Inequality and Sustainability

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February, 2002

A thesis submitted for the degree of Doctor of Philosophy of The Australian National University.
This thesis is my original work, except where indicated.

Signed

Colin David Butler
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<tr>
<td>AIDS</td>
<td>Acquired Immuno-Deficiency Syndrome</td>
</tr>
<tr>
<td>ANU</td>
<td>Australian National University</td>
</tr>
<tr>
<td>bp</td>
<td>before present</td>
</tr>
<tr>
<td>BMJ</td>
<td>British Medical Journal¹</td>
</tr>
<tr>
<td>C</td>
<td>carbon</td>
</tr>
<tr>
<td>CH₄</td>
<td>methane</td>
</tr>
<tr>
<td>CFC</td>
<td>chlorofluorocarbon</td>
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<tr>
<td>CO₂</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>CRES</td>
<td>Centre for Resource and Environment Studies</td>
</tr>
<tr>
<td>EKC</td>
<td>environmental Kuznets curve</td>
</tr>
<tr>
<td>ENSO</td>
<td>El Niño Southern Oscillation</td>
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<tr>
<td>FAO</td>
<td>Food and Agricultural Association</td>
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<tr>
<td>FX</td>
<td>foreign exchange (adjusted)</td>
</tr>
<tr>
<td>G7</td>
<td>Group of Seven</td>
</tr>
<tr>
<td>GEC</td>
<td>global environmental change</td>
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<tr>
<td>GDP</td>
<td>gross domestic product</td>
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<td>GID</td>
<td>global income distribution</td>
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<tr>
<td>GHG</td>
<td>greenhouse gas</td>
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<tr>
<td>GMO</td>
<td>genetically modified organisms</td>
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<tr>
<td>GNP</td>
<td>gross national product</td>
</tr>
<tr>
<td>GPI</td>
<td>Genuine Progress Indicator</td>
</tr>
<tr>
<td>Gt</td>
<td>gigaton ($10^9$ tons)</td>
</tr>
<tr>
<td>ha</td>
<td>hectare</td>
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<tr>
<td>H-1211</td>
<td>halon-1211</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>IIASA</td>
<td>International Institute for Applied Systems Analysis</td>
</tr>
<tr>
<td>ICP</td>
<td>International Comparison Project</td>
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¹ The British Medical Journal changed its name to the acronym several years ago.
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<td>Index of Global Environmental Change</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>IRRI</td>
<td>International Rice Research Institute</td>
</tr>
<tr>
<td>KC</td>
<td>Kravis coefficient</td>
</tr>
<tr>
<td>ky</td>
<td>kiloyears</td>
</tr>
<tr>
<td>JAMA</td>
<td>Journal of the American Medical Association</td>
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<tr>
<td>LSE</td>
<td>London School of Economics</td>
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<tr>
<td>LSH&amp;TM</td>
<td>London School of Hygiene and Tropical Medicine</td>
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<tr>
<td>m</td>
<td>metre</td>
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<tr>
<td>MAPW</td>
<td>Medical Association for the Prevention of War</td>
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<tr>
<td>MJA</td>
<td>Medical Journal of Australia</td>
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<td>mm</td>
<td>millimetre</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<tr>
<td>NBP</td>
<td>net biome production</td>
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<tr>
<td>NCEPH</td>
<td>National Centre for Epidemiology and Population Health</td>
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<tr>
<td>NEP</td>
<td>net ecosystem production</td>
</tr>
<tr>
<td>NGO</td>
<td>non-government organisation(s)</td>
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<td>NID</td>
<td>national income distribution</td>
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<tr>
<td>NIWA</td>
<td>National Institute for Water and Atmospheric Research</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NPP</td>
<td>net primary production</td>
</tr>
<tr>
<td>NRC</td>
<td>National Research Council</td>
</tr>
<tr>
<td>OCF</td>
<td>Our Common Future</td>
</tr>
<tr>
<td>ODS</td>
<td>ozone depleting substance(s)</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Development and Co-operation</td>
</tr>
<tr>
<td>OPEC</td>
<td>Organisation of Petroleum Exporting Countries</td>
</tr>
<tr>
<td>pa</td>
<td>per annum</td>
</tr>
<tr>
<td>pc</td>
<td>per capita</td>
</tr>
<tr>
<td>PHC</td>
<td>Primary Health Care</td>
</tr>
<tr>
<td>PNG</td>
<td>Papua New Guinea</td>
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<tr>
<td>ppbv</td>
<td>parts per billion by volume</td>
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</table>
ppmv  parts per million by volume
PPP  purchasing power parity
pptv  parts per trillion by volume
PRC  Peoples Republic of China
PWT  Penn World Tables
RSPAS  Research School of Pacific and Asian Studies
RSBS  Research School of Biological Sciences
RSSS  Research School of Social Sciences
SAPs  structural adjustment programme(s)
SF₃CF₃  trifluoromethyl sulphur pentafluoride
SLAPP  strategic law suit(s) against public participation
SOL  stratospheric ozone layer
SOD  stratospheric ozone depletion
SST  sea surface temperature(s)
UK  United Kingdom
UN  United Nations
UNCED  United Nations Conference for Environment and Development
UNCTAD  United Nations Conference on Trade and Aid
UNDP  United Nations Development Programme
UNEP  United Nations Environment Programme
UNFPA  United Nations Fund for Population Activities
US  United States
USSR  Union of Soviet Socialist Republics
UVR  ultra violet radiation
WB  World Bank
WCED  World Commission on Environment and Development
WDI  World Development Indicators
WDR  World Development Report
WHO  World Health Organisation
WMD  weapons of mass destruction
WW  World War
WWF  Worldwide Fund for Nature
Acknowledgements

This multidisciplinary thesis has a long history and has naturally involved contributions from many people. Although started in April 1998, its genesis is much older. I can only name a fraction of these people here. I also acknowledge an unpayable debt to the countless individuals whose work has led to the body of literature that I discuss, and to the publishers, libraries and web-masters who have enabled this knowledge to be amassed, preserved, searched and accessed. I wish to particularly thank the secretarial, administrative and information technology support staff at NCEPH, the library staff at six ANU libraries, the Launceston and Hobart campuses of the University of Tasmania and the Sir John Ramsay library at the Launceston General Hospital.

This work would not have been possible without the financial support of an Australian Post-Graduate Award and a supplementary NCEPH scholarship.

Chair of advisory panel: Emeritus Professor Bob Douglas, NCEPH, ANU (epidemiology, advice and constant support, including the overall approach to examination of the research questions discussed. I especially thank Bob for advising that a research thesis and one’s passion need not be mutually exclusive, and for the risk he took in encouraging this thesis.)

Supervisor: Emeritus Professor Jack Caldwell, NCEPH, ANU (demography)

Formal advisers:
Emeritus Professor Max Neutze (deceased 2000), RSSS, ANU (economics); Professor John Deeble, NCEPH, ANU (economics); Mr Richard Eckersley, NCEPH, ANU (future, quality of life, indicators of progress); Dr Len Smith, NCEPH, ANU (inequality analysis, advice).

Informal advisers and/or correspondents
Dr Premachandra Athukorola: ANU ; Professor Albert Berry, University of Toronto, Canada; Dr Greg Bodeker, NIWA, Omakau, Otago, New Zealand (stratospheric ozone data and advice); Mr Ian Castles, Vice President, Academy of Social Sciences, Australia (helpful and stimulating debate); Dr Lincoln
Day, Washington DC, USA (demography); Dr Ed Dlugokencky, NOAA, Boulder, CO, USA (methane data and advice); Professor Steve Dowrick, ANU (PPP analysis); Professor Mark Elvin, RSPAS, ANU; Dr David Etheridge CSIRO; Professor Bob Gregory, RSSS, ANU (economics); Dr Jeff Houlahan, University of Ottawa, Canada (amphibian data and advice); Dr Elisabetta Magnani, School of Economics, The University of New South Wales, Sydney; Mr John Maindonald, ANU; Professor Tony McMichael, LSH&TM, UK and NCEPH, ANU; Dr Branko Milanovic, Development Research Group, World Bank, Washington DC; Dr Norman Myers, Oxford University, UK (tropical deforestation advice); Dr Gunnar Myhre Department of Geophysics, University of Oslo, Norway: (radiative forcing of greenhouse gases data); Professor David Shearman, Society of Doctors for the Environment, Adelaide; Professor Henry Nix, CRES, ANU (advice re environmental data analysis and advice); Professor Ian Noble, RSBS, ANU; Professor Daniel Pauly, Fisheries Centre, University of British Columbia, Canada: (marine and fresh water fishcatch trophic data and advice); Dr Simon Szreter, Cambridge University, UK, and Professor Bob Wasson, CRES, ANU.

Members of ANU globalisation discussion group, especially Professor Christine Sylvester; members of ANU human ecology discussion group and members of the Nature and Society Forum, especially Dr Brian and Anne Furnass.

Family, friends and influential lecturers

My family, especially my parents for lifelong support and encouragement and my father, Mr David Butler, for introducing me to computers in 1983, for entering some Endnote data, and for double-checking some of the manually entered national economic data.

My wife Susan, for support and patience, especially for the long periods of absence when I was in London and Canberra.

I would like to thank several workers in international health, environmental science, epidemiology and social and political change who have indirectly motivated, encouraged or informed this work. Some are mentioned in more detail in the afterword, three not mentioned there are Professor John Guillebaud, who encouraged my interest in population, especially in central Africa; Emeritus Professor John Last, for friendship, advice and encouragement, especially in the early years when I regarded all epidemiologists with awe; and, last but not least, the late Dr Eberhard Wenzel, whose barrage of alarming emails cumulatively impelled action.
Inequality and Sustainability
Abstract

Global civilisation, and therefore population health, is threatened by excessive inequality, weapons of mass destruction, inadequate economic and political theory and adverse global environmental change. The unequal distribution of global foreign exchange adjusted income is both a cause and a reflection of global social characteristics responsible for many aspects of these inter-related crises.

The global distribution of foreign exchange adjusted income for the period 1964-1999 is examined. Using data for more than 99% of the global population, a substantial divergence in its distribution is found. The global Gini co-efficient, adjusted for national income inequality, increased from an already high value of 71% in 1964 to peak at more than 80% in 1995, before falling, very slightly, to 79% in 1999. The global distribution of purchasing parity power income is also examined, for a similar period. Though also found to be extremely unequal, its trend has not been to increased inequality. Implications of the differences between these two trends are discussed.

A weighted time series index of global environmental change (IGEC) for the period 1960-1997 was also calculated. This uses nine categories of global time series environmental data, each scaled so that 100% represents the level of each category in nature prior to anthropogenic change; zero represents decline to a critical point. This index fell from 82% in 1960 to 55% in 1997, and will further decline during this century.

Using evidence from several disciplines, it is argued that the decline in the IGEC correlates with major macro-environmental changes, which, combined with flawed social responses to scarcity and its perception, place at risk the ability of civilisation to function. This could occur because of the interaction of conflict, economically disastrous extreme climatic events, deterioration of other ecosystem services, regional food and water insecurity, and currently unforeseen events. Uncertainty regarding both a safe rate of decline and the tolerable nadir of the IGEC is substantial.

Substantial reduction in the inequality of foreign exchange adjusted income is vital to enhance the development of policies able to reverse the decline in the environmental goods which underpin civilisation, and to promote the co-operation needed to maximise the chance that civilisation will survive.
This thesis is multi-disciplinary, drawing especially from epidemiology, environmental science, pherology, economics and demography. It is divided into three main sections. The first introduces the main ideas, propositions, and non-economic literature upon which the thesis is constructed. The second section presents an improved, comprehensive measure of global economic inequality and an index of global environmental change, and also discusses relevant literature of a more technical nature. The final section has two chapters. The first presents a new theory concerning carrying capacity and inequality, and attempts to explain the main argument of the thesis from a different view. The final chapter summarises the main contributions of the thesis and suggests avenues for further research.

Section one

Chapter one introduces three main elements of the thesis. Two – inequality and sustainability – already have a vast literature. The third, “civilisation failure” is less familiar, but it too is attracting increasing attention, though not generally as this term. The writer’s home academic discipline is in public health and epidemiology, and this chapter contains an extensive review of the health literature concerning global environmental change (GEC). The chapter argues that the most serious potential adverse health effects of GEC is via a pathway of significant global “civilisation failure”.

To substantiate this claim, the chapter reviews the general scientific literature relevant to many aspects of global environmental change. This is also done to introduce the “Index of Global Environmental Change” (IGEC) in section two. The chapter concludes that adverse human health effects resulting from GEC is a legitimate, currently under-explored topic for public health research and that seeking to better understand the causes of GEC is an important and legitimate research question.

Chapter two introduces the main idea explored by this thesis, which is that the contemporary scale of global inequality risks civilisation failure by undermining and

1 The science of carrying capacity
obstructing efforts to achieve sustainability, while at the same time risking the provocation of a “global guerrilla war” via pathways of large-scale population exclusion and resentment. It is argued that inequality acts to undermine sustainability via the cumulative effect of many individual government policies.

The methodology used in the thesis is discussed. It is argued that the existing epidemiological causal criteria can be adapted to contribute to causal theory for the emerging discipline of “sustainability science”, and that the thesis makes important steps towards this. These include quantitative estimates of the distribution and trend of global economic power and the scale and trend of global environmental change, over recent decades. However, causation in this field will primarily depend on plausibility. Because of the inevitability of both uncertainty and pre-existing (Bayesian) biases, it is admitted that adducing causality beyond all doubt will continue to be elusive. Nevertheless, the evidence of a causal relationship between inequality and sustainability is at least as strong as that for most existing economic and policy assertions.

I argue that inequality – the relationship between groups with different power on a global scale – acts most directly to impair sustainability by delaying the global attitudinal transition by limiting awareness, at both elite and public levels, of the risks to civilisation from both inequality itself, and also from adverse global environmental change. This leads to policy making which obstructs the other, material elements of the sustainability transition.

Chapter three introduces the conventional, alternative pathway to the global sustainability transition, termed, provocatively, the “Cornucopian enchantment”. This is an exaggerated, simplistic set of arguments, based almost on magical thinking, which essentially proposes that sustainability can be achieved, with little effort, almost automatically, provided certain economic elements – especially free market principles – are be embedded into global society. The most articulate spokesperson associated with this view is the late Julian Simon. The literature that gives rise to Cornucopianism is generally founded on reality, but an exaggerated form has great potency, and properly deserves the term “enchantment”. An alternative – and less charitable explanation for the widespread faith in Cornucopian principles is that it avoids any effort to redistribute wealth and power, and thus is compatible with increasing inequality and the self-interest of powerful populations. Probably both explanations are partially true.
This chapter also reviews a fragment of recent demographic literature regarding the
debate between neo- and anti-Malthusianism, concentrating mainly on a single journal, the
Population and Development Review. It proposes, controversially, that the relevant papers in
this have accepted the anti-Malthusian arguments too uncritically. Whether in response to
subtle funding pressures, from a withdrawal of engagement with the issue, or for both reasons,
it is suggested that demographers in recent decades have not acted with sufficiently clarity and
purpose to effectively challenge the unconscious adoption of the Cornucopian enchantment by
elite policy makers. A consequence of this has been the worldwide trend to reduced foreign
aid. By default, this has delayed the demographic transition, thus making the attainment of
global sustainability more problematic.

Of course, demographers cannot be held to have any special responsibility for the
decline in foreign aid, nor any unique responsibility to contribute to the debate concerning
global human carrying capacity. Nevertheless, it is suggested that if demographers had not
distanced themselves as much, as a profession, from neo-Malthusians, lobby groups such as
the Union of Concerned Scientists, and the general debate concerning sustainability, then the
politically conservative advocates of the free market are likely to have had less influence upon
government, especially with regard to reduced foreign aid, structural adjustment programmes,
and other free market policies imposed on the Third World.

The final chapter in this section discusses two more key concepts, that of “critical
environmental change” and “environmental brinkmanship”. These provide a conceptual
framework to explain how global environmental change may cause global civilisation failure,
and thus cripple population health. Environmental brinkmanship is likened to nuclear
brinkmanship, acting over a longer timescale, which undermines the environmental public
goods which civilisation relies on, including for food security. It is argued that powerful
populations are prepared to countenance environmental brinkmanship not only because of
their faith in the free market, but also because of a perceived insurance policy provided by
their power, income and affluence.

Again, therefore, global inequality provides a unifying mechanism to explain how
environmental brinkmanship, and hence the erosion of sustainability, occurs.
Section two

Chapter five reviews the existing literature related to both subjective and objective measures of global inequality. It focuses on the health impacts of economic conditions in the Third World since World War II (WWII). It argues that the general rate of improvement in health in the first post-war decades, when there was less global emphasis on the free market policies, slowed when the global free-market became more powerful, especially in sub-Saharan Africa. This chapter also reviews the quantitative literature of global income inequality, in terms of foreign exchange (FX) and adjusted for purchasing power parity (PPP). This is relevant for chapter six, in which four time series studies of global income inequality, undertaken for this thesis, are presented. It is argued that FX adjusted income is the appropriate indicator of global political influence (compared to PPP adjusted measures), mainly because governments accrue foreign debt in FX terms. National inequality, especially in the Third World, evidenced by a widespread lack of democracy and government accountability, also helps to exacerbate indebtedness. This is because such governments are frequently prepared to sanction further debt to maintain living standards for their elite populations and their own power, including by the purchase of arms. This is the case even though a consequence is further economic and health disadvantage experienced by their general populations.

Chapter six presents four time series studies of global income inequality undertaken for this thesis. One study, using FX terms, finds a clear divergence in global income distribution, while the three PPP studies show no evidence of such a divergence. However, the data are sufficient to show that the relationship between the FX and PPP measures has changed over time. This is examined in detail for China and India. It is found that the Kravis coefficient\(^2\) of the average income for these countries increased substantially during the 1970s and 1980s. It is argued that this represents a significant, previously undescribed, form of interest, which in this period acted to disadvantage these countries.

Chapter seven presents a fifth quantitative time series analysis, called the Index of Global Environmental Change. This draws on global environmental data, comprised of six main indicators, two atmospheric, one stratospheric, and three concerned with marine and terrestrial ecosystems. Technical literature relevant to each indicator is also reviewed.

\(^2\) The ratio of PPP to FX adjusted incomes.
Section three

Chapter eight proposes that existing theories of human carrying capacity are flawed by insufficient consideration of inequality. Inequality, within limits, can act to increase or to decrease total human carrying capacity. Over comparatively short periods, inequality can effectively increase the living standards of powerful populations. It can do this – provided the total population is limited – without approaching global carrying capacity limits, provided the ecological utilisation of the marginal (additional) population is low. Indeed, this describes the recent global situation.

However, over a longer time period, the living standards of the disadvantaged population may deteriorate relatively, and even absolutely – at least if insufficient dissemination of technological and material progress occurs. This threatens civilisation failure in several ways. Resentment is likely to increase within the comparatively disadvantaged population, leading to civil strife and insurgency. This is likely to be concentrated within poor populations, but is unlikely to be confined there. Consequences of a global guerrilla war are likely to include reduced economic growth, civilisation failure, and eventually, civilisation collapse. We may already be on the brink of such a world.

Additionally, even though the ecological impact of the comparatively poor fraction of the population is low on a per-capita basis its large size still adds significantly to the erosion of environmental global public goods, thus independently increasing the risk of critical global change and, eventually, civilisation failure. To reduce the risk of a global guerrilla war, living standards of poor populations need to be increased. Paradoxically, this will increase the rate of erosion of environmental global public goods.

The chapter also introduces the concept of marginal carrying capacity. It argues that any area and its associated population is characterised by a certain carrying capacity, a function particularly of resources, technology, ingenuity, organisation, debt and offshore income, including interest. Average living standards correlate with the per capita carrying capacity. At low populations, or when technology or other carrying capacity “co-factors” are increasing, population increments are likely to be comparatively welcomed. But as the rate of increase in carrying capacity slows, additional population are unlikely to be as welcomed, unless the living standard of the incoming population is substantially below that of the average population. Beyond another point, additional population may start to be resented, even if they are comparatively poor. This is not only because, at this point, they are unlikely to increase the
average living standard of the general population, but because they may even decrease it, or be perceived as so doing, because, for example of additional policing expenses and other transaction costs.

At a global scale, powerful populations reserve extensive resources, both to enable the high living standards enjoyed by their population, and also as a stock for the future. By definition, these resources are denied to less powerful populations, thus reducing their potential living standard. Estimates of the maximum theoretical global human population need to be reduced in view of this.

Chapter nine reviews the main contributions made by this thesis, and suggests several avenues for future research. The most important contribution is the argument that the current scale of global inequality undermines attempts to achieve sustainability. It reviews the terms of a new vocabulary to explain this. These include “environmental brinkmanship”, “civilisation failure”, “critical global environmental change” and the “Cornucopian enchantment”.

Essentially, powerful elements within civilisation, enchanted by both the cornucopian vision and their own enjoyment – made possible by the scale of inequality – embrace policies that lead to environmental brinkmanship. In turn, civilisation failure is threatened, in the short run by a global guerrilla war, and over a longer time, by critical global environmental change.

Secondly, the thesis comprehensively demonstrates, quantitatively, the extent of global income inequality over recent decades. It improves substantially on all previous measures of global exchange adjusted income inequality by its annual resolution, and by more completely accounting for changes in national income distribution. Thirdly, it suggests for the first time that changes in the Kravis coefficient act as either a hidden interest or subsidy for countries repaying loans in exchange adjusted currency. Fourthly, the thesis presents an authoritative, comprehensive and quantitative measure of global environmental change that surpasses previous measures because of its comprehensiveness and reduced selection bias.

A fifth contribution is the suggestion that carrying capacity theories need to explicitly consider the appropriation of carrying capacity by powerful populations. Finally, it suggests that several scientific fields, especially demography, have been insufficiently critical in the face of the Cornucopian enchantment.

This thesis should stimulate further work in several disciplines, including the emerging discipline of sustainability science. It serves as a conceptual basis for attempts to quantify civilisation failure, by creating different future scenarios. For example, these could assume
different rates of population growth, inequality, technological change, adverse global environmental change, and access by disadvantaged, resentful populations to weapons of mass destruction.

Secondly, the thesis should serve as an incentive to both extend and improve measures of global environmental change and also of inequality. It should stimulate a more critical examination of the concept of purchasing power parity income, further development of measures of genuine income, and of the relationship between exchange adjusted and purchasing power parity income.

The thesis concludes that even in the best case, environmental brinkmanship will continue for the rest of this century. Civilisation will need a deal of luck to survive. To minimise what is an unconscionable risk, civilisation needs to urgently adopt policies to accelerate the sustainability transition. Reducing inequality will accelerate the demographic transition, while technological and organisational transition will slow environmental brinkmanship. Reliance on poor populations as a form of safety net to protect wealthier populations is unacceptable for both moral and strategic reasons. Recognition of the pervasiveness and risk of this thinking will help to drive the attitudinal transition needed among wealthier populations to generate the political and technological changes required.

It is concluded that to increase the chance of sustainability policy makers will need to devise ways to redistribute wealth to poorer populations, mainstream economists will have to adopt the principles of ecological economics, and scientists as a whole will need to better inform the general public of the urgency and changes needed to facilitate the sustainability transition.

At the end of the bound volume, following the bibliography and index, is a collection of papers relevant to the thesis and published or submitted during it. Many of these are referred to in the text.

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3 Written or co-written by the author.