, forthcoming <http://www.columbia.edu/~jeh1/Documents/PipelinePaper.2023.05.19.pdf>

Hansen, J. et al. (2023b) ‘El Nino and Global Warming Acceleration’, 14 June <http://www.columbia.edu/~jeh1/mailings/2023/ElNino2023.14June2023.pdf>

Hansen, J. et al. (2023c) ‘Uh-Oh, Now What? Are We Acquiring the Data to Understand the Situation?’, 14 August <http://www.columbia.edu/~jeh1/mailings/2023/UhOh.14August2023.pdf>

Hansen, J, et al. (2023d) ‘Global Warming is Accelerating. Why? Will We Fly Blind?’, 14 Sept <http://www.columbia.edu/~jeh1/mailings/2023/FlyingBlind.14September2023.pdf>

Hickel, J. (2021) *Less is More: How Degrowth Will Save The World*, London: Penguin Random House

Hickel, J. and S. Hallegatte (2022) ‘Can we live within environmental limits and still reduce poverty? Degrowth or decoupling?’, *Development Policy Review*, 40 (1), pp.1-24

Hickel, J. and G. Kallis (2020) ‘Is Green Growth Possible?’, *New Political Economy*, 25(4), pp.469-486

Higgins, D. (2022) ‘Climate Pessimism and Human Nature’, *Humanities*, 11, 129

Hinkel, J. et al., (2014) ‘Coastal flood damage and adaptation costs under 21st century sea-level rise’,Q+ *Proceedings of the 33 National Academy of Sciences*, 111 (9), pp.3292-3297.

Hinkel, J. et al. (2018) ‘The ability of societies to adapt to twenty-first century sea-level rise’, *Nature Climate Change,* 8*,* pp.570-578

Hino, M., C. Field and K. Mach (2017) ‘Managed retreat as a response to natural hazard risk’, *Nature Climate Change*, 7, pp.364-70

Hoggard Creegan, N. (2013) *Animal Suffering and the Problem of Evil*, Oxford: Oxford University Press

Hulme, M. (2019) ‘Is it too late (to stop dangerous climate change)? An editorial’, *WIRES Climate Change*, 11, 619

IPCC (2018) *Summary for Policymakers – Global Warming of 1.5°C, Special Report*, Geneva: IPCC

IPCC (2021) *Climate Change 2021: the physical science basis, contribution of Working Group I to the sixth assessment report of the Intergovernmental Panel on Climate Change: Summary for Policymakers*, Cambridge: Cambridge University Press

IPCC (2022a) *Climate Change 2022: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge: Cambridge University Press

IPCC (2022b) *Climate Change 2022: Impacts, Adaptation and Vulnerability: Summary for Policymakers*, Cambridge: Cambridge University Press

IPCC (2023) *Climate Change 2023 – Synthesis Report: Summary for Policy-Makers*,

<https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf>

Jackson, T. (2009) *Prosperity without Growth: Economics for a Finite Planet* London: Earthscan

Jackson, T. (2022) *Post Growth: Life after Capitalism*, Cambridge: Polity Press

Jackson, T. and P. Victor (2019) ‘Unravelling the claims for (and against) green growth’, *Science*, 366 (6468), pp.950-51

Jamieson, A. (2004) *Journeying in Faith: In and Beyond the Tough Places*, London: SPCK

Jenkins, S. et al. (2022) ‘Is Anthropogenic Global Warming Accelerating’, *Journal of Climate*, 35, pp.7873-90

Jenkins, S. et al. (2023a) ‘Extended producer responsibility for fossil fuels’, *Environmental Research Letters*, 18, 1, 011005

Jenkins, S. et al. (2023b) ‘Tonga eruption increases chance of temporary surface temperature anomaly above 1.5°C’, *Nature Climate Change*, 13, pp.127-129

Kay, J. and M. King (2020) *Radical Uncertainty: Decision-Making for an Unknowable Future*, London: The Bridge Street Press

Kemp, L. et al. (2022) ‘Climate Endgame: Exploring catastrophic climate change scenarios’, *PNAS*, 119, 34, e2108146119

Klose, A. et al., (2021) ‘What do we mean, ‘tipping cascade’?’, *Environmental Research Letters*, 16, 125011

Krznaric, R. (2020) *The Good Ancestor: How to Think Long Term in a Short-Term World*, London: Penguin

Kulp, S. and B. Strauss (2019) ‘New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding’, *Nature Communications*, 10, 4844

Lawrence, J. et al. (2020) ‘Implementing Pre-Emptive Managed Retreat: Constraints and Novel Insights’, *Current Climate Change Reports*, 6, pp.66-80

Lawrence, J. et al. (2022a) ‘Australasia’ in IPCC, *Climate Change 2022: Impacts, Adaptation and Vulnerability*, Cambridge: Cambridge University Press

Lawrence, J. et al. (2022b) ‘Adapting to Avoidable and Unvoidable Climate Change: What must Aotearoa New Zealand Do? *Policy Quarterly*, 18 (2), pp.51-60

Lawrence, M. et al. (2023) ‘Global Polycrisis: The causal mechanisms of crisis entanglement’, Version 1.0. Pre-print. Cascade Institute, British Columbia

Lazarus, (2009) ‘Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future’, *Cornell Law Review,* 94, pp.1153-1234

Lenton, T. et al. (2008) ‘Tipping elements in the Earth’s climate system. *Proceedings of the National Academy of Sciences, USA* 105, pp.1786-1793

Lenton, T. et al. (2019) ‘Climate tipping points: Too risky to bet against’, *Nature*, **575,** pp.592-595

Lenton, T. et al. (2022) ‘Operationalising positive tipping points towards global sustainability’, *Global Sustainability*, 5, e1, 1–16.

MacAskill, W. (2022) *What We Own the Future*, London: One World

McMichael, C. et al. (2020) ‘A review of estimating population exposure to sea-level rise and the relevance of migration’, *Environmental Research Letters*, 15, 123005

Ministry for the Environment (2017) *Coastal Hazards and Climate Change: guidance for local government*, Wellington: Ministry for the Environment

Ministry for the Environment (2019) *Arotakenga Huringa Āhuarangi: a framework for the national climate change risk assessment for Aotearoa New Zealand*, Wellington: Ministry for the Environment

Ministry for the Environment (2020) *National Climate Change Risk Assessment for Aotearoa New Zealand: main report – Arotakenga Tūraru mō te Huringa Āhuarangi o Āotearoa: pūrongo whakatōpū*, Wellington: Ministry for the Environment

Ministry for the Environment (2022a) *Kia urutau, kia ora: Kia āhuarangi rite a Aotearoa: Adapt and thrive: Building a climate-resilient New Zealand, Draft National Adaptation Plan: Managed Retreat*, Wellington: Ministry for the Environment

Ministry for the Environment (2022b) *Te mahere urutanuga ā-motu (tuhinga hukihuki), Draft National Adaptation Plan*, Wellington: Ministry for the Environment

Ministry for the Environment (2022c) *Urutau, ka taurikura: Kia tū pakari a Aotearoa I ngā huringa āhuarangi: Adapt and thrive: Building a climate-resilient New Zealand, Aotearoa New Zealand’s First National Adaptation Plan*, Wellington: Ministry for the Environment

Ministry for the Environment (2022d) *Interim Guidance on the Use of New Sea Level Rise Projections*, Wellington

Naish, T. et al. (2023) ‘The significance of vertical land movements at convergent plate boundaries in 2 probabilistic sea-level projections for AR6 scenarios: The New Zealand case’, forthcoming.

Niebuhr, R. (2021) *The Nature and Destiny of Man*, Louisville: Westminster John Knox

O'Brien, G. (2009) ‘Perfecting not Perfect: Christology and Pneumatology within an Imperfect Yet Purposeful Creation’, *Theology and Science*, 7, 4, pp.407-419

OECD (2022) *Climate Tipping Points: Insights for Effective Action*, Paris: OECD

O’Neil, B. (2023) ‘Comment: Envisioning a future with climate change’, *Nature Climate Change*, 13, September, pp. 874–876

Pikhala, P. (2018) ‘Death, the environment, and theology’, *Dialog*, 57, pp.287–294.

Rahmstorf, S. et al. (2015) ‘Exceptional twentieth-century slowdown in Atlantic Ocean overturning circulation’, *Nature Climate Change*, 5, pp.475-480

Reisinger, A. et al., (2020) ‘The concept of risk in the IPCC Sixth Assessment Report: A Summary of cross-working group discussions’, Geneva: IPCC

Ripple, W. et al. (2022) ‘World Scientists’ Warning of a Climate Emergency 2022’, *BioScience*, 72, 12, pp.1149-55

Ripple, W. et al. (2023) ‘Many risky feedback loops amplify the need for climate action’, *One Earth*, 6, 2, pp.86-91

Robinson, T. (2020) ‘Reimagining Christian Hope(lessness) in the Anthropocene’, *Religions*, 11, 192; doi:10.3390/rel11040192

Rockstrōm, J. et al. (2021) ‘We need biosphere stewardship that protects carbon sinks and build resilience’, *Proceedings of the National Academic of Sciences U.S.A*., 118, e2115218118

Rockstrōm, J. et al. (2023) ‘Safe and just Earth system boundaries’, *Nature,* 619, pp.102-111

Scheffer, M. et al. (2009) ‘Early-warning signals for critical transitions’, *Nature*, 461, 53–-9

Siders, A. et al. (2019) ‘The case for strategic and managed retreat: Why, where, when, and how should communities relocate?’ *Science*, 365(6455), pp.761-763

Siders, A. and I. Ajibade (2021) ‘Introduction: Managed retreat and environmental justice in a changing climate’, *Journal of Environmental Studies and Sciences*, 11, pp.287–293

Sollereder, B. (2013) ‘Extinction and the goodness of God: The purpose of dinosaurs’, *Christian Century*, October, pp.22-26

Sollereder, B. (2016) ‘Evolution, Suffering, and the Creative Love of God’, Perspectives on Science and Christian Faith, 68, 2, pp.99-109

Sollereder, B. (2021) *Why Is There Suffering? Pick Your Own Theological Expedition*, Grand Rapids: Zondervan

Sollereder, B. (2022) ‘The Human Role Revisited on a Rapidly Changing Planet’, *Ephata*, 4, 1, pp.259-283

Sollereder, B. (2023) ‘Climate change is here’, *The Christian Century: Responding to Climate Change*, pp.11-13

Southgate, C. (2008) *The Groaning of Creation: God, Evolution, and the Problem of Evil*, Louisville: Westminster John Knox Press

Southgate, C. (2022) ‘God and a World of Natural Evil: Theology and Science in Hard Conversation’, The Boyle Lecture, *Zygon*, 57, 4, pp.1124-1134

Southgate, C. (2023) *Monotheism and the Suffering of Animals in Nature*, Cambridge: Cambridge University Press

Steffen, W. et al. (2018) ‘Trajectories of the Earth system in the Anthropocene’, *Proceedings of the National Academics of Science USA*’, 115, 8252-8259

Stern, N. (2009) *A Blueprint for a Safer Planet*, London: Bodley Head

Strauss, B. et al. (2021) ‘Unprecendented threats to cities from multi-century sea level rise’, *Environmental Research Letters*, 16, 114015

Swinburne, R. (1989) *Responsibility and Atonement*, Oxford: Oxford University Press

Swinburne, R. (1998) *Providence and the Problem of Evil*, Oxford: Oxford University Press

Swinburne, R. (2010) *Is there a God?* Oxford: Oxford University Press

Tang, A. and L. Kemp (2021) ‘A fate worse than warming? Stratospheric aerosol injection and catastrophic risk’, *Frontiers in Climate*, 3, pp.1-17

Treasury (2023) Ngā Kōrero Āhuarangi me te Ōhanga – Climate Economic and Fiscal Assessment, Wellington: The Treasury

United Nations (2023) ‘Technical dialogue of the first global stocktake Synthesis report by the co-facilitators on the technical dialogue’, United Nations Framework Convention on Climate Change, 8 September, Advance Version

Vogel, J. and J. Hickel (2023) ‘Is green growth happening? An empirical analysis of achieved versus Paris-compliant CO2–GDP decoupling in high-income countries’, *Lancet Planet Health*, 7, e759-69

Walker, W., R. Lempert and J. Kwakkel (2012) *Deep Uncertainty*, Santa Monica: RAND

Wallace-Wells, D. (2019) *The Uninhabitable Earth: A Story of the Future*, Penguin Books

Weijer, W. et al. (2019) ‘Stability of the Atlantic meridional overturning circulation: a review and synthesis’, *Journal of Geophysical Research: Oceans*, 124, 5336–5375

Williams, R. (2012) *Faith in the Public Square*, London: Bloomsbury

Wirzba, N. (2023) ‘Waking up to the Anthropocene’, *The Christian Century: Responding to Climate Change*, pp.6-9

Wunderling, N. et al., (2021) ‘Interacting tipping elements increase risk of climate domino effects under global warming’, Earth System Dynamics, 12, 2, pp.601-619

Wunderling, N. et al. (2023) ‘Global warming overshoots increase risks of climate tipping cascades in a network model’, *Nature Climate Change*, 13, January, pp.75-82

1. The term ‘Earth system’ refers to the planet’s various interacting and interdependent physical, chemical, and biological constituents and processes. It includes Earth’s many different ‘spheres’, such as the atmosphere, hydrosphere, cryosphere, biosphere and geosphere, along with their various sub-system cycles and processes (e.g. carbon, water, nitrogen, sulphur, etc.), and deep Earth processes (e.g. seismic and tectonic activity). [↑](#footnote-ref-1)
2. See: <https://www.weforum.org/agenda/2023/01/polycrisis-global-risks-report-cost-of-living/> [↑](#footnote-ref-2)
3. In this context, Brian O’Neill (2023) helpfully contrasts between additional and total risk, and notes that many aspects of human wellbeing may improve, as least for a while, notwithstanding the impacts of climate change. [↑](#footnote-ref-3)
4. <https://www.rnz.co.nz/national/programmes/the-house/audio/2018904002/todd-muller-and-what-might-have-been> [↑](#footnote-ref-4)
5. There are various measures of ‘eco-anxiety’ and related phenomena. One of these is the environmental distress index/scale – an index of the bio-social cost of ecosystem disturbance. It combines dimensions of hazard perception, threat appraisal, felt impact of changes, loss of solace, and environmental action. [↑](#footnote-ref-5)
6. See: https://www.centreforoptimism.com/pessimism-of-the-intellect-optimism-of-the-will [↑](#footnote-ref-6)
7. While reducing global carbon-dioxide emissions rapidly is vital, other important greenhouse gases must also be reduced. [↑](#footnote-ref-7)
8. See, for instance, Gregersen, 2001; Hoggard Creegan, 2013; O’Brien, 2009; Robinson, 2020; Sollereder, 2013, 2016, 2022; Southgate, 2008, 2022, 2023; Swinburne, 1989, 1998, 2010; Williams, 2012; Wirzba, 2023; see also Bouma-Prediger, 2019; Brown, 2014; Conradie, 2022; Clough, 2012; Fiddes, 1988; Gushee, 2014; Niebuhr, 2021. [↑](#footnote-ref-8)
9. See: <https://www.iea.org/news/global-coal-demand-set-to-remain-at-record-levels-in-2023>; <https://www.iea.org/reports/oil-market-report-august-2023> [↑](#footnote-ref-9)
10. There is a large literature on the concept of ‘risk’. A straightforward approach, quoting Reisinger et al. (2020), is to say that risk constitutes: ‘The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change.’ [↑](#footnote-ref-10)
11. pH is a measure of the relative amount of free hydrogen and hydroxyl ions in the water. Carbon dioxide plus water creates carbonic acid. A pH below 7 is considered acidic, above is alkaline. The oceans have moved from a pH of 8.2 to 8.1. [↑](#footnote-ref-11)
12. See: https://climate.copernicus.eu/august-2023-second-warmest-month-closes-warmest-summer [↑](#footnote-ref-12)
13. See:+0 <https://en.wikipedia.org/wiki/2022_Pakistan_floods>. [↑](#footnote-ref-13)
14. It is vital that the required transitions (i.e. both mitigation and adaptation) are pursued in ways that are socially just. See, for instance, Gupta et al. (2023). [↑](#footnote-ref-14)
15. F more detailed reflections see, for instance, Jamieson, 2004. [↑](#footnote-ref-15)
16. See: <https://www.theguardian.com/books/2016/jul/15/rebecca-solnit-hope-in-the-dark-new-essay-embrace-unknown> [↑](#footnote-ref-16)
17. Quoted in Michael Ignatieff, *On Consolation: Finding Solace in Dark Times* (London, Picador, 2022), p.230. [↑](#footnote-ref-17)
18. See <https://www.gq.com/story/krista-tippett-on-being-interview> [↑](#footnote-ref-18)
19. See, for instance: https://www.bbc.com/news/blogs-trending-61495035 [↑](#footnote-ref-19)
20. The story of Noah in the Hebrew Scriptures (Genesis 6:9 – 9:17) comes to mind in this context, in particular the reported obedience of Noah in preparing for a coming flood and the unwillingness of most people to take the warnings seriously. [↑](#footnote-ref-20)
21. Quoted by The Interfaith Stewardship Alliance, ‘An Open Letter to the Signers of “Climate Change: An Evangelical Call to Action and Others Concerned About Global Warming’, 2006. [↑](#footnote-ref-21)