Commentary

Climate Change, Health, Ethics and the Sustainability of Civilization

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Climate change represents an ethical crisis, some aspects of which are poorly understood. "We" – most policy makers, and most people with sufficient resources to read this paper –are in deep denial. Denial makes daily life possible, even, at times, delightful, but it hinders the myriad actions that are required if humanity is to bequest a future with more options. At the moment, it looks like the coming generation will face formidable obstacles, with greatly constrained choices.

Climate change, entangled with a host of other factors that have – for over 50 years – been conceptualised as elements of "limits to growth" is an increasingly clear threat to civilization. Although this may seem far-fetched to some readers, there is a growing literature on this topic. This literature does not argue that climate change will operate by itself to create this risk; rather, it will interact with a complex suite of other social and ecological factors including competition between and within species. Over eight billion humans inhabit a single Earth-sized planet. Were Earth was the size of Jupiter far more people may be possible. But even if human ingenuity seems without limit, material resources are not.

Any decline in the "quality" of civilization will have severe health consequences, initially affecting the most vulnerable, but – if it deepens sufficiently – it will affect all of humanity.

Probably the most widely appreciated understood ethical dimension is that the dominant drivers of climate change – affluent populations based largely in the global North – are comparatively insulated (at least to date and in the near future) from the most obvious harms from greenhouse gas amplified heatwaves, droughts, famines and floods. There is also growing appreciation of the intergenerational (unethical) unfairness unabated climate change is causing, so that the post World War II generation (sometimes called "baby boomers") have unfairly benefited at the expense not only of the age cohort of Greta Thunberg (born 2003), but even more so of Greta's near contemporaries in the global South, such as Kaluki Paul Mutuku (born 1993).

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In addition to its unfairness, the catastrophe of climate change deepens due to self-deceit. This also has an ethical facet. Our success as a species has spawned hubris, a forgetting (and suppression) of too many past failures and their lessons, leaving an illusion of infallibility. "We" are too often mis-informed that as yet unviable technologies, from the direct air capture of carbon and its safe sequestration underground to the deliberate injection of atmospheric pollutants such as sulfur, in order to cool parts of Earth, will rescue future generations – or at least some of them - from the worst consequences of planetary heating. Although a few researchers have long recognised the "moral hazard" that arises from excessive faith in such practices, this dimension is, as yet, very poorly understood not only by the public, but by many in the scientific community.

Even less discussed is the relationship between climate change and the increasingly unethical scientific publishing industry. For example, can journals that rely excessively on market forces for their viability (or even for their undisclosed megaprofitability) adequately discuss key issues relevant to "planetary overload", such as hyper-capitalism? Another taboo topic is the suppression of discussion about population size and population growth rates, fuelled largely by an unholy alliance between neoliberalism and the Vatican and a vague recall that Nazi Germany and some other societies distorted ecological concepts to seek to justify genocide. Relatedly, can scientists in totalitarian societies freely and adequately analyse these problems?

If our species can better understand these complicated issues, and re-awaken the wider respect for ethics that was briefly held following Word War II, then civilisation may have a chance. The current trajectory of climate change, however, may defer this needed re-awakening for generations, and – perhaps – then only in a mythical form.

1. Introduction: 90 seconds until midnight – civilization's end?

On April 11, 1955 Albert Einstein, the 20th century's most famous scientist, wrote to Bertrand Russell, then arguably the world's most famous philosopher, agreeing "gladly" to "sign your excellent statement".[1] Einstein died of a ruptured abdominal aortic aneurysm (for which he declined emergency surgery) seven days later. The statement he agreed to sign is now widely called the "Russell-Einstein manifesto". It called for a new way of thinking, and warned:

> "If everybody in London, New York, and Moscow were exterminated, the world might, in the course of a few centuries, recover from the blow. But we now know, especially since

the Bikini test, that nuclear bombs can gradually spread destruction over a very much wider area than had been supposed."

The manifesto did not mention the end of civilization, but this was implicit. Partly in response to the peace movement, nuclear weapons non-proliferation treaties were signed (since 1968)[2] and the abyss of global nuclear war appeared to retreat. However, in January 2023, the "doomsday clock" curated by the *Bulletin of the Atomic Scientists* was again brought forward, this time to only ninety seconds to midnight.[3] The nine-page statement in support of this clock movement mentions "climate change" seven times. "Midnight" is undefined, but it surely implies great harm to civilization, and perhaps even human extinction, were nuclear winter to result.[4]

1.1. Civilization collapse and climate change

An extensive literature discusses the collapse of ancient civilizations, in part from natural climate change. However, articles recognizing that anthropogenic climate change risks civilization have emerged quite slowly. The 1972 Limits to Growth (LTG) study mentioned rising carbon dioxide (CO_2) but did not identify its threat as pre-eminent. LTG forecast that business-as-usual practices (including unchecked pollution, such as from CO_2) would lead to a major decline in population and human well-being, if not by 2030, then perhaps by 2072.[5] This could herald civilization failure, and perhaps even collapse, even though that term has no universal definition.[6]

Although taken seriously at the highest level, including by US President Carter,[7] support for the LTG conclusions was generally suppressed,[8] including by future Nobel Economics Laureate William Nordhaus[9][10] and John Maddox, then editor in chief of *Nature*.[11] Complacency and incomprehension, fostered support for business-as-usual practices. Following Carter's defeat (1980), hostility to LTG increased. The fuel-sparing speed limits Carter introduced in the US were abandoned; incoming President Reagan removed solar water heaters installed by Carter on the White House's roof.[12] This was a powerful symbol of support for fossil fuels. Reagan also publicly decried the importance of global population levels, during an election debate with his Democratic opponent when running for his second term.[13] The "cornucopian enchantment"[14] had begun – the illusion that limits are illusory, that climate change can be fairly easily solved or adapted to, and that deregulated market forces will enhance human well-being on a planetary scale.

1.2. Civilization collapse in the early health literature on climate change

In the 1960s and 1970s several articles were published in health journals warning of humanity's collective vulnerability to adverse global environmental change. Pioneering microbiologist René Dubos (chiefly responsible for the world's first commercially manufactured antibiotic, gramicidin[15]) became the first planetary health lobbyist. In 1969 Dubos quoted then US ambassador to the United Nations, Adlai Stephenson, as remarking that the human passengers on a "little spaceship" are "preserved from annihilation only by the care, the work, and I will say, the love we give our fragile craft".[16] In the 1970s human ecologists Stephen Boyden[17] and Frederick Sargent each warned, in health journals, of human health risks from ecosystem damage.

Also far presaging the first articles on climate change and health published in health journals, Barbara Ward and Dubos, in 1973 called for the "care and maintenance of a small planet".[18] In 1989, articles in the *Lancet*, *Canadian Medical Association Journal* and the *New England Journal of Medicine* each warned of health effects of climate change, later sometimes called "tertiary",[19][20] such as famine, conflict and large-scale displacement and migration, none of them warned explicitly of civilization collapse. While the epidemiologist Tony McMichael's book "Planetary Overload" (1993)[21] argued that the collapse of several civilizations were partly due to environmental change. However, neither the book by McMichael nor by Ward and Dubos (to whom McMichael had contacted for career advice) explicitly warned that modern civilization could collapse.

A World Health Organization report, from 1998, argued that "the public health community needs to face the challenges presented by global change and equip itself with the necessary scientific and technical means to anticipate and, where possible, prevent human health consequences arising from degrading life-support systems".[22] In 2000, as far as I know for the first time in a health journal, I warned that 'if human demands on natural capital exceed the "environmental Plimsoll Line" then we risk not only the failure of civilization, but its collapse'.[23] This paper also stressed the role of inequality in this process.

1.3. "Managing the health effects of climate change"

In 2009, a widely cited paper in the *Lancet* (Costello *et al*) claimed "climate change could be the biggest global health threat of the 21st century".[24] However, this 37 page article (plus references) does not

contain the word "civilization" nor does it describe explicit or plausible pathways by which climate change could lead to such a catastrophe.

Costello *et al* state: "An additional 2 billion people would be water stressed, while billions more would face hunger or starvation". However, we already have a world where over 700 million people endure chronic undernutrition, particularly of calories.[25] Two billion people (or more) ingest adequate calories but are iron deficient, thus robbing them of vitality.[26] Globally, about 4 billion people are *already* exposed to extremely high water stress for at least one month a year.[27] Today, for a substantial proportion of humanity, health conditions are very poor. Universal abundance, as forecast by apostles of deregulation, has proven a mirage, especially the "trickle down" to the global South.

Costello *et al* also mention the risk of "armed conflict", including as a result of worsening water scarcity. However, there is no discussion of nuclear weapons and no hint of conflict on a scale sufficient to seriously harm civilization. At the time of its publication, the risk of civilization collapse was still tabooed in the thinking and writing of almost all health workers.[28]

1.4. Civilization collapse outside the health literature

Today, the possibility of civilization collapse is still greatly under-appreciated by health workers and their funders. However, parts of the broader scientific literature have become less guarded. In 2003 Martin Rees (later president of the Royal Society) published "Our Final Century".[29] Articles about "planetary boundaries" hint at civilization's demise, warning that "a safe operating space for humanity" risks transgression. Of significance, the longer version of the first paper on planetary boundaries acknowledges a conceptual debt to the LTG.[30] In 2013 historians published "The collapse of Western civilization: a view from the future", in which they argued that many scientists, including those who focus on climate, are too cautious.[31] Also in 2013, anthropologists speculated that the collapse of the classic Mayan civilization held "archaeological and environmental lessons" for the Anthropocene.[32] In 2014 an archaeologist suggested that the collapse of the Bronze Age civilization has lessons for the modern era.[33]

In the last five years, the topic of civilization's vulnerability to climate change and other aspects of planetary overload appears, finally, to be almost respectable.[6][34]. Leading British broadcaster and conservationist Sir David Attenborough warned (2018) that inaction on climate change could lead to "the collapse of our civilizations".[6] Antonio Guterres (UN Secretary-General) referred to "an atlas of

human suffering and a damning indictment of failed climate leadership. (...) Unchecked carbon pollution is forcing the world's most vulnerable on a frog march to destruction – now. The facts are undeniable. This abdication of leadership is criminal. The world's biggest polluters are guilty of arson of our only home".[35]

In 2021, three senior environmental scientists, including Sir Robert Watson, a former chair of the Intergovernmental Panel on Climate Change, confessed to having been "deceived" by the premise of net zero.[36] They acknowledged "humanity has gambled its civilization on no more than promises of future solutions".

In 2023 Steel et al described the "mechanisms and uncertainties associated with climate collapse" as of critical importance.[6] These workers identified several variants. In one, climate change and co-factors are associated with "local collapse" – breakdown in vulnerable locations while civilization elsewhere is largely intact. This is similar to the concept of "regional overload"; i.e. planetary overload, on a smaller scale.[37]

Steel et al's second scenario is called "broken world", a term for which they credit philosopher Tim Mulgan.[38] In this scenario, collapse is more widespread, but sub-global. In their third scenario ("global collapse") cities are almost abandoned, nation states disappear, and global population declines significantly. They point out that this process is unlikely to be abrupt, but unfold perhaps over a century or more. They do not mention the possibility of nuclear war, a risk that must increase if nation states fray.

2. Interacting risks

Human-driven climate change will not operate *by itself* to create a global civilizational risk; it will interact with a suite of other social and ecological factors. To warn of this peril is *not*, as is sometimes claimed[39] a form of "environmental determinism", the simplistic idea that environmental factors operate outside their social, historic, and political context.[40]

Environmental determinism did exist in the 19th century, even as a respectable thesis, complementing "social Darwinism", a time when most European powers had empires in hot places. Theories of racial inferiority ("caused" by the environment – especially those that were tropical) may have reduced the guilt of some of the occupying populations and their beneficiaries. Although some recent

environmental authors may exercise language that could be interpreted as simplistic, such cases are rare and should not be interpreted as any general return towards environmental determinism.[20][41]

3. Paths to civilization collapse

Our current dilemmas have arisen via a host of psychological, commercial, and political factors that have delayed not only meaningful mitigation of climate risk[36][42] but also of recognition of other LTG constraints, such as the reducing purity of metal deposits such as of copper.[43] In addition to environmental and military factors, the manipulation of opinion by the use of algorithms and inherently biased artificial intelligence (AI)[44] also contributes to civilizational risks. The 2023 Bletchley Declaration concluded that "frontier" AI systems have the potential to generate "catastrophic harms", unless safety is made a priority.[45] AI, which provokes a discourse that has been called "enchanted determinism"[46] and which seems likely to worsen discrimination against minorities,[47] also has an extremely high carbon footprint.[44]

Most fundamentally, the co-factors that drive civilizational risk include competition between and within species – elements understood by Malthus, and underpinning evolutionary theory.[48] Global human population already exceeds eight billion. Unclaimed resources – whether fertile land, cheap oil, or phosphorus – are increasingly scarce.[49][50] The pollution sink for the waste gases that drive climate change is overflowing. Land subsidence, including from aquifer depletion and current and planned dams, is worsening sea level rise in several vulnerable delta settings, including densely populated coastal Bangladesh[51] and the Mekong.[52] Many other aspects of LTG compound civilization's difficulties.

The fastest route to civilization collapse is nuclear war. A "minor" nuclear conflict may be survivable, but could generate retaliation and spread. Even if that is avoided, the precedent of "survivable" nuclear war – were it established – might lead to its repeat, perhaps by other state or even quasi-state actors. The death of over 1 billion people might lead to an uneasy respite, as the remaining 7-9 billion humans rush to appropriate the "freed up" land and other resources. However, by then, how much of that land might be uninhabitable? Further, even a "limited" nuclear war may compromise global food security.[53]

At the moment, international actors such as the UN, together with still significant goodwill (e.g. to hold sporting events and for world leaders to meet face to face) appears to limit the prospect of

nuclear weapon use. However, climate change (and other LTG elements), if left unchecked for much longer, could erode these pockets of co-operation, by means such as making increasing parts of Earth uninhabitable, and thus increasing existing competition for resources. This could evolve via several means, such as a combination of heat and humidity exceeding the limits of human tolerance. [54] Extreme storms may cripple cities, as unexpectedly occurred in Acupulco, Mexico, in 2023.[55]

4. "Environmental brinkmanship"

The current proximity to collapse (perhaps still decades away and, even now, with a chance of avoidance) has also been called "environmental brinkmanship".[56] Although a few optimists continue to insist that human ingenuity is limitless and, relatedly, that all major problems are soluble, [57] the frequency and confidence of such pronouncements is diminishing. Cornucopians, who were especially influential in the closing decades of the 20th century,[58][59][60] ignore or discount counter-examples where human ingenuity has *not* solved bottlenecks, such as the 1994 Rwandan genocide,[61] [62] the Syrian civil war (probably worsened by climate change),[63] and the internecine conflict between Palestine and Israel. Many other bottlenecks,[64] traps and tipping points[65][66] loom, such as the risk that the Amazon forest – currently drought stricken, in part from deforestation (which reduces rainfall) – will becoming a net carbon source rather than sink.[67]

5. Ethics, climate change and biodiversity loss

The climate crisis is widely considered to have evolved due to the success of human capacity to manipulate nature; not just by building "nests" or farming (as some fungal-nurturing termites, ants and beetles also do[68]) but also by consciously extracting elements and mixtures from the air and in mines in order to grow more food and to drive machines. These machines, and the fossil fuels that largely power them, partially substitute for human slaves upon which previous civilizations depended. [69] The utility and versatility of fossil fuels has been of tremendous benefit to civilization. However, the question is of their dose. Although slavery of humans and animals has been reduced by fossil fuels, each form persists.[70]

The climate crisis has many important ethical dimensions, many of which are poorly understood. Jamieson[71] argues that the movement to slow anthropogenic climate change can learn from the British abolition of the Atlantic slave trade (in 1807). He points out that our current dependence on

carbon is as "naturalized" (i.e. possesses a social licence) as slavery once did. He also argues that some reformers were both insiders and outsiders; Bill McKibben (founder of the climate change lobby group 350.org) graduated from Harvard University. William Wilberforce, a prominent slavery abolitionist, was a staunchly conservative member of the British establishment, who never left the Church of England.

AC Grayling, in his book "The History of Philosophy" defines ethics as the enquiry into the concepts and theories of what is good, of right and wrong, of moral choice and action.[72] Ethics is related to values, including to fairness. Kahn[73] links the emergenc of bioethics with allegedly scientific experiments undertaken on humans during World War II, and with the Tuskegee studies (1932-1972) in the US. This led to the 1964 Declaration of Helsinki, passed by the World Medical Association. One of its principles was that research protocols must be submitted to independent ethics committees to decide if the proposed studies meet international standards and norms.

Trying to preserve civilization from the interaction of climate change and militarism may be criticized for anthropocentricism, but it is surely an ethical pursuit. Anthropogenic climate change, described in 1957 as a large-scale "geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future"[74] has not been approved by an ethical committee. Perhaps, if civilization endures for long enough, a future Nuremberg Commission will be harshly critical of those who they judge most responsible.

Probably the most widely appreciated ethical dimension to climate change is that the affluent populations based largely in the global North – who, via their behavior, are its dominant drivers – are, to date and apparently in the very near future, comparatively insulated from the most obvious harms from greenhouse-gas-amplified heatwaves, droughts, famines, and floods.[75][76] However, less well appreciated, several countries in the global South are also significant contributors to climate change, principally via deforestation. These nations include Indonesia (also a major coal exporter[77]), Brazil and the Democratic Republic of the Congo.[78]

Biodiversity loss from the global South is also substantial. Under the 2015 Paris climate agreement, Brazil pledged to restore 120,000 km[2] of Amazon forest by 2030,[79] approximately 1/3rd of the total area of forest degraded between 2001 and 2018.[80] However, although deforestation in Brazil declined in the first half of 2023 [81], it it will be difficult for Brazil will honor this pledge. Already, heat and drought are causing great distress to the Amazonian ecosystem. For example, in 2023 more than 150

river dolphins perished when the lake in which they had lived approached a temperature of 40°C (104°F).[81]

6. Intergenerational inequity

There is also growing appreciation of the intergenerational unfairness that unabated climate change is causing: baby boomers have unfairly benefited at the expense not only of the cohort of Swedish Greta Thunberg (born 2003), but even more so of her near contemporaries in the global South, such as the Kenyan climate activist Kaluki Paul Mutuku.[82] There are, of course, many future generations in addition to those who are young today.[38] Their well-being is placed at risk by recent and current actions.

In 2022, fossil-fuel subsidies amounted to more than US$1 trillion globally, reducing fossil fuel prices and stimulating their use.[83] A report by the International Monetary Fund concluded that such subsidies might be as high as US$7 trillion, were externalities and opportunity costs included.[84] In low-income settings, such subsidies are an important element of poverty relief. Their removal could be compensated by increased direct transfers to the poor.[83]

7. Population policy and inequity

It is plausible that the shift in elite US thinking about the risk of rapid population growth for people in the global South – from one of concern to one of complacency (market forces will fix it) – was in part motivated by the undervaluing of the lives and well-being of people in low-income settings.[85] In support of this proposition, Herman Daly (1938-2022), the pre-eminent ecological economist of recent decades[86] ruminated: “Without slaves, where can we get the cheap labor needed to keep the economy growing? From the proletariat, of course, just like the Ancient Romans.” Daly also pointed out that “The Latin word proles means offspring, and in Ancient Rome the proletariat was the class with no property whose contribution to the Republic was to proliferate many offspring—servants, soldiers, and laborers for the benefit of the patricians”.[87]

These ideas can be interpreted to mean that Daly was conceptualizing “surplus” populations in the global South as a Marxist-inspired concept of a “reserve army” to depress global wages. Daly was, of course, critical of such policies, aware of the risk they posed, not only to the well-being of the global poor, but also to the Earth system. Related to this, but unusually for an economist from the Left, Joan

Robinson (1903-1983) wrote "Marx thinks of the supply of labor as being fed by the ruin of the peasant and artisan economy. In his anxiety to combat the reactionary views of Malthus, he refused to admit that a rapid growth of population is deleterious to the interests of the working class".[88]

Discussion about population size, population growth rates, and poverty continues to be largely suppressed, including by an alliance between neoliberalism (ideology dominated by market forces) and the Vatican.[89] An otherwise excellent book on the climate and ecological crises, published by the Pontifical Academy of Science, is almost completely silent on the need and benefits of increased family planning in low-income settings.[90]

Adding to these reasons for the suppression of discussion of population is the fact that Nazi Germany distorted ecological concepts, including the positing of dynamic, fluid 'border regions' to seek to justify genocide.[91] A symptom of this suppression is the reflexive dismissal of such concerns as "neo-Malthusian", a term used derogatively by some.[92] These slurs cloud clear thinking.

8. Food, inequity, climate change and human survival

Global inequity may have delayed recognition by the Food and Agricultural Organization (FAO) of the risk that climate change poses to food security.[93] The first major paper on this topic (1994) concluded, in its abstract, that "developing countries are likely to bear the brunt of the problem".[94] However, FAO did not appear to recognize a serious threat from climate change until 2003, when it belatedly highlighted the issue at its 29th Committee on World Food Security.[95] Would FAO have been more responsive if forecasts had been reversed; i.e. that the US grain belt would wilt whereas agriculture in India and sub-Saharan Africa would thrive?

Concrete evidence to support this hypothesis may not emerge. However, there are many documented examples of such unfairness, including from other actors ostensibly concerned with equitable global development. In 1991 then World Bank chief economist Lawrence Summers distributed a memo arguing that the Bank should encourage the migration of dirty industries to developing countries, as the "economic logic" for this was "impeccable".[96] For many years, the World Bank also ignored the risk of climate change. A former head of the World Bank's Industry and Energy department declared "global warming is not a concern".[97]

Today, rich countries (corporations, governments and overly complacent populations) continue to observe many practices that will disproportionately increase harm from climate change in the global

South. They lead the pack in wishful thinking. The 28th Conference of the Parties (of the UN Framework Convention on Climate Change), held in Dubai in late 2023 was more of the same, attended by 34 billionaires, of whom most appear to be disproportionately aggravating climate change, including via greenwash.[98]

9. Self-deception, denial and climate change

In addition to unfairness, the catastrophe of climate change is deepening due to self-deception and denial, at many levels, especially among governments and even some senior scientists.[31][36][99] This too has an ethical facet. Our success as a species has spawned hubris, a forgetting (and suppression) of too many past failures and their lessons, leaving an illusion of infallibility.[64][100] The public, especially in the global North, are too often mis-informed that as yet unviable technologies, from the direct air capture of carbon and its safe sequestration underground (or in the ocean) to the deliberate injection of atmospheric pollutants such as sulfur, in order to cool parts of Earth,[36][101] will rescue future generations – or at least some of them – from the worst consequences of planetary heating.[102] Although a few researchers have long recognized that the promise of future technology creates moral hazard[101] ("burn now, pay later"[36]), this dimension is, as yet, very poorly understood not only by the public, but by many in the scientific community.

10. Publishing, ethics, profits and civilization's survival

Finally, inadequately discussed is the relationship between climate change and the increasingly problematic scientific publishing industry.[103] For example, can journals that rely excessively on market forces for their viability (including generally undisclosed but alleged mega-profitability for some) adequately discuss key issues that threaten our collective future, such as hyper-capitalism?

Maddox, author of "The Doomsday Syndrome"[58] a book which argued that the future of humanity was bright, was twice editor in chief of *Nature* (1966-73, 1980-95). During his second period of command, *Nature* published many articles about climate change but few that were utterly pessimistic. Maddox even authored, in his final year as editor, a sympathetic review of a book that ridiculed the concerns of environmentalists. In it, Maddox proclaimed "the emperor of sustainable development has no clothes".[11] It is plausible that Maddox's complacency biased submissions and publications in *Nature* towards optimism, even though other factors undoubtedly contributed, including evidence that

such bias is common in humans.[104] Paul Demeny, founding editor of the *Population and Development Review* (1975-2012) also approved a stream of optimistic articles (with occasional dissent), contributing to additional complacency about humanity's long-term future.

Relatedly, how can scientists in totalitarian societies freely and adequately analyze these problems? [105] Contemporary writing on LTG by authors from countries such as China, Russia, and Saudi Arabia is either rare or non-existent.

11. Conclusion: Reversing the Doomsday Clock

The myriad adverse effects of human generated global heating, "rain bombs" and weather wilding are enhancing the risk to civilization that Russell, Einstein and others foresaw as a consequence of the invention of the hydrogen bomb. If our species can better understand these desperately important issues, and revive the greater respect for ethics that briefly dawned following World War II[23] then civilization may have a chance.

UN Secretary General Guterres appears to understand our collective risk; however, most political leaders continue, at best, to privilege imagined national security and well-being over that of their neighbors and the broader world, in a variant of the tragedy of the commons.[106] Although some analysts have shown, in certain cases, this tragedy can and has been avoided[107] the world is, currently, far short of the needed levels of global co-operation and tolerance to be confident that this tragedy can be avoided at the global scale.

The current trajectory of climate change, which appears to be steepening,[108] threatens, in combination with other aspects of LTG and the existence of nuclear weapons, to end civilization. The few survivors of such a catastrophe may, eventually, reconstruct a shadow of the current marvels too many people now take for granted, such as supply chains that deliver coffee and oranges for breakfast. They might be assisted by information once proposed by James Lovelock as a durable (non-computerized) instruction manual for people in such a plight, which he called "a book for all seasons". [109] The current trajectory of climate change, however, may defer this needed re-awakening for generations, perhaps to those huddling around a fire, recounting tales seen as mythical. [110][111]

Humans have survived immense difficulties in the past, including a period when its total population may have shrunk to fewer than 4,000, almost a million years ago, bringing our ancestors close to extinction.[112] Although many civilizations have disappeared, new ones have always emerged – to

date. However, the threat of widespread use of nuclear weapons has changed this calculus. Were Einstein and Russell alive today they would surely endorse a similar statement to the one they led in 1955 – and they would mention climate change.

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