POLICY PAPER

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Existential climate-related security risk:

A scenario approach

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CONTENTS

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FOREWORD

Admiral Chris Barrie, AC RAN Retired

In 2017-18, the Australian Senate inquired into the implications of climate change for Australia's national security. The Inquiry found that climate change is "a current and existential national security risk", one that "threatens the premature extinction of Earth-originating intelligent life or the permanent and drastic destruction of its potential for desirable future development".

I told the Inquiry that, after nuclear war, human-induced global warming is the greatest threat to human life on the planet. Today's 7.5 billion human beings are already the most predatory species that ever existed, yet the global population has yet to peak and may reach 10 billion people, with dire implications absent a fundamental change in human behaviour.

This policy paper looks at the existential climate-related security risk through a scenario set thirty years into the future. David Spratt and Ian Dunlop have laid bare the unvarnished truth about the desperate situation humans, and our planet, are in, painting a disturbing picture of the real possibility that human life on earth may be on the way to extinction, in the most horrible way.

In Australia recently we have seen and heard signals about the growing realisation of the seriousness of our plight. For example, young women speak of their decisions to not have children, and climate scientists admitting to depression as they consider the "inevitable" nature of a doomsday future and turn towards thinking more about family and relocation to "safer" places, rather than working on more research.

Stronger signals still are coming from increasing civil disobedience, for example over the opening up of the Galilee Basin coal deposits and deepwater oil exploration in the Great Australian Bight, with the suicidal increase in carbon emissions they imply. And the outrage of schoolchildren over their parent's irresponsibility in refusing to act on climate change.

As my colleague Professor Will Steffen has said of the climate challenge: "It's not a technological or a scientific problem, it's a question of humanities' socio-political values… We need a social tipping point that flips our thinking before we reach a tipping point in the climate system."

A doomsday future is not inevitable! But without immediate drastic action our prospects are poor. We must act collectively. We need strong, determined leadership in government, in business and in our communities to ensure a sustainable future for humankind.

In particular, our intelligence and security services have a vital role to play, and a fiduciary responsibility, in accepting this existential climate threat, and the need for a fundamentally different approach to its risk management, as central to their considerations and their advice to government. The implications far outweigh conventional geopolitical threats.

I commend this policy paper to you.

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OVERVIEW

- Analysis of climate-related security threats depends significantly on understanding the strengths and limitations of climate science projections. Much scientific knowledge produced for climate policy-making is conservative and reticent.
- Climate change now represents a near- to mid-term existential threat to human civilisation. A new approach to climate-related security risk-management is thus required, giving particular attention to the high-end and difficult-to-quantify "fat-tail" possibilities.
- This may be most effectively explored by scenario analysis. A 2050 scenario is outlined in which accelerating climate- change impacts pose large negative consequences to humanity which might not be undone for centuries.
- To reduce such risks and to sustain human civilisation, it is essential to build a zero-emissions industrial system very quickly. This requires the global mobilisation of resources on an emergency basis, akin to a wartime level of response.

INTRODUCTION

> *The true worst-case scenario might be one where we don't venture out from our safe harbors of knowledge to explore the more treacherous shores of uncertainty.*
>
> — Dr Gavin Schmidt, Director of the NASA Goddard Institute for Space Studies[1]

Climate change intersects with pre-existing national security risks to function as a threat multiplier and accelerant to instability, contributing to escalating cycles of humanitarian and socio-political crises, conflict and forced migration.

Climate-change impacts on food and water systems, declining crop yields and rising food prices driven by drought, wildfire and harvest failures have already become catalysts for social breakdown and conflict across the Middle East, the Maghreb and the Sahel, contributing to the European migration crisis.

Understanding and foreseeing such events depends crucially on an appreciation of the real strengths and limitations of climate-science projections, and the application of risk-management frameworks which differ fundamentally from conventional practice.

[1] Schmidt, G. 2018. "The best case for worst case scenarios", *Real Climate*, 19 February 2019, accessed 18 March 2019, http://www.realclimate.org/index.php/archives/2019/02/the-best-case-for-worst-case-scenarios.

SCIENTIFIC RETICENCE

Climate scientists may err on the side of "least drama", whose causes may include adherence to the scientific norms of restraint, objectivity and skepticism, and may underpredict or down-play future climate changes.[2] In 2007, security analysts warned that, in the two previous decades, scientific predictions in the climate-change arena had consistently under-estimated the severity of what actually transpired.[3]

This problem persists, notably in the work of the Intergovernmental Panel on Climate Change (IPCC), whose *Assessment Reports* exhibit a one-sided reliance on general climate models, which incorporate important climate processes, but do not include all of the processes that can contribute to system feedbacks, compound extreme events, and abrupt and/or irreversible changes.[4]

Other forms of knowledge are downplayed, including paleoclimatology, expert advice, and semi-empirical models. IPCC reports present detailed, quantified, complex modelling results, but then briefly note more severe, non- linear, system-change possibilities in a descriptive, non-quantified form. Because policymakers and the media are often drawn to headline numbers, this approach results in less attention being given to the most devastating, difficult-to-quantify outcomes.

In one example, the IPCC's *Fifth Assessment Report* in 2014 projected a sea-level rise of 0.55-0.82 metre by 2100, but said "levels above the likely range cannot be reliably evaluated". By way of comparison, the higher of two US Department of Defence scenarios is a two-metre rise by 2100, and the "extreme" scenario developed by a number of US government agencies is 2.5 metres by 2100.[5]

Another example is the recent IPCC 1.5°C report, which projected that warming would continue at the current rate of ~0.2°C per decade and reach the 1.5°C mark around 2040. However the 1.5°C boundary is likely to be passed in half that time, around 2030, and the 2°C boundary around 2045, due to accelerating anthropogenic emissions, decreased aerosol loading and changing ocean circulation conditions.[6]

[2] Brysse, K., et al. 2013, "Climate change prediction: Erring on the side of least drama?", *Global Environmental Change,* 23(1), 327-337.
[3] Campbell, K.M., et al. 2007. *The Age of Consequences: The foreign policy and national security implications of global climate change*, Washington DC, Centre for Strategic and International Studies /Center for New American Security, 9.
[4] Wuebbles, D.J., et al. 2017. *Climate Science Special Report: Fourth National Climate Assessment, Volume I,* Washington DC, US Global Change Research Program, 411.
[5] Thieler, E.R. and Zervas, C. 2017. *Global and Regional Sea Level Rise Scenarios for the United States*, NOAA Technical Report NOS CO-OPS 083, Silver Spring MA, NOAA/NOS Center for Operational Oceanographic Products and Services.
[6] Xu, Y., et al. 2018. "Global warming will happen faster than we think", *Nature*, 564 (7734), 30-32; Henley, B.J., and King. A.D. 2017. "Trajectories toward the 1.5°C Paris target: Modulation by the Interdecadal Pacific Oscillation", *Geophysical Research Letters*, 44(9), 4256-62; Jacob, D., et al. 2018. "Climate Impacts in Europe Under +1.5°C", Global Warming', *Earth's Future*, 6(2), 264-285.

EXISTENTIAL RISK

An existential risk to civilisation is one posing permanent large negative consequences to humanity which may never be undone, either annihilating intelligent life or permanently and drastically curtailing its potential.

With the commitments by nations to the 2015 *Paris Agreement*, the current path of warming is 3°C or more by 2100. But this figure does not include "long-term" carbon-cycle feedbacks, which are materially relevant now and in the near future due to the unprecedented rate at which human activity is perturbing the climate system. Taking these into account, the Paris path would lead to around 5°C of warming by 2100.[7]

Scientists warn that warming of 4°C is incompatible with an organised global community, is devastating to the majority of ecosystems, and has a high probability of not being stable. The World Bank says it may be "beyond adaptation".[8] But an existential threat may also exist for many peoples and regions at a significantly lower level of warming. In 2017, 3°C of warming was categorised as "catastrophic" with a warning that, on a path of unchecked emissions, low-probability, high-impact warming could be catastrophic by 2050.[9]

The Emeritus Director of the Potsdam Institute, Prof. Hans Joachim Schellnhuber, warns that "climate change is now reaching the end-game, where very soon humanity must choose between taking unprecedented action, or accepting that it has been left too late and bear the consequences."[10] He says that if we continue down the present path "there is a very big risk that we will just end our civilisation. The human species will survive somehow but we will destroy almost everything we have built up over the last two thousand years."[11]

Unfortunately, conventional risk and probability analysis becomes useless in these circumstances because it excludes the full implications of outlier events and possibilities lurking at the fringes.[12]

Prudent risk-management means a tough, objective look at the real risks to which we are exposed, especially at those "fat-tail" events, which may have consequences that are damaging beyond quantification, and threaten the survival of human civilisation.

Global warming projections display a "fat-tailed" distribution with a greater likelihood of warming that is well in excess of the average amount of warming predicted by climate models, and are of a higher probability than would be expected under typical statistical assumptions. More importantly, the risk lies disproportionately in the "fat-tail" outcomes, as illustrated in Figure 1.

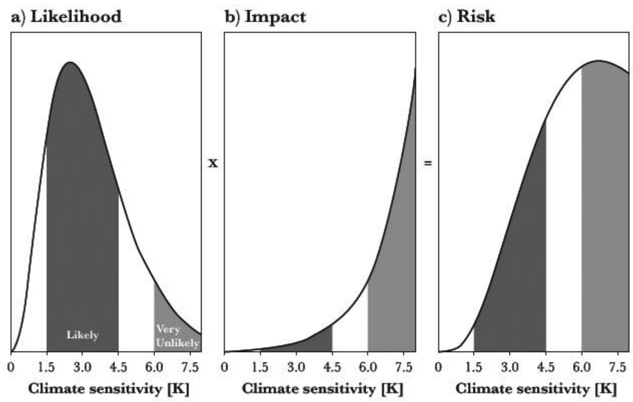

Figure 1. Schema of climate-related risk. (a) Event likelihood and (b) Impacts produce (c) Risk. Lower likelihood events at the high end of the probability distribution have the highest risk (Credit: RT Sutton/E Hawkins).

This is a particular concern with potential climate tipping-points — passing critical thresholds which result in step changes in the climate system that will be irreversible on human timescales — such as the polar ice sheets (and hence sea levels), permafrost and other carbon stores, where the impacts of global warming are non-linear and difficult to model with current scientific knowledge.

Recently, attention has been given to a "hothouse Earth" scenario, in which system feedbacks and their mutual interaction could drive the Earth System climate to a point of no return, whereby further warming would become self-sustaining. This "hothouse Earth" planetary threshold could exist at a temperature rise as low as 2°C, possibly even lower.[13]

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[7] Reilly, J., et al. 2015. *Energy and Climate Outlook: Perspectives from 2015*, Cambridge MA, MIT Program on the Science and Policy of Global Change.
[8] Spratt, D., and Dunlop, I. 2018. *What Lies Beneath: The understatement of existential climate risk*, Melbourne, Breakthrough National Centre for Climate Restoration, 14.
[9] Xu, Y., and Ramanathan, V. 2017. "Well below 2 °C: Mitigation strategies for avoiding dangerous to catastrophic climate changes", *Proceedings of the National Academy of Sciences*, 114(39), 10315-10323.
[10] Schellnhuber, H.J. 2018. "Foreword", in Spratt, D., and Dunlop, I. 2018, *op. cit*, 3.
[11] Breeze, N. 2018. "It's non-linearity, stupid", *The Ecologist*, 3 January 2019, accessed 18 March 2019, https://theecologist.org/2019/jan/03/its-nonlinearity-stupid
[12] Schellnhuber, H.J. 2018, *op. cit.*, 3.
[13] Steffen, W., et al. 2018. "Trajectories of the Earth System in the Anthropocene", *Proceedings of the National Academy of Sciences*, 115(33), 8252-8259.

EXISTENTIAL RISK MANAGEMENT

Because the consequences are so severe — perhaps the end of human global civilisation as we know it — "even for an honest, truth-seeking, and well-intentioned investigator it is difficult to think and act rationally in regard to… existential risks".[14] Particular issues arise: What are the plausible worst cases? And how can one tell? Are scientists self-censoring to avoid talking about extremely unpleasant outcomes? Do scientists avoid talking about the most alarming cases to motivate engagement?[15]

Analysis of climate-related security threats in an era of existential risk must have a clear focus on the extremely serious outcomes that fall outside the human experience of the last thousand years. These "fat-tail" outcomes have probabilities that are far higher than is generally understood.

Traditionally, risk is assessed as the product of probability and damage. But when the damage is beyond quantification, this process breaks down. With existential risks, learning from mistakes is not an option, and we cannot necessarily rely on the institutions, moral norms, or social attitudes developed from our experience with managing other types of risk.

What is needed now is an approach to risk management which is fundamentally different from conventional practice. It would focus on the high-end, unprecedented *possibilities,* instead of assessing middle-of-the-road *probabilities* on the basis of historic experience.

Scenario planning can overcome such obstacles, provided it is used to explore the *unprecedented possibilities,* and not simply act as a type of conventional sensitivity analysis, as is often the case in current practice. Properly applied, it can provide a framework that enables managers to better handle these critical uncertainties, avoid dangerous "group think" and provide flexible rather than unidimensional strategies, thereby potentially improving the quality of decisions in this vital arena.[16]

Existential risks require a normative view of the targets required to avoid catastrophic consequences, based on the latest science within a qualitative, moral framework. Action is then determined by the imperative to achieve the target. It requires policy that is integrated across national, regional and global boundaries, and which recognises that issues such as climate, energy, the ecological crisis and resources overuse are inextricably linked and cannot be treated in separate "silos", as at present.

In Prof. Schellnhuber's words: "We must never forget that we are in a unique situation with no precise historic analogue. The level of greenhouse gases in the atmosphere is now greater, and the Earth warmer, than human beings have ever experienced. And there are almost eight billion of us now living on this planet. So calculating probabilities makes little sense in the most critical instances… Rather, we should identify *possibilities,* that is, potential developments in the planetary makeup that are consistent with the initial and boundary conditions, the processes and the drivers we know."[17]

In this spirit, we sketch a 2050 scenario.

[14] Bostrom, N., and Cirkovic, M.M. 2008. *Global Catastrophic Risks*, Oxford, Oxford University Press, 9.
[15] Schmidt, G. 2019, *op. cit.*
[16] Meißner, P. 2013. "The benefits of scenario-based planning" in Schwenker, B. and Wulf, T. (eds.) *Scenario-based Strategic Planning*, Weisbaden, Springer Fachmedien Weisbaden.

[17] Schellnhuber, H.J. 2018, *op. cit.,* 3.

A 2050 SCENARIO

2020–2030: Policy-makers fail to act on evidence that the current *Paris Agreement* path — in which global human-caused greenhouse emissions do not peak until 2030 — will lock in at least 3°C of warming. The case for a global, climate-emergency mobilisation of labour and resources to build a zero-emission economy and carbon drawdown in order to have a realistic chance of keeping warming well below 2°C is politely ignored. As projected by Xu and Ramanathan, by 2030 carbon dioxide levels have reached 437 parts per million — which is unprecedented in the last 20 million years — and warming reaches 1.6°C.[18]

2030–2050: Emissions peak in 2030, and start to fall consistent with an 80 percent reduction in fossil-fuel energy intensity by 2100 compared to 2010 energy intensity. This leads to warming of 2.4°C by 2050, consistent with the Xu and Ramanathan "baseline-fast" scenario.[19] However, another 0.6°C of warming occurs — taking the total to 3°C by 2050 — due to the activation of a number of carbon-cycle feedbacks and higher levels of ice albedo and cloud feedbacks than current models assume.

[It should be noted that this is far from an extreme scenario: the low-probability, high-impact warming (five percent probability) can exceed 3.5–4°C by 2050 in the Xu and Ramanathan scheme.]

2050: By 2050, there is broad scientific acceptance that system tipping-points for the West Antarctic Ice Sheet and a sea-ice-free Arctic summer were passed well before 1.5°C of warming, for the Greenland Ice Sheet well before 2°C, and for widespread permafrost loss and large-scale Amazon drought and dieback by 2.5°C. The "hothouse Earth" scenario has been realised, and Earth is headed for another degree or more of warming, especially since human greenhouse emissions are still significant.[20]

While sea levels have risen 0.5 metres by 2050, the increase may be 2–3 metres by 2100, and it is understood from historical analogues that seas may eventually rise by more than 25 metres.

Thirty-five percent of the global land area, and 55 percent of the global population, are subject to more than 20 days a year of lethal heat conditions, beyond the threshold of human survivability.

The destabilisation of the Jet Stream has very significantly affected the intensity and geographical distribution of the Asian and West African monsoons and, together with the further slowing of the Gulf Stream, is impinging on life support systems in Europe. North America suffers from devastating weather extremes including wildfires, heatwaves, drought and inundation. The summer monsoons in China have failed, and water flows into the great rivers of Asia are severely reduced by the loss of more than one-third of the Himalayan ice sheet. Glacial loss reaches 70 percent in the Andes, and rainfall in Mexico and central America falls by half. Semi-permanent El Nino conditions prevail.

Aridification emerges over more than 30 percent of the world's land surface. Desertification is severe in southern Africa, the southern Mediterranean, west Asia, the Middle East, inland Australia and across the south-western United States.

Impacts: A number of ecosystems collapse, including coral reef systems, the Amazon rainforest and in the Arctic.

Some poorer nations and regions, which lack capacity to provide artificially-cooled environments for their populations, become unviable. Deadly heat conditions persist for more than 100 days per year in West Africa, tropical South America, the Middle East and South-East Asia, contributing to more than a billion people being displaced from the tropical zone.

Water availability decreases sharply in the most affected regions at lower latitudes (dry tropics and subtropics), affecting about two billion people worldwide. Agriculture becomes nonviable in the dry subtropics.

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[18] Xu, Y., and Ramanathan, V. 2017, *op. cit*.
[19] Xu, Y., and Ramanathan, V. 2017, *op. cit*.
[20] Data for this scenario is drawn from a wide range of sources, including: Xu, Y. and Ramanathan, V. 2017, *op. cit*.; Campbell, K.M., et al. 2007, *op cit.*; Mora, C., et al. 2017. "Global risk of deadly heat", *Nature Climate Change*, 7, 501-506; Lynas, M. 2007. *Six Degrees: Our future on a hotter planet*, London, Fourth Estate; Wallace-Wells, D. 2019. *The Uninhabitable Earth: Life after warming*, New York, Duggan Books.

Most regions in the world see a significant drop in food production and increasing numbers of extreme weather events, including heat waves, floods and storms. Food production is inadequate to feed the global population and food prices skyrocket, as a consequence of a one-fifth decline in crop yields, a decline in the nutrition content of food crops, a catastrophic decline in insect populations, desertification, monsoon failure and chronic water shortages, and conditions too hot for human habitation in significant food-growing regions.

The lower reaches of the agriculturally-important river deltas such as the Mekong, Ganges and Nile are inundated, and significant sectors of some of the world's most populous cities — including Chennai, Mumbai, Jakarta, Guangzhou, Tianjin, Hong Kong, Ho Chi Minh City, Shanghai, Lagos, Bangkok and Manila — are abandoned. Some small islands become uninhabitable. Ten percent of Bangladesh is inundated, displacing 15 million people.

Even for 2°C of warming, more than a billion people may need to be relocated and In high-end scenarios, the scale of destruction is beyond our capacity to model, with a high likelihood of human civilisation coming to an end.[21]

National security consequences: For pragmatic reasons associated with providing only a sketch of this scenario, we take the conclusion of the *Age of Consequences* 'Severe' 3°C scenario developed by a group of senior US national-security figures in 2007 as appropriate for our scenario too:

> Massive nonlinear events in the global environment give rise to *massive nonlinear societal events*. In this scenario, nations around the world will be *overwhelmed by the scale of change* and pernicious challenges, such as pandemic disease. The internal cohesion of nations will be under great stress, including in the United States, both as a result of a dramatic rise in migration and changes in agricultural patterns and water availability. The flooding of coastal communities around the world, especially in the Netherlands, the United States, South Asia, and China, has the potential to *challenge regional and even national identities*. Armed conflict between nations over resources, such as the Nile and its tributaries, is likely and nuclear war is possible. The social consequences range from increased religious fervor to *outright chaos*. In this scenario, climate change provokes *a permanent shift in the relationship of humankind to nature*'.[22] (emphasis added)

[21] Wariaro, V., et al. 2018. *Global Catastrophic Risks 2018*, Stockholm, Global Challenges Foundation, 24.

[22] Campbell, K.M., et al. 2007, *op. cit.*, 9.

DISCUSSION

This scenario provides a glimpse into a world of "outright chaos" on a path to the end of human civilisation and modern society as we have known it, in which the challenges to global security are simply overwhelming and political panic becomes the norm.

Yet the world is currently completely unprepared to envisage, and even less deal with, the consequences of catastrophic climate change.[23]

What can be done to avoid such a probable but catastrophic future? It is clear from our preliminary scenario that dramatic action is required this decade if the "hothouse Earth" scenario is to be avoided. To reduce this risk and protect human civilisation, a massive global mobilisation of resources is needed in the coming decade to build a zero-emissions industrial system and set in train the restoration of a safe climate. This would be akin in scale to the World War II emergency mobilisation.

There is an increasing awareness that such a response is now necessary. Prof. Kevin Anderson makes the case for a Marshall Plan-style construction of zero-carbon-dioxide energy supply and major electrification to build a zero-carbon industrial strategy by "a shift in productive capacity of society akin to that in World War II".[24] Others have warned that "only a drastic, economy-wide makeover within the next decade, consistent with limiting warming to 1.5°C", would avoid the transition of the Earth System to the Pliocene-like conditions that prevailed 3-3.3 million years ago, when temperatures were ~3°C and sea levels 25 metres higher.[25] It should be noted here that the 1.5° goal is not safe for a number of Earth System elements, including Arctic sea-ice, West Antarctica and coral reefs.

The national security sector has unrivalled experience and capacity in such mobilisation, and can play a unique role in its development and implementation, as well as educating policymakers of the existential security risks in failing to do so.

POLICY RECOMMENDATIONS

- Recognise the limitations of policy-relevant climate change research which may exhibit scientific reticence.
- Adopt a scenario approach giving specific attention to high-end warming possibilities in understanding medium-range (mid-century) climate and security risks, particularly because of the existential implications.
- Give analytical focus to the role of near-term action as a determinant in preventing planetary and human systems reaching a "point of no return" by mid-century, in which the prospect of a largely uninhabitable Earth leads to the breakdown of nations and the international order.
- Urgently examine the role that the national security sector can play in providing leadership and capacity for a near-term, society-wide, emergency mobilisation of labour and resources, of a scale unprecedented in peacetime, to build a zero-emissions industrial system and draw down carbon to protect human civilisation.

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[23] Ism, C., et al. 2017. *Global Catastrophic Risks 2017*, Stockholm, Global Challenges Foundation, 35.

[24] Anderson, K. 2019. 'Climate's holy trinity: how cogency, tenacity & courage could yet deliver on our Paris 2°C commitment', Presentation to Oxford Climate Society, 24 January 2019, accessed 18 March 2019,
https://www.youtube.com/watch?v=7BZFvc-ZOa8.

[25] Burke, K.D. et al., 2018. 'Pliocene and Eocene provide best analogs for near-future climates', *Proceedings of the National Academy of Sciences*, 115 (52), 13288-13293.