

A large colony of King penguins is shown on a beach. The penguins are densely packed, filling the frame from the foreground to the background. They have black heads and backs with bright yellow-orange plumage on their chests and necks. The background is a soft-focus view of the ocean with gentle waves.

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The Persistence of Population Pessimism

Julian Morris*

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“Our teeming population is the strongest evidence our numbers are burdensome to the world, which can hardly support us from its natural elements. Our wants grow more and more keen and our complaints more bitter in all mouths, while nature fails in affording us our usual sustenance. In every deed, pestilence and famine and wars have to be regarded as a remedy for nations as the means of pruning the luxuriance of the human race.”

Tertullian, *Treatise of the Soul*

Concern about over-population is not an exclusively modern phenomenon, as the above quotation, written by a Carthaginian priest in 210 AD, demonstrates. At the time it was written, total World population was around 250 million.¹

Among the most famous of the population pessimists was Robert Malthus, who sought to explain what he saw as “an obvious truth” namely, “that population must always be kept down to the level of the means of subsistence” (1798, p. vii). He did not mean that population *should* be kept at the level of subsistence; rather, that it inevitably would be kept at that level – as a result of what he called the population “principle”. His reason for so doing was to critique William Godwin and others who had recently been writing about ways in which the prospects for humanity might be improved through the eradication of war, disease and famine.

Malthus saw this reversion to subsistence as “the strongest obstacle in the way to any very great future improvement of society” (*ibid.*). In turn, he posited that “the power of population is indefinitely greater than the power in the earth to produce sustenance for man” (Malthus 1798, p.4). He argued that the expansion of the population would be held in check by, “the grinding law of necessity, misery, and the fear of misery” (1798, p. 56) – this is his population “principle”. The “necessity” arises from Malthus’s postulate that the increase in food production could not keep up with the increase in human numbers.² Fear of misery gave rise to preventive checks

on population growth, including “vices” (contraception, homosexuality) and (in later editions) “moral restraint” (abstinence). Misery would arise through the failure or inadequacy of the preventative checks and would result from such horrors as war, disease and famine.

Malthus presumed that the lower classes were incapable of moral restraint and that vices were inadequate to restrain population, so the wellbeing of a peasant, brought about by an increase in productivity, would simply induce him to have more children and thereby return to the level of subsistence.

It is ironic that Malthus should have invented this “principle” just at the moment when England was in the process of escaping the very trap he described. Various technological innovations had already resulted in increased agricultural productivity – and were beginning to result in new forms of industry. Since the late 1700s, a continuous stream of such innovations have resulted not only in dramatic increases in per capita output, but also increases in life expectancy (notwithstanding the reductions in life expectancy experienced by the urban poor during the nineteenth century).

The average baby born in England in 2009 can expect to live more than twice as long as the average baby born in 1798, while benefitting from considerably greater income and wealth, as well as more affordable and better food, shelter and other basic goods – not to mention the proliferation of technologies that make life more pleasurable. With some notable exceptions, similar improvements have occurred in much of the world (see e.g. Goklany 2007).

In spite of these evident improvements in human well-being, Malthusian fears have repeatedly arisen – and have repeatedly been debunked. As Schumpeter notes, ‘the old idea ... that the production of foodstuffs ... creates its own demand because people will multiply as it expands,’ is ‘as persistent as it [is] useless’ (Schumpeter 1954, p.191). As a result, neo-Malthusians have sought to broaden the concern away from mere production of food to various environmental concerns (though often

production of food is at the heart of these too).

In this new issue of the EJSD, Pierre Desrochers and Christine Hoffbauer discuss the intellectual history of the debate over population. Looking in particular at the contribution of Fairfield Osborn and William Vogt, they show that by the late 1960s concern about overpopulation was more-or-less the conventional wisdom.

It was into this milieu that, in December 1967, *New Scientist* published an article by Paul Ehrlich, called “Playing the Piper”, in which he stated “the battle to feed all of humanity is over ... In the 1970s and 1980s hundreds of millions of people will starve to death in spite of any crash programs embarked upon now.” The following year, a book-length elaboration, racily titled by the publisher, *The Population Bomb*, appeared to critical and popular acclaim. Also in 1968, the late Garrett Hardin’s “The Tragedy of the Commons” appeared in *Science* and although it is now remembered primarily for its description of what happens when there are no restrictions on grazing a commons, the article’s central tenet was the need to limit population growth.

In subsequent work, Ehrlich sought to systematise his concerns. In a notable paper with John Holdren, published in *Science* in 1971, he posited that the impact of a particular population size could be estimated by the following identity: $I = P \cdot F$, where I is impact, P is population size and F is a vector of factors.

In a critical review of Barry Commoner’s *The Closing Circle*, Ehrlich and Holdren (1972) developed this concept into the now-famous $I = P \cdot A \cdot T$ identity, where affluence (A) and technology (T) now replaced the broader vector of factors (F). Their purpose was to challenge Commoner’s contention that modern technology was the main driver of environmental damage. Commoner responded: “Ehrlich is so intent upon population control as to be unwilling to tolerate open discussion of data that might weaken the argument for it” (1972, p. 55).

Reflecting after forty years on *The Population Bomb* in the current issue of EJSD, Paul and Anne Ehrlich (who was unnamed co-author of the original book) argue in this issue that, if anything, they were overly optimistic in their earlier book. They remind the reader that they wrote *The Bomb* before the collapse of many of the world’s fisheries, the discovery of role of CFCs in ozone depletion, the spread of large-scale agriculture and, most importantly in their view, the discovery of global warming.

While far from cornucopian, Douglas Southgate explains how improvements in agricultural yields have continued to contradict the Malthusian thesis with regard to food production. However, Southgate has

concerns that impediments to and lack of investment in the development of new agricultural technologies might impede a continuation of this trend, and lead to deforestation and clearing of wild habitats for farmland.

As Paul Dragos Aligica notes in this issue, the late Julian Simon was initially attracted to the views of Ehrlich, Holdren, Commoner and other neo-Malthusians. But when he looked into the issues they raised, he found that the evidence did not support their contentions. Puzzled, Simon searched for an explanation: he realised that more people meant not only more mouths to feed but also more brains to think. Resources, he observed, are a product of human innovation – viz. the sequential development of better ways of moving goods and people, using different inputs. So, he said that people are the ‘ultimate resource’ and very often an increase in the number of people will be beneficial since it will result in an increase in the number of beneficial innovations.

While Simon was responding to a particular set of concerns, his general thesis was not entirely new: Desrochers and Hoffbauer refer to the work of William Petty, an economist and the inventor of national income accounting, who wrote in 1682: “[I]t is more likely that one ingenious curious man may rather be found out amongst 4,000,000 than 400 persons.”

Bjorn Lomborg (2001) had also believed that population growth and other factors were leading to environmental degradation, so when he came across an article³ about Julian Simon in *Wired* magazine, he initially set out to refute it – but found that instead he largely confirmed its findings.

In the past few years, Jared Diamond (2005) has once again popularised the view that unrestrained population growth can lead to collapse. But his claims of overpopulation as a major factor in the Rwandan genocide are rebutted by Karol Boudreaux’s article in this issue, in which she shows that there were many other more important causes. For further work challenging the accuracy of Diamond’s work see “Institutions, Progress, Affluence and Technology”, special issue of *Energy & Environment* in 2005.

More sophisticated adaptations of the IPAT identity allow for technology to play a more positive role (e.g. Chertow 2001; Waggoner and Ausubel 2002). Using a similar framework developed previously (Goklany 1996), Indur Goklany’s article in this issue assesses the implications of IPAT and concludes – having evaluated a wide range of evidence – that “in many respects affluence, technology and human well-being reinforce each other in what has been called the cycle of progress.”

At a policy level, concerns regarding the impact of

population growth have been used to justify all manner of interventions, including some, such as forced abortions and sterilisations, that are morally repugnant. The indirect effects have often also been dreadful. For example, China's 'one child' policy appears to have resulted in a significant increase in abandonment and infanticide, especially of girls (Johansson and Nygren 1991).

In this issue, Randal O'Toole addresses a seemingly more prosaic issue but nonetheless one with widespread implications: policies predicated on the assumption that it is possible to impose optimum population densities on urban areas. He argues that the density which emerges from the free choices of individuals will vary across time, place and technology – and should not be subject to attempts at central planning.

If nothing else, the diverse articles in this issue of the EJSd show that forty years after the publication of *The Population Bomb*, there remains considerable disagreement regarding the relationships between population growth, technological change, food availability, environmental impact, and human well-being. Readers are encouraged to make up their own minds about who is right and who is wrong.

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Notes

- 1 <http://www.census.gov/ipc/www/worldhis.html>
- 2 Malthus posited – without any empirical basis – that human numbers would increase at a geometrical rate, while production of foodstuff could only be increased at an arithmetic rate.
- 3 http://www.wired.com/wired/archive/5.02/ffsimon_pr.html

The Population Bomb Revisited

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Abstract

The Population Bomb has been both praised and vilified, but there has been no controversy over its significance in calling attention to the demographic element in the human predicament. Here we describe the book's origins and impacts, analyze its conclusions, and suggest that its basic message is even more important today than it was forty years ago.

It has now been forty years since we wrote *The Population Bomb* (Ehrlich 1968). The book sold some 2 million copies, was translated into many languages, and changed our lives. There is not much disagreement about the significance of the volume – whether a person agrees with it or not, *The Population Bomb* helped launch a worldwide debate that continues today. It introduced millions of people to the fundamental issue of the Earth's finite capacity to sustain human civilization. We believe that despite its flaws, the book still provides a useful lens for viewing the environmental, energy, and food crisis of the present time.

On a more personal level, it got Paul labeled the “population bomber” and categorized as someone who thought overpopulation was the sole problem of humanity. To this day when he lectures or appears on the media, he is pursued by inaccurate or out of context “quotes” from *The Bomb*. Such quotes are frequently assumed to represent our current thinking on many topics – including ones on which we have subsequently written entire books.

The Population Bomb was written in response to a request that Paul summarize arguments he had been making in the media that the population issue should be taken up by the growing environmental movement. That movement had been triggered in no small part by Rachel Carson's *Silent Spring* (Carson 1962). The suggestion

came in early 1968 from David Brower of the Sierra Club and Ian Ballantine of Ballantine Books. They hoped to get the population book out in time to influence the presidential election (how naïve we were!), and we wrote the book in a few weeks of evenings. Although the publisher insisted on a single author, it was from the beginning a joint effort. And the publisher exercised his right to select the title; our preference was Population, Resources, and Environment.

Reaction to the Population Bomb

The book has been seen, at the very least to some on the lunatic fringe, as of some enduring importance. It was listed by the *Intercollegiate Review* as one of the fifty worst books of the 20th century, along with John Kenneth Gailbraith's *The Affluent Society*, John Maynard Keynes' *General Theory of Employment, Interest, and Money*, and John Rawls' *A Theory of Justice*.¹ In *Human Events*' list of the “Ten Most Harmful Books of the Nineteenth and Twentieth Centuries,” it came in 11th place (“honorable mention”); even so, it bested Charles Darwin's *The Origin of Species* and *Silent Spring* by Rachel Carson, though it was outranked by Keynes (again), Marx's *Das Kapital*, and *The Kinsey Report*, among others.²

Much of the negative response to *The Population Bomb*, from both the far right and the far left, was clearly a reaction to its main message – that it can be a very bad thing to have more than a certain number of people alive at the same time, that Earth has a finite carrying capacity, and that the future of civilization was in grave doubt.

Originally Marxists thought that “The productive power at mankind's disposal is immeasurable” (Engels 1844), and thus they simply couldn't envision overpopulation. The far left in modern times found the advocacy of limiting population growth immoral. They saw the basic issue not as overpopulation but as maldistribution

of resources and worried that the far right would use overpopulation as an excuse to promote births of only the “right kind” (skin color, religion, national origin) of people – as was demonstrated by the eugenics movement and racist elements in the population control movement. The latter problem has caused Paul to put great effort into refuting the idea, once expressed by William Shockley,³ that people are color-coded for quality (Ehrlich and Holm 1964, Ehrlich and Feldman 1977, Ehrlich 2000). Conservatives, wed to the idea that free markets could solve any problem, didn’t like the idea that population size was a legitimate area for government intervention.

Those opposed to contraception, abortion, and sex education in the United States of course hated it, while the sexually repressed simply didn’t like any discussion of reproductive issues in their sex-soaked society. None of those constituencies seemed to understand that the fundamental issue was whether an overpopulated society, capitalist or socialist, sexually repressed or soaked, egalitarian or racist/sexist, religious or atheist, could avoid collapse. Four decades of largely ignored population growth and related issues -- especially patterns of rising consumption and their environmental effects -- since then make collapse now seem ever more likely and possibly sooner than even many pessimists think.

In late June 2008 James Hansen, a top NASA scientist, told Congress the climate situation has gotten so bad that the civilization’s only hope is drastic action. He asserted that the world has long passed the “dangerous level” for greenhouse gases in the atmosphere and must get back to 1988 levels. In his view, the volume of man-made carbon dioxide already injected into Earth’s atmosphere can remain for no more than a couple more decades without causing changes such as mass extinctions, ecosystem collapses, and dramatic sea level rises. In summary, he said, “We’re toast if we don’t get on a very different path.”⁴ And, of course, any path that satisfactorily deals with climate disruption would necessarily involve control of human numbers.

Perhaps the biggest barrier to acceptance of the central arguments of *The Bomb* was—and still is—an unwillingness of the vast majority of people to do simple math and take seriously the problems of exponential growth. This is not just the man in the street – it includes individuals who otherwise might be considered highly educated. A classic example was the statement by a professor of business administration, specializing in mail-order marketing, Julian Simon, who found prominence as a critic of environmental science: “We now have in our hands – in our libraries, really – the technology to feed, clothe, and supply energy to an ever-growing population for the

next 7 billion years” (Myers and Simon 1994, p. 65)⁵. In 1994, when that was written, the world population was growing at 1.4 percent annually. At that rate it would only take some 6000 years for the mass of the human population to equal the mass of the universe.

A similar lack of understanding of the power of exponential growth in population and consumption was demonstrated by Wilfred Beckerman, Professor of Political Economy at University College London before moving to Oxford. According to Beckerman, the problems associated with exponential growth in the use of any finite resource were “just as true in Ancient Greece.... This did not prevent economic growth from taking place since the age of Pericles.... [T]here is no reason to suppose that economic growth cannot continue for another 2500 years.” (Beckerman 1972).⁶ Assuming “slow” economic growth at a little over one percent per year, if England had existed in Pericles’ time (ca. 450 BC), the average family income would have had the annual buying power of about a millionth of a penny (Parsons 1977)! That is, if one started with a millionth of a penny in ancient Greece, and invested it at an interest rate of one percent annually, it would have generated about the same amount of money as a British family’s income in 1977.

Equally silly statements are made about the relationship of human numbers to prosperity. As late as 2007, echoing Chairman Mao⁷ and Julian Simon,⁸ demographer Nicholas Eberstadt called people the “wealth of modern societies” (Eberstadt 2007). People, of course, can be regarded as productive assets (embodying, as economists would put it, “human capital”), but it is an error to consider increases in human numbers as automatically expanding real wealth – the capacity for well-being. Given the growing scarcity of natural resources, population growth normally reduces per capita genuine wealth, and can even shrink a nation’s total wealth (e.g., Arrow et al. 2004). If wealth were a function of population size, China and India each would be three to four times as rich as the United States and more affluent than all the nations of Europe combined, Africa’s wealth would outstrip that of North America or Europe, and Yemen would be three times as well off as Israel (Population Reference Bureau 2008).

Population since *The Bomb*

World-renowned scientist James Lovelock, whose invention of the apparatus that allowed discovery of the threat to the ozone layer and saved humanity, recently stated: “We have grown in number to the point where

our presence is perceptibly disabling the planet like a disease.”⁹ When *The Population Bomb* was written, there were roughly 3.5 billion people in the world. Four decades later there are 6.7 billion people (Population Reference Bureau 2008), meaning that the world population has nearly doubled since *The Bomb* rolled off the presses. Despite this growth, there have been some remarkable advances on the population front. Birthrates have dropped in most of the world, partly in response to government-sponsored programs in education (especially of women), giving women job opportunities, making contraceptive information and materials accessible – and to economic factors.

Some of the lowest birthrates are now found in the rich, fully industrialized nations of Europe and in Japan. That’s fortunate in one respect because it is the high-consuming rich nations that place the greatest pressure on humanity’s staggering life-support systems (Ehrlich and Holdren 1971, Ehrlich and Ehrlich 2005). The big exception is the United States, which is a center of over-consumption and whose population continues growing because of a relatively high birthrate (average family size about 2.1 children, compared with 1.4 in Italy and Spain and 1.3 in Germany and Japan) and high immigration rate (4 per thousand, with Italy the same, Spain 7, Germany 0, and Japan 0). The nation has recently been in the strange position of debating immigration policy without ever discussing population policy.

Sadly, the United States has also been plagued by administrations, first under Ronald Reagan and then under George W. Bush, that have in effect encouraged high birthrates by withholding aid to family planning programs that allow women access to safe abortion. Even so, the majority of developing countries have adopted family planning programs, and many have substantially reduced their birthrates as the perception of children as valued farm labor has changed with urbanization to one in which children do not join the labor force early and are expensive to educate. Meanwhile some high-consuming European populations have even started shrinking in size – ironically accompanied by complaints about “aging populations.” That the change in age distribution is inevitable as population growth stops, and is often beneficial and easily managed, is ignored (Ehrlich and Ehrlich 2006). More importantly, so is the vast benefit of lessening pressure on our already battered life-support systems.

Thus the central goal of *The Population Bomb*, to encourage the adoption of policies that would gradually reduce birthrates and eventually start a global decline toward a human population size that is sustainable in the long run, has been partially achieved. Rather than

doubling the population in 35 years, as continued growth at the 1968 rate would have done, we may not reach that level – 7 billion – until 2013, 45 years after *The Bomb* was published.

Fortunately, the implications of population growth for our future overall well-being are gradually working their way back into the public and political consciousness today (e.g., Feeney 2008), especially in terms of the harm growth does in retarding the development of poor nations (Campbell et al. 2007). That’s very fortunate because the depressing fact is that, even with the good news on the population front, humanity may add some 2.5 billion people to the population before growth stops and (we hope) a slow decline begins.

It is essential to try to minimize those additions because they will have a disproportionate negative impact on our life-support systems. Our ancestors naturally farmed the richest soils and used the most accessible resources first (Ehrlich and Ehrlich 2005, p. 102). Now those soils, where people first settled as they took up farming, have often been eroded away or paved over, and societies are increasingly forced to turn to marginal land to grow more food. Instead of extracting rich ores on or near the surface, deeper and much poorer deposits must be mined and smelted today, at ever-greater environmental cost. Water and petroleum must come from lower quality sources, deeper wells, or the latter often from far beneath the ocean, and must be transported over longer distances. The environmental and resource impacts of past and future population growth will haunt humanity for a long time.

Where *The Bomb* was on the right track

Aside from its general emphasis on the perils of population growth, the book also drew early attention to over-consumption as a problem (p. 133)¹⁰, something that is increasingly seen as a pattern that may be more difficult to alter than over-reproduction (see, e.g., Ehrlich and Goulder 2007, Ehrlich and Ehrlich 2008). The U.S. share of global consumption has dropped substantially since *The Bomb* was published; as the book predicted, its share of world population has also dropped from a little under 7 percent to less than 5 percent. Yet the United States still consumes nearly a quarter of Earth’s resource flows. While the factors influencing reproductive patterns are now relatively well recognized, and thus the ways in which family-size choices can be altered, equivalent understanding of consumption choices has not been established.

What about the often-cited warnings about world population outstripping food supplies? Our skepticism on the oceans as a source of increased food has been more than borne out. We wrote, referring to a claim in an editorial in the January 28, 1967 issue of *Saturday Evening Post* (p. 86): “What about those ‘unmeasurable riches’ of the sea? Unhappily, they have been measured and found wanting. The notion that we can extract vastly greater amounts of food from the sea in the near future is quite simply just another myth promoted by the ignorant or the irresponsible” (p. 99). The wild seafood catch has not kept pace with population’s rise. Despite escalating (and environmentally dangerous) efforts at herding fishes in the oceans (“fish farming”), the total yield from the seas (wild plus farmed) has only increased about 20 percent per person, mostly in less desirable fish species – with no sign of “unmeasurable riches.” The long-term costs of attempting to continue increasing the wild fish harvest are projected (e.g., Pauly et al. 1998, Jackson 2008) to be disastrous, and even the popular press is beginning to realize that the future of the oceans is truly at risk (Renton 2008). Only a combination of reduced fishing pressures, a ban on bottom trawling, restoration of fisheries’ coastal “nursery” ecosystems, establishment of large networks of marine reserves, and (probably) stabilization of the climate through great reductions of the flow of CO₂ into the atmosphere (and thus reducing the acidification of the seas) would likely brighten that future.

Similarly, our view of the panacea potential of novel food sources such as single-cell protein from bacteria or algae cultured on petroleum or sewage (e.g., Marx 1989), leaf protein (Pirie 1966), or food production by nuclear agro-industrial complexes (Oak Ridge National Laboratory 1968) has proven entirely correct (pp. 100–105), as has our estimate that high-yield grains held the most hope for increasing human food supplies (pp. 106–107) and our concern about the environmental downsides of what was termed the “Green Revolution” (Dahlberg 1979, Ehrlich and Ehrlich 1990, Ehrlich and Ehrlich 1991).

The book was ahead of its time in its attention to new threats of vast epidemics connected to population size, coming out as it did just as Surgeon General William H. Stewart was declaring that vaccination and antibiotics had conquered infectious diseases. Decades before AIDS began to kill millions of people, we wrote of our concern about the deterioration of the epidemiological environment and the possibility of a “super flu” (pp. 69–71), which are far more serious worries today than they were forty years ago (Daily and Ehrlich 1996a, Daily

and Ehrlich 1996b). And it gave ample attention to the overuse of pesticides, especially DDT, which remains a serious problem, despite knowledge that often, maybe always, integrated pest control is a more economically (Cowan and Gunby 1996) and ecologically rational approach (Ehrlich and Ehrlich 1990, pp. 57–59).

What did *The Bomb* get wrong?

From a personal point of view, the worst aspect of the book was its title, which was taken (with permission) from General William H. Draper, founder of the Population Crisis Committee and a pamphlet issued in 1954 by the Hugh Moore Fund. Draper was, in tune with the tenor of the times and his friendship with George H.W. Bush, most concerned with the control of the populations of dark-skinned people (for an overview of the less savory aspects of population limitation, see Connelly 2008). The publisher’s choice of *The Population Bomb* was perfect from a marketing perspective but it led Paul to be miscategorized as solely focused on human numbers, despite our interest in all the factors affecting the human trajectory.

Perhaps the most serious flaw in *The Bomb* was that it was much too optimistic about the future. When it was written, carbon dioxide was thought to be the only gas whose greenhouse effect might cause serious global heating (the roles of methane, nitrous oxide, and chlorofluorocarbons were not recognized until a decade or so later). When the book was published, some climatologists thought that any warming from carbon dioxide emissions would be counteracted by anthropogenic dust and contrails from high-flying jets, which would have a global cooling effect. As a result, we could only write that exploding human populations were tampering with the energy balance of Earth and that the results globally and locally could be dire. Since *The Bomb* was written, increases in greenhouse gas flows into the atmosphere, a consequence of the near doubling of the human population and the near tripling of global consumption, indicate that the results likely will be catastrophic climate disruption caused by greenhouse heating.

In 1968 Sherwood Rowland and Mario Molina had not yet discovered the potential of chlorofluorocarbons to destroy the ozone layer and make life on Earth’s surface impossible. Norman Myers was years from calling world attention to the destruction of tropical rainforests; when *The Bomb* was written, the possibility that the tropical moist forests of the Amazon basin, Africa, and Asia might be destroyed was essentially unknown.

Also unknown were the threats of endocrine disrupting contaminants (pollutants that mimic hormones), compounds with non-linear dose-response curves that may be more dangerous in trace rather than high concentrations (Myers and Hessler 2007, Narita et al. 2007). Polar bears were not having reproductive difficulties blamed on pollutants then, nor were they losing their habitat due to melting sea ice. And we did not anticipate the largely successful attempts of the Reagan and George W. Bush administrations to roll back environmental regulations, promote over-reproduction globally, and (in the case of Bush) start a resource war over fossil fuels (Klare 2004, Ehrlich and Ehrlich 2005). The first post-World War II resource war was over water – the 1967 Israeli-Arab war. Those two wars may have been precursors of many more resource wars with intimate connections to overpopulation (Klare 2001, Klare 2008).

There were of course flaws in *The Population Bomb's* analysis of known threats. The first lines of the Prologue (p. 11) proved to be among the most troublesome in the book: “The battle to feed all of humanity is over. In the 1970s the world will undergo famines – hundreds of millions of people are going to starve to death in spite of any crash programs embarked upon now.” We are often asked what happened to the famines *The Bomb* predicted, as if the last four decades were a period of abundant food for all. But, of course, there were famines, essentially continuously in parts of Africa. Perhaps 300 million people overall have died of hunger and hunger-related diseases since 1968. But the famines were smaller than our reading of the agricultural literature (Paddock and Paddock 1964) at the time had led us to anticipate. What happened? The central factor, of course, was the medium-term success of the “green revolution” in expanding food production at a rate beyond what many, if not most, agricultural experts believed likely. As a result, there wasn't a general rise in the death rate from hunger – although there have been periodic regional rises in South Asia and Africa, and the world now may be on the brink of another major rise.

As was suggested in the same paragraph of the Prologue, many lives were saved by “dramatic programs to ‘stretch’ the carrying capacity of the earth by increasing food production.” The success of expansion of India's grain production was far beyond that foreseen by experts such as Raymond Ewell (pp. 39–40) and Louis L. Bean (pp. 40–41). On the other hand, the cautious optimism of Lester Brown (then administrator of the International Agricultural Development Service) was justified for the short term, although Brown has subsequently become much more pessimistic.

The analysis of the food situation in *The Population Bomb* was thus wrong in that it underestimated the impact of the green revolution. At the same time it did recognize that serious ecological risks would accompany the spread of that revolution (p. 108), although missing the overdrafts of groundwater, declines in the genetic variability of crops, and some other problems. It emphasized the importance of both curbing population growth and attempting to expand food production, and it is worth noting that falling population growth rates in the rich nations of Europe have played a significant role in the creation of agricultural surpluses in those countries. Nevertheless, the absolute numbers of “hungry” people by 2005 (around 850 million) were somewhat less than they were in 1968. That was a cheering result, but the numbers of under- and malnourished people may now have risen again by 100 million or more in the current food shortage crisis. Even so, the reduction of the hungry portion of the world population may well have been bought at a high price of environmental destruction to be paid by future generations. It should be noted that in 1968, as today, there was and is enough food to feed everyone an adequate diet if food were distributed according to need. But there is not the slightest sign that humanity is about to distribute anything according to need, and it is uncertain how long there will be enough food for everyone even if there were more equitable distribution.

The Bomb was also somewhat misleading in stating that the birthrate in the United States might soon rise as the post-World War II baby boomers matured into their reproductive years. Instead, it actually dropped significantly in the early 1970s. One interesting question raised by this is how much of that change was the result of rising concern about overpopulation generated in part by *The Bomb* itself. And in 1968 the critical importance for lowering birthrates of providing women with education and job opportunities, as well as access to contraception and abortion, was under recognized, and we did not properly emphasize their potential role in reducing birthrates.

The biggest tactical error in *The Bomb* was the use of scenarios, stories designed to help one think about the future. Although we clearly stated that they were not predictions and that “we can be sure that none of them will come true as stated,” (p. 72) – their failure to occur is often cited as a failure of prediction. In honesty, the scenarios were way off, especially in their timing (we underestimated the resilience of the world system). But they did deal with future issues that people in 1968 should have been thinking about – famines, plagues, water shortages, armed international interventions by

the United States, and nuclear winter (e.g., Ehrlich et al. 1983, Toon et al. 2007) – all events that have occurred or now still threaten. We also didn't realize that many commentators would assume that our analysis in *The Population Bomb* comprised our last thoughts on the subject and would never bother to look at the many hundreds of subsequent articles and books in which we updated and revised our conclusions (e.g., Ehrlich and Holdren 1971, Ehrlich et al. 1977, Ehrlich et al. 1981, Ehrlich and Ehrlich 1981, Ehrlich and Ehrlich 1987, Ehrlich and Ehrlich 1989, Ehrlich and Ehrlich 1990, Ehrlich and Ehrlich 1991, Ehrlich et al. 1992, Ehrlich et al. 1995, Ehrlich and Ehrlich 2005).

Back to fundamentals

The essential point made about population growth is as valid today as it was in 1968: "Basically, there are only two kinds of solutions to the population problem. One is a 'birthrate solution,' in which we find ways to lower the birthrate. The other is a 'death rate solution,' in which ways to raise the death rate – war, famine, pestilence – find us" (p. 34).

The answer to the question of whether future substantial rises in death rates could have been avoided if more comprehensive action to reduce birthrates had been initiated in the late 1960s, will probably never be clear. Those death rate rises seem ever more likely today as hunger wracks millions of poor people and causes food riots (Anonymous 2008) and as the agricultural enterprise in many regions is threatened by massive climate disruption (Fogarty 2008), although the uncertainties are great and are likely to remain so for a substantial period of time. In any case, one only need look at current projections for population shrinkage by mid-century due to AIDS in countries such as Botswana and widespread increases in hunger because of rising food prices (Lean 2008) to realize that if we continue on a business-as-usual course, a full-scale death rate solution may soon be upon us.

Much of the focus of *The Bomb* was on avoiding a collapse of humanity's global civilization from "three of the four apocalyptic horsemen—war, pestilence, and famine" (p. 69). Those horsemen were also doubtless involved in most of the past local and regional collapses of which we are aware – civilizations of Akkadia, Sumeria, Babylonia, Nineveh, Rome, the Classic Maya, Easter Island, Norse Greenland, and so on (e.g., Tainter 1988, Diamond 2005). The same horsemen, joined by a fourth, toxification, represent increasing threats today as globalization destroys the safety valve of modularization and the civilization

facing collapse is for the first time truly global (Ehrlich and Ehrlich 2005, Ehrlich and Ehrlich 2008).

The fundamental point of *The Population Bomb* is still self-evidently correct, we believe: the capacity of Earth to produce food and support people is finite. More and more scholars have realized that as our population, consumption, and technological skills expand, the probability of a vast catastrophe looms steadily larger (Homer-Dixon 2006). James Lovelock "believes global warming is now irreversible, and that nothing can prevent large parts of the planet becoming too hot to inhabit, or sinking underwater, resulting in mass migration, famine and epidemics. Britain is going to become a lifeboat for refugees from mainland Europe, so instead of wasting our time on wind turbines we need to start planning how to survive." Lovelock fears we won't invent the technologies necessary to save us in time and expects "about 80%" of the world's population to be wiped out by 2100." Prophets have been foretelling Armageddon since time began, he says. "But this is the real thing" (Aitkenhead 2008). British astronomer Sir Martin Rees suggests similar possibilities as the title of a recent book indicates: *Our Final Hour: A Scientist's Warning: How Terror, Error, and Environmental Disaster Threaten Humankind's Future In This Century – On Earth and Beyond* (Rees 2003).

Signs of potential collapse, environmental and political, seem to be growing. The pattern is classic – population grows to the limits of current technologies to support it, followed by technological innovation (e.g., long canals in Mesopotamia, green revolution in India, biofuels in Brazil and U.S.) accompanied by more population growth and environmental deterioration, while politicians and elites fail to recognize the basic situation and focus on expanding their own wealth and power.

On the population side, it is clear that avoiding collapse would be a lot easier if humanity could entrain a gradual population decline toward an optimal number. Our group's analysis of what that optimum population size might be like comes up with 1.5 to 2 billion, less than one third of what it is today. We attempted to find a number that would maximize human options – enough people to have large, exciting cities and still maintain substantial tracts of wilderness for the enjoyment of outdoors enthusiasts and hermits (Daily et al. 1994). Even more important would be the ability to maintain sustainable agricultural systems and the crucial life support services from natural ecosystems that humanity is so dependent upon. But too many people, especially those in positions of power, remain blissfully unaware of that dependence.

Conclusions

The Population Bomb certainly had its flaws, which is to be expected. Science never produces certainty. Nonetheless we are all, scientists or not, always attempting to predict the future (will the stock go up or down? Will he be a good husband? Will it rain later?). And when we plan, we do the best we can.

One of our personal strategies has always been to have our work reviewed carefully by other scientists, and *The Population Bomb* was no exception. It was vetted by a series of scientists, including some who became top leaders in the scientific enterprise. That is one reason that long ago the fundamental message of *The Bomb* moved from a somewhat heterodox view to a nearly consensus view of the scientific community. Consider the following two 1993 statements. The first was the World Scientists' Warning to Humanity, released by the Union of Concerned Scientists (1993) and signed by more than 1500 of the world's leading scientists, including more than half of all living Nobel Laureates in science. The second was the joint statement by 58 of academies participating in the Population Summit of the World's Scientific Academies, including the U.S. National Academy of Sciences, the British Royal Society, and the Third World Academy (National Academy of Sciences USA 1993).

The World Scientists' Warning said in part: "Human beings and the natural world are on a collision course. Human activities inflict harsh and often irreversible damage on the environment and on critical resources. If not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about."

Part of the Academies' pronouncement read: "the magnitude of the threat... is linked to human population size and resource use per person. Resource use, waste production and environmental degradation are accelerated by population growth. They are further exacerbated by consumption habits.... With current technologies, present levels of consumption by the developed world are likely to lead to serious negative consequences for all countries.... As human numbers further increase, the potential for irreversible changes of far-reaching magnitude also increases."

These statements recognized that humanity has reached a dangerous turning point in its domination of the planet (Ehrlich and Ehrlich 2008), a view even

more common in the scientific community today (e.g., Hall and Day 2009). The same genius that allowed us to achieve that dominance now must be harnessed if we are to prevent our very success from sealing our doom. We think, with all its warts, *The Bomb* did exactly what we had hoped – alerted people to the importance of environmental issues and brought human numbers into the debate on the human future. It was thus a successful tract, and we're proud of it.

Notes

1. See <http://www.listsofbests.com/list/92/>.
2. See <http://www.humanevents.com/article.php?id=7591>.
3. See http://thinkexist.com/quotation/nature_has_color-coded_groups_of_individuals_so/179145.html.
4. See http://seattlepi.nwsource.com/national/1501ap_sci_warming_scientist.html
For a more technical treatment see Hansen et al., 2008
5. Simon was also instigator of bets on the future of the environment. For those interested in this episode a detailed account with references can be found in Ehrlich and Ehrlich (1996), pp. 100–104.
6. See <http://webdiary.com.au/cms/?q=node/2006>.
7. "Of all things in the world, people are the most precious. Under the leadership of the Communist Party, as long as there are people, every kind of miracle can be performed." (*The Bankruptcy of the Idealist Conception of History*.) <http://www.marxists.org/subject/china/peking-review/PR1975-02c.htm>.
8. Who thought the "ultimate resource" was the human mind.
9. Quoted in *Africa Geographic* 15, no. 7 (August 2007): p. 112.
10. All page references in *The Population Bomb* are to the first edition.

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Have increases in population, affluence and technology worsened human and environmental well-being?

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Abstract

This paper examines whether over the long term, empirical data supports Neo-Malthusian fears that exponential population growth would lead to increasing resource scarcity, and that increases in population, affluence and technology would worsen human and environmental well-being.

It finds that, in fact, global population is no longer growing exponentially. Second, from a historical perspective, food, energy and materials are more affordable today than they have been for much of human history. Third, despite unprecedented growth in population, affluence, consumption and technological change, human well-being has never been higher, and in the last century it advanced whether trends in environmental quality were up or down.

With respect to the environment, however, the record is mixed. Initially, in the rich countries, affluence and technology worsened environmental quality, but eventually they provided the methods and means for cleaning up the environment. As a result, after decades of deterioration, their environment has improved substantially. That is, these countries have undergone an “environmental transition” such that affluence and technology are no longer part of the problem, but are now part of the solution. In general, the world also seems to be on the verge of environmental transitions for cropland and water withdrawals.

Even developing countries have gone through their environmental transitions for access to safer water and sanitation, and leaded gasoline. But these countries have not yet made the transitions for other environmental indicators in many places, although technological diffusion, accompanied by some affluence, has moved them ahead of where developed countries used to be at equivalent levels of development.

If the past is any guide, affluence and technological change are indispensable to ensuring that advances in human well-being continue into the future even as environmental quality improves.

1. Introduction

Concerns about population growth historically revolved around the notion that there may be insufficient arable land, minerals or energy to meet the needs of an exponentially increasing population. Adding to these today are fears that as technologies become more powerful and wealth increases so too would consumption of natural resources, which are further compounded by worries about the wastes discharged to the air, land and water in the course of developing and using these resources. Thus, the fear is that even if we do not run out of resources, we might overwhelm the earth's assimilative capacities. Absent empirical information, it can be plausibly argued that together these factors conspire to increase environmental impacts with potentially disastrous effects on human welfare.

The general skepticism of population growth, economic development, and technology exhibited by many, if not most, environmentalists and Neo-Malthusians – henceforth Neo-Malthusians – is captured by the equation, $I = PAT$, where I is a measure of environmental impact, P is the population, A stands for affluence – a surrogate for per capita production or per capita consumption, often measured in terms of the gross domestic product (GDP) per capita – and T , denoting technology, is a measure of the impact per unit of production or consumption (e.g., Commoner 1972; Ehrlich and Holdren

1971; Ehrlich and Goulder 2007). [Technology, as used here, includes both hardware (e.g., scrubbers, catalytic convertors and carbon adsorption systems) and software technologies (e.g., policies and institutions that govern or modulate human actions and behavior, culture, management techniques, computer programs to track or model environmental quality, and emissions trading) (Ausubel 1991; Goklany 1995).]

According to the IPAT equation, if all else remains the same, an increase in population, affluence or technology would each act as multipliers for environmental impact (Commoner 1972; Ehrlich and Holdren 1971; Ehrlich and Ehrlich 1991; Ehrlich 2008). And as that impact increases, human well-being would necessarily deteriorate.

The IPAT identity has been remarkably influential. It has intuitive appeal because of its apparent simplicity and seeming ability to explain how population, consumption or affluence, and technology can affect human and environmental well-being. It serves, for example, as the “master equation” for the field of industrial ecology (e.g., Graedel and Allenby 1995). One of its versions underpins the Intergovernmental Panel on Climate Change’s emission scenarios that have been used to estimate the amounts and rates of future climate change and its impacts (IPCC 2000, pp. 83–84).

While noting that the IPAT equation is a simplified representation and sometimes acknowledging that the terms on the right hand side are not independent of each other, its formulators have nevertheless used it to support their contention that the human enterprise as currently constituted is unsustainable in the long run, unless the population shrinks, we diminish, if not reverse, “over-consumption” or economic development (particularly in the United States), and apply the precautionary principle to new technologies, which in their view essentially embodies a presumption against further technological change unless the technology involved is proven safe and clean (Ehrlich and Holdren 1971; Ehrlich and Ehrlich 1991; Myers 1997; Raffensperger and Tickner 1999).

Despite recognizing that “benign” technology could reduce some impacts, many Neo-Malthusians argue, to quote Jared Diamond (2005, p.504), it is a mistake to believe that “[t]echnology will solve our problems.” In fact, goes this argument, “All of our current problems are unintended negative consequences of our existing technology. The rapid advances in technology during the 20th century have been creating difficult new problems faster than they have been solving old problems...” Diamond (2005, pp. 505). Ehrlich and co-workers argue that for most important activities, new technology

would bring diminishing returns because as the best resources are used up (e.g. minerals, fossil fuels and farm land), society would increasingly have to turn to marginal or less desirable resources to satisfy demand which would increase energy use and pollution (Ehrlich and Holdren 1971; Ehrlich et al. 1999).

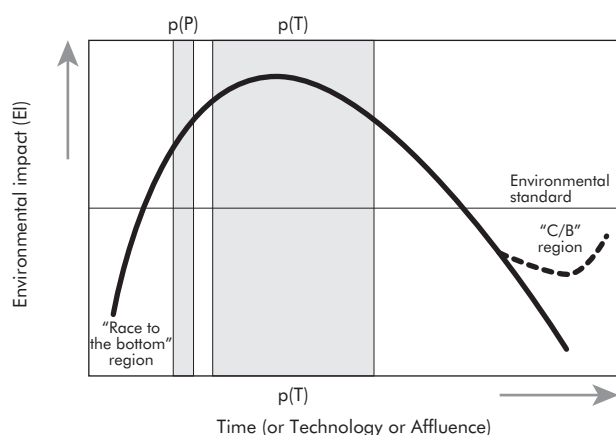
It has also been argued that technological advances could be, and have been, counterproductive. First, such advances can reduce the cost of resource exploitation which, then, increases environmental impacts – for example by using chain saws and bull dozers to create clear cuts of timber. Second, improved technologies can reduce the prices of consumption goods which stimulate greater demand and further increase resource extraction.

There are alternative views of the impact of technological change and economic growth regarding human and environmental well-being. Simon, for instance, argues that economic growth and technological innovation conceived by more abundant brains in a more populated world tend to improve human and environmental well-being (Simon 1995). Others, such as Jesse Ausubel, argue that additional technological change has to be part of the solution, in order to reduce environmental impact, but nevertheless view economic growth as a multiplier of impacts, rather than a contributor to the solution (Ausubel 1998; Landes 1998; Ryan 1999).

In the 1990s, several economists undertook empirical analysis of the relationship between economic growth and environmental impact. Analysing a cross-section of countries, they found that the relationship between per capita GDP and environmental impact followed an inverted “U” shape similar to that identified by Simon Kuznets for income inequality. On the basis of this empirical relationship they posited the environmental Kuznets curve (EKC) hypothesis, which says that as countries grow, the environment first gets worse, then, as they achieve a certain level of development, the damage peaks and begins to improve again (Shafik 1994; Grossman and Krueger 1995).

In the “environmental transition” hypothesis, Goklany (1995, 1998, 2007a) has generalized the EKC hypothesis to attempt to account for both economic development and technological change. Under this hypothesis, initially societies opt for economic and technological development over environmental quality because it allows them to escape from poverty and improve their quality of life by making both needs and wants (e.g. food, education, health, homes, comfort, leisure and material goods) more affordable. But once basic needs are met, over time members of society perceive that environmental deterioration compromises their quality of life and they

Figure 1 **A stylized depiction of the Environmental Transition Hypothesis, a generalization of the Environmental Kuznets Curve**



It shows the evolution of environmental quality – the negative of environmental impact (EI) – as a society evolves from a low to a high level of economic development. The figure assumes that affluence and technology advance with time, which is broadly consistent with historical experience since the start of the Industrial Revolution. NOTE: p(P) = “period of perception,” the period during which the notion that environmental degradation can compromise human well-being gains acceptance; p(T) = “period of transition,” the period over which that perception leads to actions which eventually reduce environmental degradation; “Race to the Bottom Region” (where society strives to increase economic development despite increasing EI); NIMBY Region = “not in my backyard region” (EI enters this region if benefits far exceed costs to beneficiaries); C/B Region = cost/benefit region (where benefits and costs have to be more carefully balanced). Source: Goklany (2007a)

start to address their environmental problems. Being wealthier and having access to greater human capital, they are now better able to afford and employ cleaner technologies. Consequently, environmental deterioration can, first, be halted and, then, reversed. Under this hypothesis, technological change and economic growth may initially be the causes of environmental impacts, but eventually they work together to effect an “environmental transition” – after which they become a necessary part of the solution to environmental problems. Such a transition, if it occurs at all, would be evident as a peak in a stylized curve of environmental impact versus time, assuming that both economic development and technology advance with time. This assumption, while true in general since Malthus’ time, hasn’t always been so, nor is there a guarantee that it will hold for all places at all times in the future. Figure 1 provides a stylized rendition of the environmental transition hypothesis.

In the following, I examine whether long term empirical data support the Neo-Malthusian notion that as

populations increase, become wealthier, and technology advances, we will run out of resources, leading to a deterioration of environmental quality, and human well-being. I inspect trends that typically span several decades, because short term trends can be misleading. My examination, which is illustrative rather than exhaustive, focuses mainly on the U.S. because of the better availability and accessibility of long term data for that country and because it has traveled furthest on the path of economic development of any large economy. In addition, I use global data, where available, and also data from a selection of less developed countries, mainly India and China, in order to compare and contrast their experience with that of the U.S.

With respect to human well-being, although I briefly touch on indicators such as poverty, education, child labor, level of economic development, and economic and social freedom, I will use life expectancy as the major indicator of human well-being. This is consistent with its use as one of the three factors in the United Nations’ original Human Development Indicator (see e.g. UNDP 2008).¹ Some may object to the use of life expectancy as an indicator of human well-being on the grounds that a longer life expectancy does not necessarily translate into better health. While theoretically this may be correct, real world experience shows that as populations live longer they also live more healthily, as evidenced by the fact that the health-adjusted life expectancy, i.e., life expectancy adjusted downward partially to discount life years spent in poor health, is generally higher today than unadjusted life expectancy in times past (Goklany 2007a, p. 40).

Regarding environmental quality, I examine trends in various indicators of humanity’s impacts on land, air and water. Specifically, regarding the impact on land, I use cropland as the major environmental indicator, since conversion of habitat to cropland is generally deemed to be the most significant pressure on species, habitat and ecosystems (see MEA 2005; Goklany 1998, and references therein). With respect to water, I focus on water withdrawals and use because water diversion to meet human needs is generally regarded as the greatest threat to freshwater biodiversity (e.g., IUCN 1999, 2000; Wilson 1992; see also MEA 2005, p. 117). Regarding air and water pollution, the selection of indicators is guided largely by the World Health Organization’s (2002) analysis which estimates that water related diseases, indoor air pollution, and urban outdoor air pollution are the largest environmental contributors to the global mortality and disease burden. I also look at indicators related to climate change, not because it is among the

highest contributors to the global mortality and disease burden – it ranks below the top ten – but because of the current interest in all matters related to global warming (Goklany 2007a, pp. 355–356).

Based on the long term environmental trends, I will estimate both the absolute amount and rate of technological change, assuming the validity of the IPAT identity. This will allow me to verify whether empirical trends support the Neo-Malthusian worldview represented by the IPAT identity that technology makes matters worse for the environment. These estimates also provide an indication of how much credence should be given to estimates of long term future environmental consequences that do not fully account for technological change, as frequently seems to be the case for analyses of the impact of climate change, for instance (e.g., Goklany 2007d). I do not, however, attempt to dissect the factors that may or may not be responsible for changes in affluence and technology.

Note that long term data are unlikely to be homogeneous, and are plagued with numerous uncertainties which increase the further one goes back in time or during periods of unrest, wars and social tensions. Therefore, such data are best used to draw qualitative rather than quantitative conclusions. Also, unless noted otherwise, GDP in this paper is provided in terms of constant 1990 International dollars (adjusted for purchasing power parity, PPP), per Maddison (2003) and GGDC (2008). Finally, note that the analysis presented here draws liberally from, and updates, Goklany (2007a).

Following is a roadmap for this paper.

In Section 2, I examine whether, consistent with Malthusian fears, the population continues to increase exponentially, and whether population growth rates have increased with both affluence and technological change.

In Section 3, I look at the original concern of Malthusians, namely, that greater consumption driven by larger populations, greater affluence and new technologies would make food and non-renewable resources, specifically metals, scarcer. In this section, scarcity is measured by real prices relative to an indicator of income (e.g., wages, disposable income, or GDP per capita).

Section 4 investigates whether greater affluence and consumption of material goods, chemicals and fossil fuels have indeed reduced human well-being, as feared by Neo-Malthusians.

In Section 5, I examine trends in various environmental indicators that represent human impact on land, water, and air to determine whether environmental well-being is, in fact, deteriorating as population, affluence and technology have changed. Sections 5.1 and 5.2

explore trends in land converted to cropland, and in water withdrawal and consumption, respectively. These indicators are proxies for the (inverse) pressures exerted by humanity on terrestrial and freshwater biodiversity. Section 5.3 focuses mainly on trends in water-related diseases, and Section 5.4 on air pollutants. Section 5.5 examines various global warming related trends, specifically trends in carbon dioxide emissions, and in deaths due to extreme weather events, which, it has been suggested may rise due to future warming.

Section 6 provides, for the environmental indicators addressed in the previous section, estimates of technological change, assuming that the IPAT identity is valid.

Section 7 discusses the findings of the preceding analyses, and Section 8 offers some conclusions.

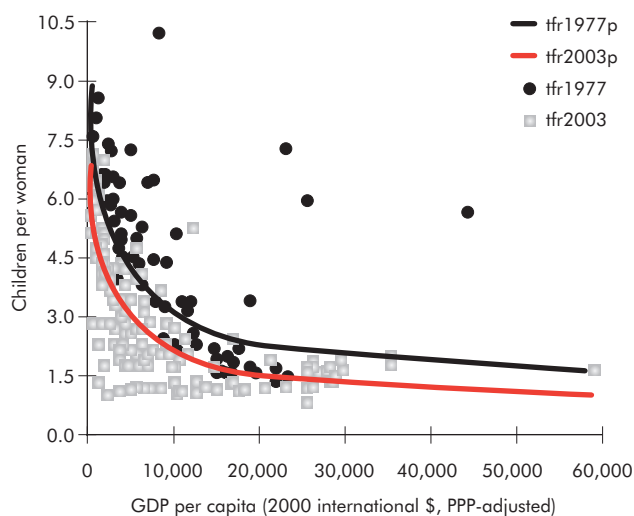
2. Trends in population growth and total fertility rates

The original Neo-Malthusian premise was that population would grow exponentially. Indeed until the latter decades of the 20th century, these concerns seemed well founded, as technological change increased the rate of population growth by reducing mortality rates. However, the rate of population increase has slowed in recent decades. In the five years from 1965 to 1970, the World's population grew by 10.6 per cent. By contrast, the current rate of population growth has fallen to 6.0 per cent every five years and is expected to fall further (UNPD 2007). Accordingly, recent population projections show that population should peak during this century, perhaps at less than 9 billion. Lutz *et al.* (2007) claim that there is a 90 percent probability that global population will not exceed 11.5 billion in 2100.

Nevertheless, while most experts currently discount the possibility of exponential population increase, the notion lingers on in the popular mind (see, e.g., Revkin 2008). This tends to color discussions on environmental matters. In any case, Neo-Malthusians insist that even current population levels may be catastrophic for humanity, with some suggesting that the earth's sustainable limit may be anywhere between 0.5 to 2 billion (Dahl 2005).

The onset of the decline in growth rate was more or less concurrent with mortality rate declines in general, and preceded the appearance of AIDS. The proximate cause is obviously a decline in total fertility rate (TFR), that is, the number of children borne by a woman, which seems to have occurred worldwide, but to a differing extent in each country and culture. What are the underlying causes of the decline in TFR?

Figure 2 **Total fertility rate (TFR) vs. per capita income, 1977–2003**



Source: Goklany (2007a)

Figure 2, based on cross country data from the World Bank (2005), shows that TFR is inversely related to the level of economic development (as measured by GDP per capita) and falls over time (a crude surrogate for technological change).^{2,3} Goklany (2007a, 2007b) argues that the underlying relationships are more complex, with the conditions supporting economic and technological development and, significantly, the desire for such development, also important drivers.

First, since lower poverty – the not-so-surprising consequence of economic growth – means lower infant mortality rates and higher survival rates, it reduces pressures for more births. This is particularly important because children are among the few available forms of insurance in poorer countries, which is one reason why they have the highest TFRs. Richer societies tend to have social security programs which can reduce the pressure for more children. Second, higher incomes mean greater access to technology, which reduces the value of child labor. Third, richer societies offer greater educational and economic opportunities for women, which also increases the opportunity costs of their child bearing and child rearing years. Fourth, the time and cost of educating children to be competitive and productive in a richer and more technologically advanced society encourages small family sizes.

Apart from economic and technological development, factors that contribute to economic growth and the desire for greater wealth can help create conditions that tend to lower TFR. In particular, literacy and the

amount of education, especially of women, helps propagate good habits of diet, nutrition, sanitation and safe drinking water. This improves health and reduces mortality, in general, and infant and maternal mortality, in particular. As noted, this reduces pressures to maximize birth and enables couples to plan the size of their families. At the same time, improved health leads to greater wealth (or economic growth).

Finally, many couples – arguably swayed by commercials and lifestyles depicted by a ubiquitous, globalized and globalizing visual mass media – defer child birth in favor of current consumption (Goklany 2007a).

Together these factors explain why TFR has dropped progressively with both economic development and time. Thus, in the IPAT equation, P is not independent of A and T: sooner or later, as a nation grows richer, its population growth rate falls (e.g., World Bank 1984), which might lead to a cleaner environment (Goklany 1995, 1998, 2007b).

Therefore, while economic development and technological change might initially increase the rate of population growth by reducing mortality rates, in the long run, they moderate population growth by helping directly or indirectly create the conditions for many families to voluntarily opt for fewer children (and lower TFR).

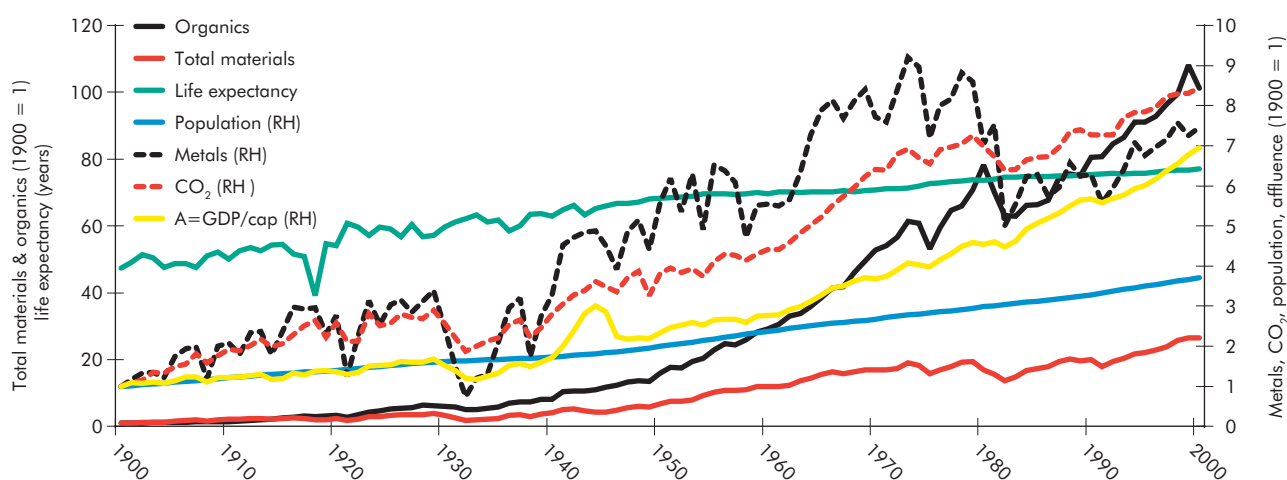
3. Trends in human well-being

Although global population is no longer growing exponentially, it has quadrupled since 1900. Concurrently, affluence (or GDP per capita) has sextupled, global economic product (a measure of aggregate consumption) has increased 23-fold and carbon dioxide has increased over 15-fold (Maddison 2003; GGDC 2008; World Bank 2008a; Marland et al. 2007).⁴ But contrary to Neo-Malthusian fears, average human well-being, measured by any objective indicator, has never been higher.

Food supplies, Malthus' original concern, are up worldwide. Global food supplies per capita increased from 2,254 Cals/day in 1961 to 2,810 in 2003 (FAOSTAT 2008). This helped reduce hunger and malnutrition worldwide. The proportion of the population in the developing world, suffering from chronic hunger declined from 37 percent to 17 percent between 1969–71 and 2001–2003 despite an 87 percent population increase (Goklany 2007a; FAO 2006).

The reduction in hunger and malnutrition, along with improvements in basic hygiene, improved access to safer water and sanitation, broad adoption of vaccinations, antibiotics, pasteurization and other public health

Figure 3 **U.S. material, chemical and energy use, population and affluence compared to life expectancy, 1900–2000**



Source: Adapted from Goklany (2007a), based on Matos (2005), Marland et al. (2005), Maddison (2003)

measures, helped reduce mortality and increase life expectancies. These improvements first became evident in today's developed countries in the mid- to late-1800s and started to spread in earnest to developing countries from the 1950s. The infant mortality rate in developing countries was 180 per 1,000 live births in the early 1950s; today it is 57. Consequently, global life expectancy, perhaps the single most important measure of human well-being, increased from 31 years in 1900 to 47 years in the early 1950s to 67 years today (Goklany 2007a).

Globally, average annual per capita incomes tripled since 1950. The proportion of the world's population outside of high-income OECD countries living in absolute poverty (average consumption of less than \$1 per day in 1985 International dollars adjusted for purchasing power parity), fell from 84 percent in 1820 to 40 percent in 1981 to 20 percent in 2007 (Goklany 2007a; WRI 2008; World Bank 2007).

Equally important, the world is more literate and better educated. Child labor in low income countries declined from 30 to 18 percent between 1960 and 2003. In most countries, people are freer politically, economically and socially to pursue their goals as they see fit. More people choose their own rulers, and have freedom of expression. They are more likely to live under rule of law, and less likely to be arbitrarily deprived of life, limb and property. Social and professional mobility has never been greater. It is easier to transcend the bonds of caste, place, gender, and other accidents of birth in the lottery of life. People work fewer hours, and have more money and better health to

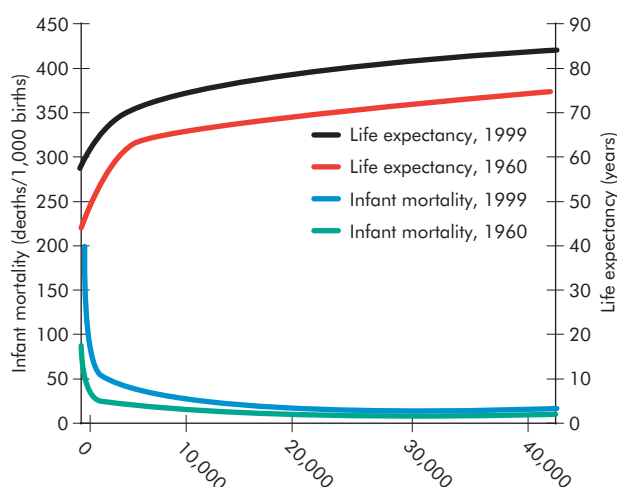
enjoy their leisure time (Goklany 2007a).

Figure 3 summarizes the U.S. experience over the 20th century with respect to growth of population, affluence, material, fossil fuel energy and chemical consumption, and life expectancy. It indicates that population has multiplied 3.7-fold; income, 6.9-fold; carbon dioxide emissions, 8.5-fold; material use, 26.5-fold; and organic chemical use, 101-fold. Yet its life expectancy increased from 47 years to 77 years and infant mortality (not shown) declined from over 100 per 1,000 live births to 7 per 1,000.

It is also important to note that not only are people living longer, they are healthier. The disability rate for seniors declined 28 percent between 1982 and 2004/2005 and, despite better diagnostic tools, major diseases (e.g., cancer, and heart and respiratory diseases) occur 8–11 years later now than a century ago (Fogel 2003; Manton et al. 2006).

If similar figures could be constructed for other countries, most would indicate qualitatively similar trends, especially after 1950, except Sub-Saharan Africa and the erstwhile members of the Soviet Union. In the latter two cases, life expectancy, which had increased following World War II, declined after the late 1980s to the early 2000s, possibly due poor economic performance compounded, especially in Sub-Saharan Africa, by AIDS, resurgence of malaria, and tuberculosis due mainly to poor governance (breakdown of public health services) and other manmade causes (Goklany 2007a, pp.66–69, pp.178–181, and references therein). However, there are

Figure 4 **Life expectancy & infant mortality as a function of economic development and secular technological change, 1960–1999**



Note: MXR = market exchange rates.

Source: Goklany (2007a), based on World Bank (2001)

signs of a turnaround, perhaps related to increased economic growth since the early 2000s, although this could, of course, be a temporary blip (Goklany 2007a; World Bank 2008a).

Notably, in most areas of the world, the health-adjusted life expectancy (HALE), that is, life expectancy adjusted downward for the severity and length of time spent by the average individual in a less-than-healthy condition, is greater now than the unadjusted life expectancy was 30 years ago. HALE for the China and India in 2002, for instance, were 64.1 and 53.5 years, which exceeded their *unadjusted* life expectancy of 63.2 and 50.7 years in 1970–1975 (WRI 2008).

Figure 4, based on cross country data, indicates that contrary to Neo-Malthusian fears, both life expectancy and infant mortality improve with the level of affluence (economic development) and time, a surrogate for technological change (Goklany 2007a). Other indicators of human well-being that improve over time and as affluence rises are: access to safe water and sanitation (see below), literacy, level of education, food supplies per capita, and the prevalence of malnutrition (Goklany 2007a, 2007b).

4. Are food and non-renewable resources becoming scarcer?

Neo-Malthusians are also concerned that as populations

increase and become more affluent, basic resources will become scarcer, and that we may even run out of some. This, of course, was the basis for the famous bet between Paul Ehrlich and Julian Simon over whether the price of a basket of commodities would increase from 1980 to 1990, which the latter won.

However, in the last decade nominal (i.e., current) dollar prices for most commodities – food, energy, minerals and metals – have surged, due to increased demand and expansion of the money supply. In this section I will examine whether and to what extent recent increases have made these commodities less affordable. I will focus on metals, gasoline, and food in a variety of settings.

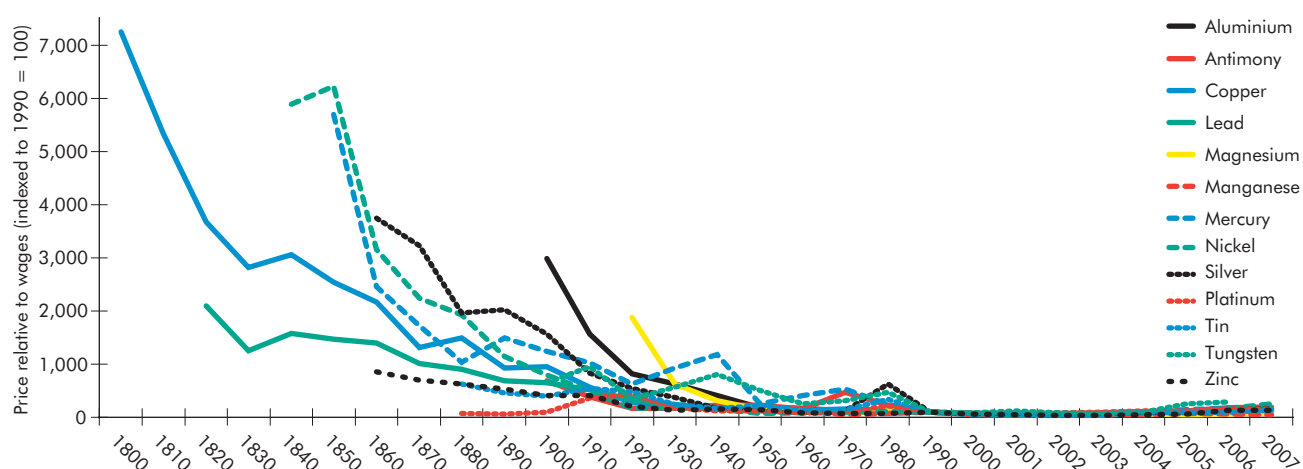
My preferred index of affordability is the ratio of price to an individual's wages or disposable personal income – the lower the ratio, the less affordable the commodity. However, where data on wages and disposable income are not available readily, I will use GDP or GNP per capita.

Metals

Figure 5 shows trends from 1800 to 2007 in the price of thirteen metals for the U.S. relative to wages, indexed to the 1990 level (=100). This indicates that these metals are generally priced higher today than in the 1990s, but not as high as they were in the 1970s and 1980s (except possibly for zinc and nickel). Perhaps more importantly, they are more affordable today than for most of history. Of course, we have no idea whether the current blips will become a long term trend or recede like previous blips in the long slide in prices-relative-to-wages.

Figure 6 shows indices for the nominal and real price of metals from 1900 to 2008. The nominal price index is patched together from Pfaffen-zeller's (2007) index for six metals (aluminum, copper, lead, silver, tin, and zinc) for 1900–2000, and World Bank's (2008c, 2009) metals and minerals price index for the remainder of the period. The real price index is derived from the nominal price index using the BEA (2009) GDP deflator for 1929–2008, and the implicit price index published in U.S. Bureau of the Census (1975: 224) from 1900–1928. Although the indices are patched together using different data sources, there is no escaping the surge in prices since 2001–2002. Even in real terms, the metals price index hasn't been higher since World War I. However, in terms of affordability, estimated as the real GDP per capita divided by the real price, the picture is a little different.

Figure 7 shows that affordability peaked in 2002. It

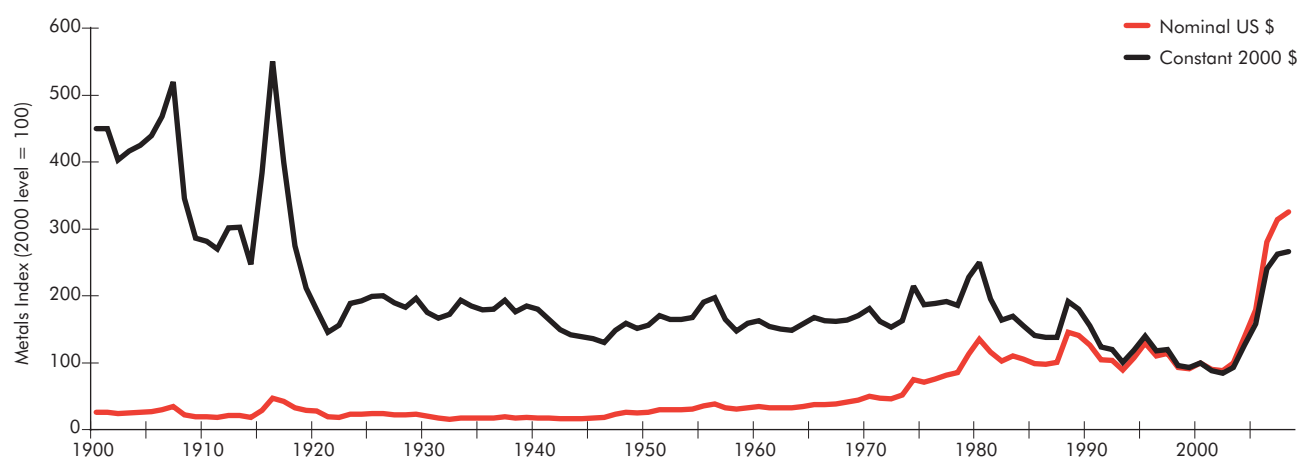
Figure 5 **Metal prices relative to wages, U.S., 1800–2007**

Sources: (1) Data for 1800–1990 are from Moore (1995). (2) Price data from 1990–2007 are from various issues of USGS, *Mineral Commodities Summaries and Minerals Year Books*, available at <http://minerals.usgs.gov/minerals/pubs/commodity/>, visited on July 7, 2008. (3) Wage data for 1990–2007 are from Bureau of Labor Statistics, *Establishment Data: Historical Hours and Earnings*, available at <ftp://ftp.bls.gov/pub/suppl/empsit.ceseeb2.txt>, visited June 27, 2008

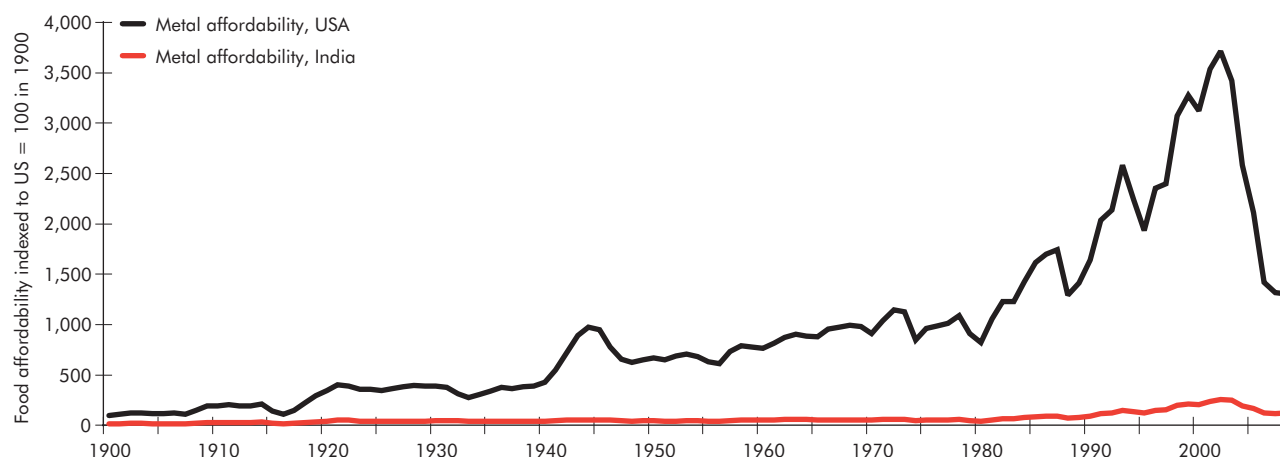
is presently at the 1983–1984 level for the United States, and the 1991–1992 level for India. So, despite recent price run ups due to unprecedented demand, metals are more affordable today than they have been for much of history. For the average Indian, metals are eight times more affordable today than in 1900, and for the average American, they are thirteen times more affordable.

Food

Essentially similar patterns as that for metals are evident for food affordability (see Figure 8, which has been developed using the same sources and methods as that used for the previous figure). Food affordability peaked in 2001 for both the U.S. and India; food is 13 times more affordable today for the average American than it

Figure 6 **Metals commodity indices, 1900–2008**

Sources: (1) Commodity price in nominal dollars is indexed to 100 in 2000. Data are from Pfaffenzeller's (2007) index for metals for 1900–2000, and the World Bank index for minerals and metals for 2001–2008, courtesy of Betty Dow (World Bank 2008c) and World Bank (2009). (2) Constant dollars are based on GDP deflator for the U.S. from 1929–2008 using BEA (2009), and GNP deflator from USBC (1975:224), for 1900–1928

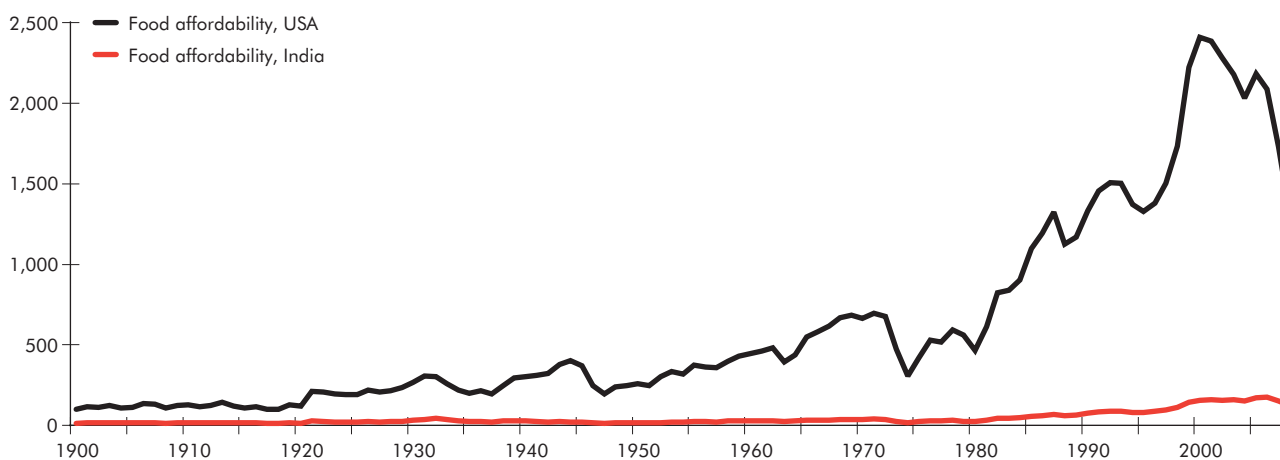
Figure 7 **Metals affordability index, India and U.S., 1900–2008**

Sources: (1) See Figure 5. (2) U.S. and Indian GDP per capita are based on Maddison (2003) for 1900–1980, and GGDC (2008) for 1981–2007. For 2008, U.S. GDP per capita is based on the 2007–2008 growth in GDP per capita from BEA (2009), while Indian GDP per capita is based on a 5 percent growth in GDP per capita from 2007 to 2008 per EIU (2008)

was in 1900, whereas for the average Indian it is 8 times more affordable. This is one factor in the increased availability of food supplies per capita in India, and the long term decline in the proportion of the Indian population suffering from hunger and malnutrition (see Goklany 2007a, p. 22).

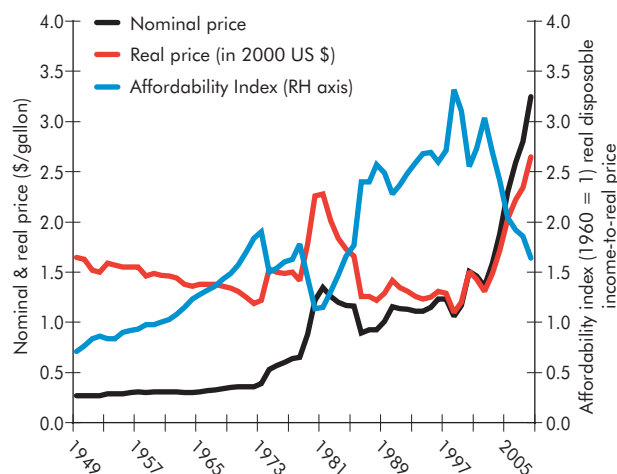
Gasoline in the U.S.

Figure 9 shows from 1949 to mid-2008, the nominal and real price indices for gasoline, and a gasoline affordability index for the U.S., the last calculated as the ratio of the average person's disposable income to the price of gasoline.⁵ This figure, which uses a nominal price of regular gasoline of \$3.25 a gallon in 2008, shows that both the real inflation-adjusted price and the nominal

Figure 8 **Food affordability index, India and U.S., 1900–June 2008**

Sources: (1) Commodity price in nominal dollars is indexed to 100 in 2000. Data are from Pfaffenzeller's (2007) index for metals for 1900–2000, and the World Bank index for minerals and metals for 2001–2008, courtesy of Betty Dow (World Bank 2008c) and World Bank (2009). (2) Constant dollars are based on GDP deflator for the U.S. from 1929–2008 using BEA (2009), and GNP deflator from USBC (1975:224), for 1900–1928

Figure 9 **Gasoline affordability index, 1949–2008, (1960=1)**



The affordability index is calculated as the ratio of per capita disposable income to the price per U.S. gallon of regular gasoline (see text).

Sources: DOE (2009), BEA (2009)

price in 2008 were at the highest they had been since at least 1949.⁶ The gasoline affordability index (indexed to the 1960 level = 1) peaked in 1998 at 3.32. During 2008, averaged over the year, it was at 1.64, a level first reached in 1971 and last seen in 1984.⁷

5. Trends in environmental well-being

In this section I will examine long term trends in various key environmental indicators to establish whether they are consistent with Neo-Malthusian or other views regarding the effect of economic growth and technological change on the environment. I will use the IPAT equation to determine how well changes in impacts (I) track with changes in population (P), affluence (A), and technology (T).

Estimating technological change

In applying the IPAT equation, affluence will be measured by GDP per capita or, if that's unavailable, gross national product (GNP) per capita. For the U.S. the difference between these two measures in any year is slight – on average, within 0.54 percent (with a range from +1.21 to -0.05 percent) for 1929–1997 (Goklany 2007a).

Since A is represented by GDP per capita, the IPAT equation may be rewritten as:

$$I \equiv \text{population} \times (\text{GDP}/\text{population}) \times T \quad \dots (1)$$

Since total consumption – the product of P and A – is equivalent to GDP, the technology-factor (T) can be estimated using:

$$T = I/\text{GDP} \quad \dots (2)$$

Thus, T is equivalent to impact per unit of GDP. Notably, a decline in T would reduce I and denotes an improvement in technology.

The technological change (ΔT) from an initial time (t_i) to final time (t_f) can then be estimated by:

$$\Delta T = \Delta(I/\text{GDP}) \quad \dots (3)$$

If population, affluence, their product (GDP), and the technology-factor are all normalized to unity at t_i , then

$$\Delta T = (I_f/\text{GDP}_f) - 1, \quad \dots (4)$$

where subscript f denotes the value at the end of the period.

Where emissions (E) are used to characterize the environmental impact, technological change is the change in emissions per GDP, that is,

$$\Delta T = \Delta(\text{emissions}/\text{GDP}) = (E_f/\text{GDP}_f) - 1 \quad \dots (5)$$

I will, except where noted, use Equation 4 (or 5) to estimate technological change, and whether that has made matters better or, consistent with the Neo-Malthusian view, worse over the period of analysis. For some indicators, e.g., mortality from extreme weather events (a purported indicator of global warming) or water related diseases, I will substitute P_f for GDP_f ($= P_f \times A_f$) in the above equations on the basis that, *ceteris paribus*, as a first order approximation, mortality increases linearly with P but is relatively insensitive to affluence.

5.1 Cropland or terrestrial habitat conversion

Because cropland is critical for producing the food and nutrition necessary to ward off hunger and malnutrition – still among the largest contributors to global mortality (Goklany 2007a, pp. 355–356) – the first Malthusian concern was that humanity may run out of cropland. Now many are concerned that there may be too much

cropland. In fact, the single largest threat to terrestrial ecosystems and biodiversity is the diversion of habitat to agricultural uses, particularly cropland (Goklany 1998; MEA 2005: 117).

Figure 10 shows trends for the U.S. from 1910 to 2006 in the amount of cropland planted, population (P), affluence (A), GDP ($= P \times A$), as well as two measures of technology, namely, T (calculated as I/GDP) and T' (calculated as I/P). All variables are normalized to 1910.

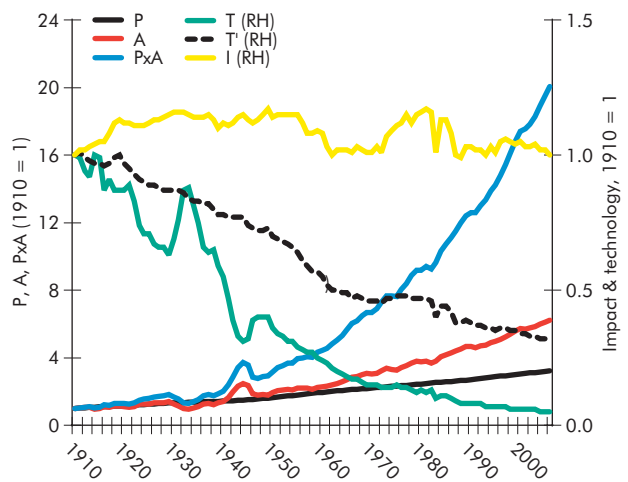
This figure shows that despite a more-than-tripling of the population and a 19-fold increase in consumption (GDP), cropland was unchanged at 330 million acres. That is, the impact as measured by this indicator has not increased, contrary to naïve interpretations of the IPAT equation. This is because the decline in the T-factor has compensated for these increases. T' was at 0.31 in 2006 relative to 1910, i.e., technology reduced the impact by 69 percent over what it would otherwise have been.

Arguably, however, it is more appropriate to use GDP ($= P \times A$) to estimate technology because affluence increases the demand for meat and milk, and the propensity for wastage. Using this measure, T ($= I/\text{GDP}$) stands at 0.05 in 2006 relative to 1910, that is technology reduced impact by 95 percent. Perhaps, the correct measure would be to use the product of population and the logarithm of affluence. Regardless, T and T' bracket the range for technology.

Note that cropland was higher (387 million acres) in both 1949 and 1981 than in 1910 and 2006. The current area of cropland might have been lower still but for subsidies which have partially negated the improvements that technological change might otherwise have achieved. Note, however, that some of the increase in yield that has helped halt land conversion could be due to higher carbon dioxide concentrations (e.g., IPCC 2001, p.254). This is included in the technology term by default.

Figure 11, which shows global trends in cropland from 1700 to 2005, also offers no support for the proposition that increases in population and affluence necessarily increase impacts. In fact, this figure indicates that technological change since 1961 "saved" about 1,300 million hectares from conversion to cropland and that, like in the U.S., cropland may be peaking globally (that is, going through an environmental transition; Goklany 2007a). Whether it actually stabilizes and/or declines consistent with the environmental transition hypothesis depends on the availability, and barriers to, technological change. In this regard, European attitudes toward genetically modified crops, and the diffusion of those attitudes to developing countries, particularly in Africa, retards technological change and are counterproductive, as are

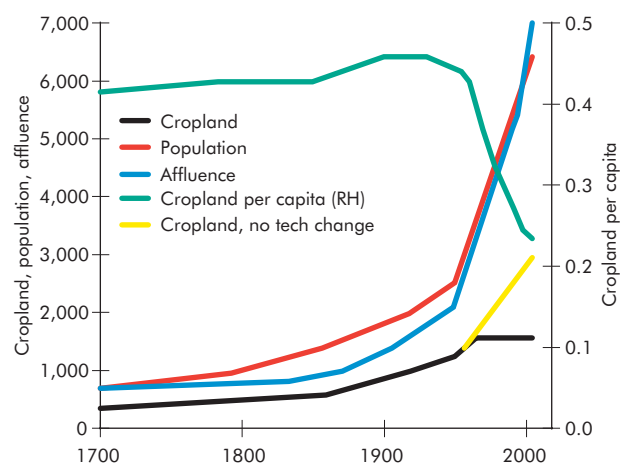
Figure 10 **IPAT for U.S. cropland, 1910–2006**



Sources: GDP and population data are from Maddison (2003), GGDC (2008), World Bank (2008a); cropland data is from ERS (2008)

subsidies in developed countries which keep more land under cultivation (Goklany 2007a).

Figure 11 **Global cropland (in billion hectares), population (in billion people), affluence (in thousands of 1990, PPP-adjusted International\$), and cropland per capita, 1700–2005**



Note that the difference between the dotted and solid blue lines equals the amount of habitat "saved" from conversion had technology been frozen at 1961 levels.

Sources: Goklany (2007a), Maddison (2003), GGDC (2008), FAOSTAT (2008); World Bank (2008a)

5.2 Water withdrawal and consumption

Just as the diversion of land to meet human needs is the single greatest threat to terrestrial biodiversity, so is diversion of water the greatest threat to freshwater biodiversity.

For the United States, over the 50-year period, 1950–2000, the split between surface and ground water withdrawals has stayed more or less constant at 80/20 percent, respectively (Hutton *et al.* 2004). The portion of surface-water withdrawals that was classified as saline increased from 7 to 20 percent between 1950 and 1975. It has since remained approximately constant.

Between 1950 and 1980, while U.S. population increased by 53 percent and, economic consumption by 191 percent, total water withdrawals increased by 144 percent. However, between 1980 and 2000, water withdrawals declined by 7 percent despite increases of 24 and 90 percent in population and economic consumption, respectively (Hutson *et al.* 2004). Moreover, the long term trend of declining total wetland area in the U.S. seems to have halted and even reversed, with 190,000 acres being added between 1998 and 2004 (Dahl 2006).

By contrast with the reduction in water withdrawals in the U.S., data from Shiklomanov (2000) indicates that while water withdrawals and use might be approaching saturation globally, they had not peaked as of 1995, although on a per capita basis, they began to decline in the 1980s. See Figure 12.

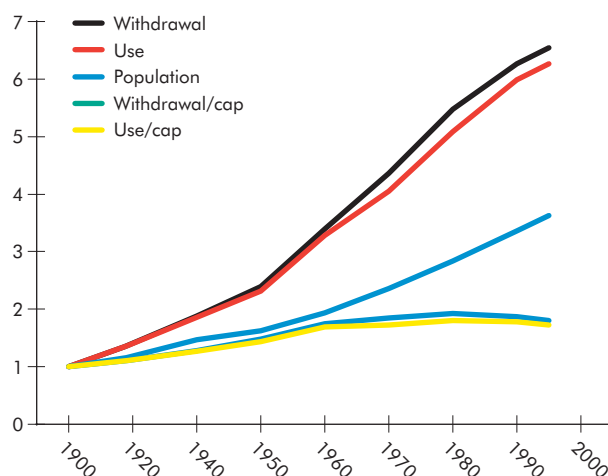
5.3 Water-related impacts

Water has traditionally been high on the list of environmental priorities because of the potential of death and disease from water related diseases. Figure 13 shows that from 1900–1970, U.S. death rates due to various water-related diseases – dysentery, typhoid, paratyphoid, other gastrointestinal disease, and malaria – declined by 99.6 to 100.0 percent (USBC, various years).

These reductions, which preceded the 1972 Clean Water Act, can be attributed to, among other things, greater knowledge of better hygiene, greater access to safe water and sanitation, and new and more effective therapies.

Analysis of cross country data indicates that with economic development and time, access to both safe water and sanitation generally increases in terms of absolute numbers and, more significantly, as a proportion of total population (Goklany 2007a, 2007b). Because of higher levels of economic development and technological

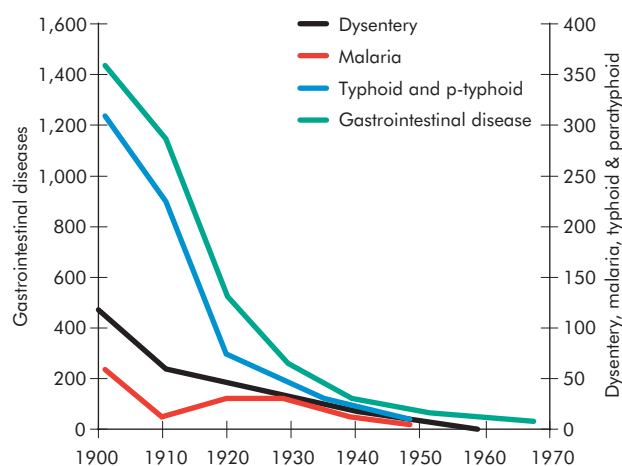
Figure 12 **Global water withdrawals and use, 1900–1995**



Source: Shiklomanov (2000)

diffusion, such access, although not yet universal, has never been higher. Between 1990 and the early 2000s, for example, the proportion of the population with access to safer water increased from 70 to 84 percent in South Asia and 49 to 53 percent in Sub-Saharan Africa, while with regard to sanitation, it increased from 16 to 35 percent in South Asia, and 32 to 36 percent in Sub-Saharan Africa (World Bank 2008b).

Figure 13 **Death rates for various water related diseases, 1900–1970**



Source: Goklany (2007a), based on USBC (various years, 1975)

5.4 Traditional air pollution

Concern over traditional air pollutants – soot, other forms of particulate matter, sulfur dioxide, carbon monoxide and, in some places, ozone – was instrumental in raising environmental consciousness in the U.S. and today's richer countries. Long term data indicates that air quality for these traditional pollutants has generally improved, particularly for the substances – and in the areas – that were of the greatest public health concern (Goklany 2007a). For these countries, long term air quality trends show pronounced peaks that are generally consistent with the environmental transition hypothesis rather than with Neo-Malthusian theories that affluence and technological change make matters worse.

With respect to the U.S., probably a harbinger for other countries, the earliest environmental transitions apparently occurred for indoor air quality (by the 1940s), followed later by improvements in outdoor air quality. This is especially significant because the vast majority of people spend the majority of their time indoors, generally at home. Therefore indoor exposure is perhaps the single most critical determinant of the potential public health impact of air pollution. Remarkably, these improvements in indoor air quality, which were enabled by improvements in technology and greater affluence, occurred voluntarily as households moved away from solid fuels such as coal and wood to cleaner energy sources within the home – oil, gas, electricity.

With respect to U.S. national outdoor air quality as well, the transitions seem to have occurred earlier for pollutants and locations that were of the earliest and greatest concern. They occurred first for total suspended particulate matter (around 1957), followed by sulfur dioxide (early-to-mid 1960s), carbon monoxide (mid-to-late 1960s), lead (mid-to-late 1970s), ozone (mid-to-late 1970s nationally but mid-1950s in California, where it was a major early concern), and finally nitrogen oxides (in the late-1970s). Perhaps surprisingly, many of these transitions also preceded the U.S. Clean Air Act Amendments of 1970.

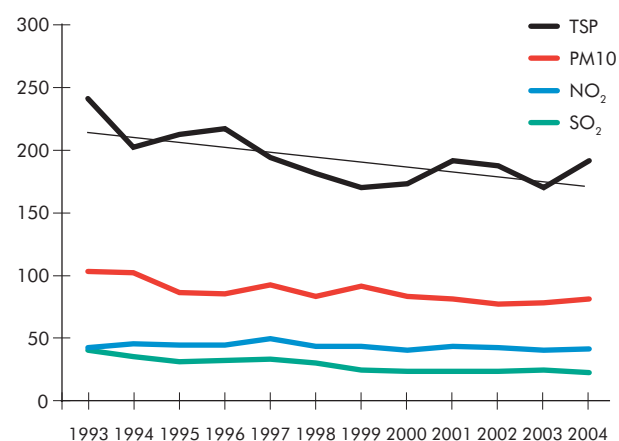
For the traditional air pollutants, trends in emissions (an indicator of less relevance to public health and welfare than either indoor or outdoor air quality), indicate that they too have gone through their environmental transitions in the US.

Notably, air quality in the currently industrializing (or developing) countries is substantially worse than in developed countries. Beijing, Mexico City, New Delhi and Cairo, for instance, are among the most polluted cities in the world. Nevertheless, developing countries

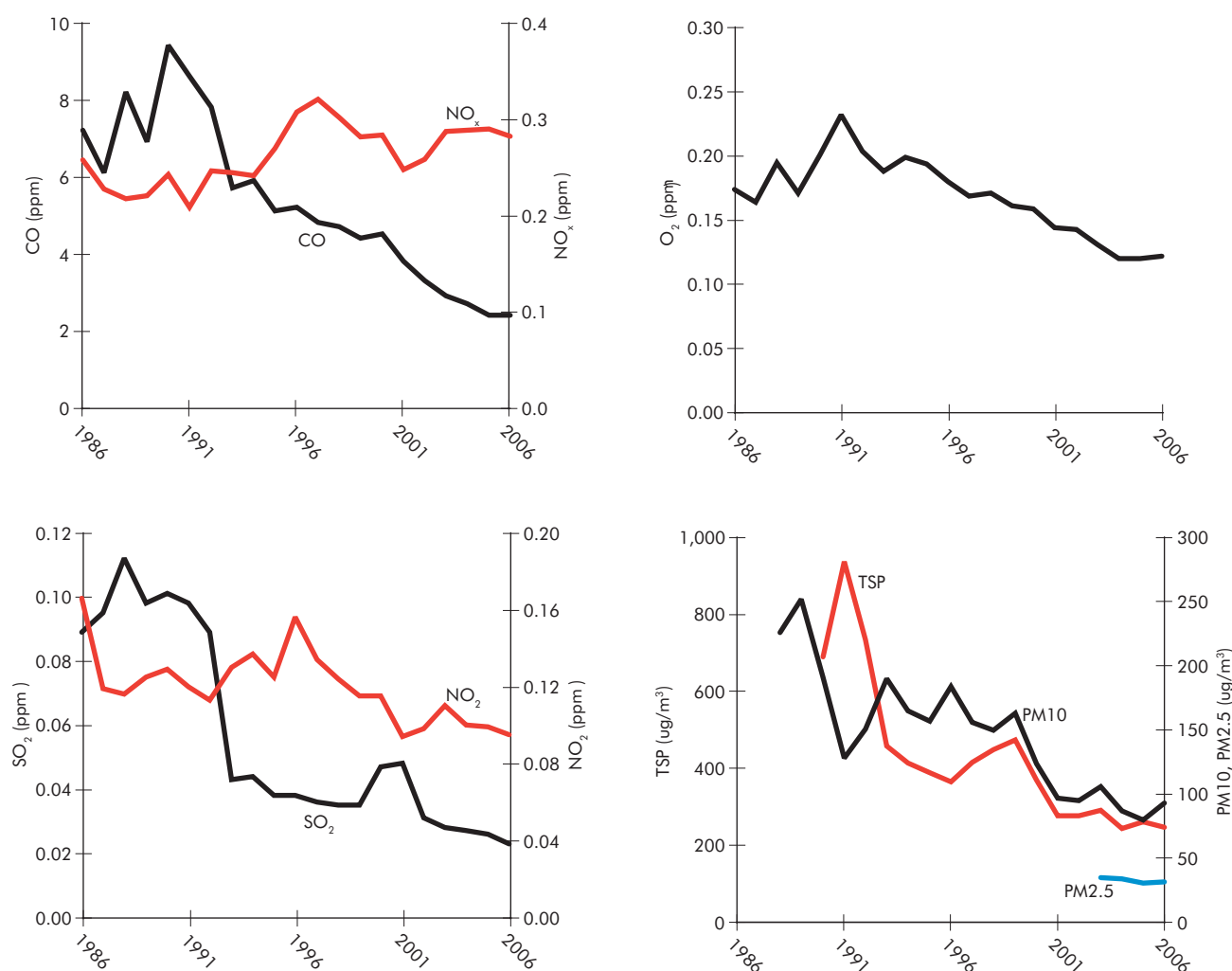
seem to have learnt from the experience of developed countries. In fact, in many respects, they are ahead of where industrialized countries were when they were at the same level of economic development. For example, the U.S. first introduced unleaded gasoline in 1975 when its GDP per capita was \$16,300, whereas India and China instituted some controls for lead-in-gasoline by 1997, when their GDPs per capita were \$1,600 and \$3,000, respectively (Maddison 2003; Goklany 2007a). By 2006, only about 25 countries out of about 200 were using leaded gasoline (Dumitrescu 2005) although the global GDP per capita was about \$7,300. This, of course, is due to the diffusion of knowledge and technology from industrialized to developing countries.

Analysis of air pollution trends from 1993–2004 in twenty Asian cities – Bangkok, Beijing, Busan, Colombo, Dhaka, Delhi, Hanoi, Ho Chi Minh, Hong Kong, Jakarta, Kathmandu, Kolkata, Mumbai, Manila, Seoul, Shanghai, Singapore, Surabaya, Taipei and Tokyo – showed that, in general, TSP and PM-10 decreased between 1993 and 2004, although ambient levels were above limits set by the World Health Organization (Figure 14; CAI-Asia 2006). [Sixteen of the 20 cities are in developing Asia.] For SO₂, levels had been improved to within WHO guidelines. For NO_x, the levels had been stabilized around WHO guidelines. These results are consistent with Hao and Wang's (2005) analysis indicating that despite substantial emission increases, average concentrations in Chinese cities for total suspended particulates, PM-10, and SO₂ declined by 25, 10 and 44 percent, respectively, between 1990 and 2002.⁸

Figure 14 **Air quality trends in 20 major Asian cities, 1993–2004**



Source: CAI-Asia (2006)

Figure 15 **Air quality trends in the Mexico City metropolitan area, 1986–2006**

Source: Molina et al. (2008)

In other words, some areas in Asia have apparently gone through their environmental transitions for a variety of air pollutants, and at lower levels of economic development than in the U.S.

There have been improvements in Latin America as well. Figure 15 shows improvements in Mexico City, legendary for its air pollution, from 1986–2006 (Molina et al. 2008). Similarly, PM-10 concentrations in Brazil's industrial region of Cubatão – among the world's fastest growing industrial areas – declined from 180 to about 80 micrograms per cubic meter from 1984–1998 (Wheeler 2001). Fine particulate matter (PM-2.5) concentrations dropped 52 percent in Santiago, Chile between 1989 and 2001 (Koutrakis et al. 2005).

The major air pollution problems in developing countries are, however, indoors. Half of the world's population continues to use solid fuels such as coal, dung and

wood. The World Health Organization's *Global Burden of Disease 2000 (Version 2)* study estimates that in 2000 air pollution was responsible for 2.4 million premature deaths (or 4.3 percent of all deaths). Two-thirds of these deaths were attributed to indoor pollution from particulate matter in developing countries – from cooking and heating with coal, dung and wood – and the remainder to outdoor air pollution (WHO 2002a, 2002b; Bruce et al. 2000). On the basis of disability-adjusted life years (DALYs), a measure which discounts every year of life lived under a disability by the severity of that disability, indoor air pollution accounts for 2.7 percent of annual lost DALYs worldwide, and outdoor air for 0.5 percent.

If the currently poor inhabitants of less developed countries were to grow richer, they would have the means to switch out of dirty solid fuels and into cleaner established technologies such as natural gas, oil or even

electricity, which would help reduce the disease burden in these countries significantly. It would essentially allow today's developing countries to follow the same path so successfully taken by the rich nations in reducing population exposure to air pollutants. This is essentially the opposite of the claim made by opponents of affluence.

5.5 Global warming

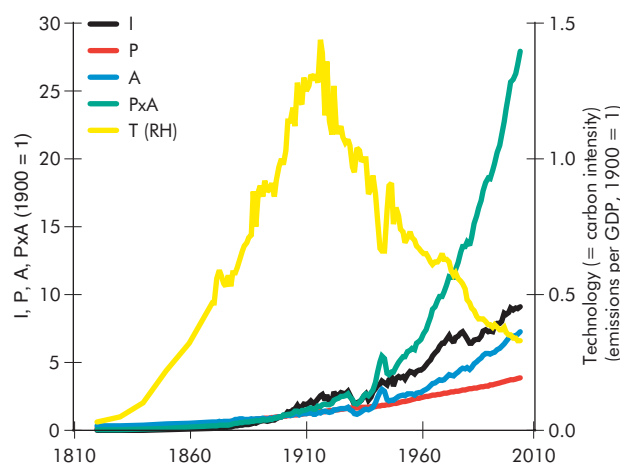
Carbon dioxide

Unlike the other environmental indicators examined thus far, carbon dioxide has only recently been elevated in the popular mind as a significant environmental problem. Arguably, this elevation did not occur until around the late 1990s with the passage of the Kyoto Protocol or even the first decade of the 21st century, with the publication of the IPCC's Third and Fourth Assessment Reports. Even now, some would dispute this characterization, while others would dispute its importance (e.g., Lomborg 2004; Goklany 2005). Efforts to reduce CO₂, therefore, are still immature. This task is further complicated by the socioeconomic consequences of reducing CO₂ emissions (Nordhaus 2008) and the fact that it will necessarily take time, technology and capital to modify existing energy infrastructure. Accordingly, it is no surprise that empirical trends do not indicate that CO₂ has peaked. However, in many places emissions per GDP (or the carbon intensity) have peaked and are falling steeply. Indeed, CO₂ per unit of GDP is a *leading* environmental indicator (because absent a long term sustained reduction in it, a growing economy will be unable to bring about a transition with respect to total emissions; Goklany 2007a).

Figures 16 and 17 show U.S. and global trends from 1820 to 2004 in each of the terms of the IPAT equation and PxA (=GDP), all normalized to 1900 for CO₂. I (i.e., CO₂ emissions), P, A, and PxA are plotted on the left hand axis, and technology (=I/PxA) on the right hand axis.

They show that for the U.S., despite a 27-fold increase in GDP since 1900, CO₂ emissions increased 8-fold. This translates into a 67 percent reduction in impact per unit of consumption (i.e., the T-factor, which is also the carbon intensity of the economy) during this period, or a 1.1 percent reduction per year in the carbon intensity between 1900 and 2004. Since 1950, however, U.S. carbon intensity has declined at an annual rate of 1.7 percent. (Arguably, CO₂ emissions might have been lower, but for the hurdles faced by nuclear power.)

Figure 16 **U.S. IPAT trends for CO₂, 1820–2004**

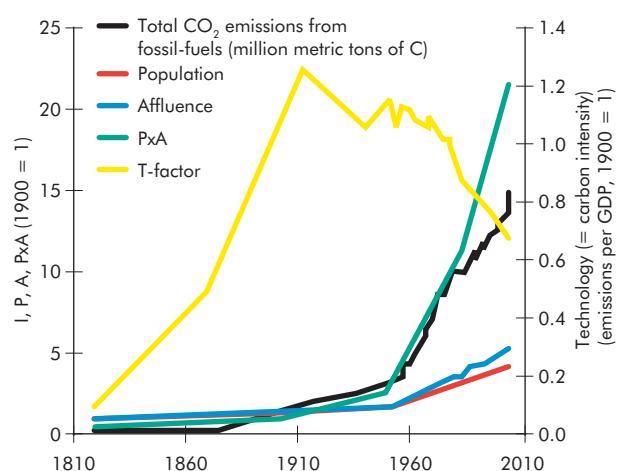


Sources: Marland et al. (2007), Maddison (2003), GGDC (2008)

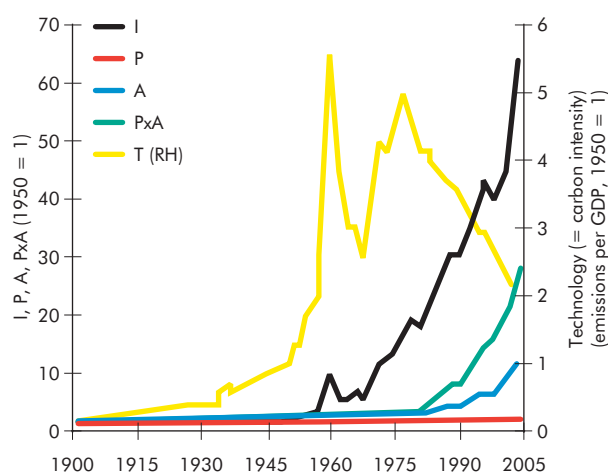
Globally, output increased 21-fold since 1900, while CO₂ increased 13-fold because technology reduced the impact cumulatively by 32 percent or 0.4 percent per year. Both U.S. and global carbon intensity increased until the early decades of the 20th century. Since 1950, global carbon intensity has declined at the rate of 0.9 percent per year.

Figure 18 shows the components of IPAT and PxA for China from 1900–2004, each normalized to 1950 levels. Chinese output increased by a factor of 27 since 1950,

Figure 17 **Global IPAT trends for CO₂, 1820–2004**



Sources: Marland et al. (2007), Maddison (2003), GGDC (2008), World Bank (2008a)

Figure 18 **China IPAT trends for CO₂, 1900–2004**

Sources: Marland *et al.* (2007), Maddison (2003), GGDC (2008)

while CO₂ emissions increased by more than twice as much (a factor of 63), reflecting its rapid transition from a rural agrarian society to the world's manufactory. From 1950 to 2004, improvements in carbon intensity failed

to keep pace with the cumulative output increase. Since 1979, the first year of China's economic reforms, carbon intensity has dropped at an annual rate of 1.3 percent, in part because of the reforms. Nevertheless, this drop has not been large enough to compensate for the tremendous increase in consumption.

Since improvements in technology mostly preceded general recognition of CO₂ as an environmental issue, they can mainly be attributed to "business as usual" where all economic participants seek to maximize private welfare (including profits) via minimization of costs (including energy costs).

Deaths due to extreme events

To the extent that extreme weather events are exacerbated by global warming, deaths due to such events could be an indicator of the impacts of global warming.

Globally, both cumulative mortality and cumulative mortality rate⁹ for all extreme weather events (namely, drought, extreme temperatures, floods, slides, waves and surges, wildfires, and wind storms) have been declining since the 1920s [Goklany (2007c), based on data from

Table 1: **The effects of technological change on declining U.S. and global mortality and mortality rate for extreme weather events during the 20th century**

	Deaths, earliest 10-year period	Deaths, final 10-year period	Death rates, earliest 10-year period (per million)	Death rates, final 10-year period (per million)	Technological change (%), based on mortality rate	Rate of technological change (%/year), based on mortality rate
World all extreme events 1900/09–1997/2006	1,280,000	258,000	78.8	4.17	–95.3	–3.1
U.S. Hurricanes 1900/09–1997/2006	8,730	1,760	11.3	0.60	–94.7	–4.6
U.S. floods 1903/12–1997/2006	260	740	0.31	0.26	–15.8	–0.3
U.S. tornados 1917/26–1997/2006	3,160	620	2.90	0.22	–92.5	–4.1
U.S. Lightning 1959/68–1997/2006	1,180	440	0.63	0.16	–75.4	–2.2

Source: Goklany (2007c), based on EM-DAT (2007) for global mortality data; McEvedy and Jones (1978) for global population; Blake *et al.* (2007) for U.S. hurricanes; NCDC (2005, 2007) and NWS (2007) for U.S. lightning and tornados; HIC (2007) for U.S. floods; USBC (2007) for U.S. population. NOTE: A negative sign indicates that technological change reduces impacts.

EM-DAT (2007)). While older data are necessarily suspect, between 1900–1909 to 1997–2006, mortality apparently dropped by 80 percent and mortality rate by 95 percent, the latter at an annual rate of 4.6 percent (see Table 1). The drops after the 1920s (not shown below) are even steeper (Goklany 2007c).

Table 1 also shows that with regard to the U.S., a similar comparison of the earliest 10-year period to the latest 10-year period (1997–2006) for which data were available at the time of analysis, mortality due to hurricanes, tornados and lightning was reduced by 80, 80 and 63 percent, and mortality *rate* by an annual rate of 4.6, 4.1 and 2.2 percent per year, respectively. However, for floods, mortality increased by 85 percent, but mortality rate declined 16 percent (an annual rate of 0.3 percent).

Note that for each of these U.S. indicators in Table 1, except hurricanes, mortality and mortality rates peaked during the 20th century. For hurricanes the peak occurred in 1900–1909, and was dominated by the 8,000 fatalities due to the 1900 Galveston hurricane, and there was a subsidiary peak during the last period because of the 2005 hurricane season, for which I used a death tally of 1,525 per Blake (2007).

6. Effects of long term technological change on impacts

Table 2 shows for the environmental indicators and areas examined in Section 4, long term changes in environmental impact (I), population (P), affluence (A), their product ($GDP = P \times A$), the technology factor (T), and technological change (ΔT). T and ΔT are calculated using Equations 4 or 5, except for mortality, where population is substituted for GDP.

The entries for each of the components of the IPAT equation are their values at the end of the period of analysis normalized to unity at the beginning of the period. Thus, the first row indicates that in 2006, U.S. population was 3.22-times its 1910 level; affluence, 6.24-times; GDP, 20.08-times. Nevertheless, the environmental impact of U.S. agriculture, measured by the amount of cropland, was essentially unchanged. T, measured by cropland per GDP, was 0.05 times its 1910 level. Hence, the amount of technological change (ΔT) during the intervening period – the percent change in impact per unit of GDP – is minus 95.0 percent (in the second last column). [The *minus* sign indicates that the environmental impact per unit of GDP *declined*, i.e., matters *improved*.] Finally, the last column provides an estimate of the annual rate

of technological change, assuming exponential change (minus 3.1 percent per year).

As with all trends, results displayed in Table 2 can be sensitive to the starting and ending years used for compiling the data, particularly for episodic events, e.g., extreme weather events. To avoid bias, in these cases I used the longest readily available record.

This table indicates that since 1900 affluence has increased faster than population worldwide, and in the U.S., China and India.

Second, but for technological change, impacts would generally have been much higher, in many instances by an order of magnitude or more. For instance, per unit of GDP, technological change reduced the global environmental impact of agriculture by 84 percent from 1950 to 2005. In fact, it has stabilized the amount of habitat converted to cropland in the U.S. and almost stabilized it globally (Figures 10 and 11). During the 20th century, it reduced death rates from various water related diseases in the U.S. by 99.6–100 percent. It also reduced the cumulative global death rate from extreme weather events by 95 percent, while reducing U.S. death rates from hurricanes, lightning, floods and tornados by 16–95 percent. Because of technology, U.S. indoor air pollution levels are currently 96 to 99 (+) percent lower than they otherwise would be. However, while technology reduced the rate of increase, CO₂ emissions, nevertheless, grew substantially.

Third, improvements are apparently more pronounced for indicators most directly related to human well-being. Specifically, for each pollutant, indoor air quality improved earlier and faster than outdoor emissions (which comprise the bulk of emissions), and mortality rates were reduced more than indicators whose relationship to public health is more indirect. With respect to global warming related indicators, mortality rates from total extreme weather events declined substantially, although carbon dioxide emissions increased despite reductions in the carbon intensities of economies. The latter is true even in India and China, where recent improvements in carbon intensities coincide with the initiation of economic liberalization, despite generous fuel subsidies to consumers.

For the environmental indicators used to characterize the impacts on land, air, and water – cropland, indoor air quality, traditional air pollutant emissions, and mortality from water-related diseases – technological change generally more than compensated for any long term increase that might have occurred in impact due to increases in either population or affluence, but not always for the combined effect of the two (i.e., $P \times A$). The exceptions

to this are: (a) U.S. NO_x emissions where technology compensated for population increase between 1900 and 2003, but not for affluence, (b) water withdrawals for the U.S. from 1950–2000, where technology compensated for population but not for affluence, and (c) global water withdrawals and consumption from 1900–1995, where technology failed to keep pace with either population or affluence.

What the table does not show is that even where technology was unable fully to compensate for the increase in aggregate output over the entire period – water withdrawals and national air emissions are cases in point – it moderated impacts so that, by the end of the period, in most cases impacts had peaked and were substantially lower than in previous decades (Goklany 2007a, p. 133).

In general, long term environmental trends have not conformed to the notion that, sooner or later, technology will necessarily increase environmental impacts. Moreover, if one goes sufficiently far back into the historical record, e.g., for habitat converted to cropland, air pollution emissions or water related diseases, the initial trends will show environmental deterioration, seemingly validating the Neo-Malthusian view. But over time this interpretation fails, as the environmental impact is more or less halted (e.g., cropland) or even reversed (air and water pollution) (Goklany 2007a). Such declines lend credence to the environmental transition hypothesis and indicate that, in effect, sooner or later technology no longer acts as a multiplier, but as a divisor for the environmental impact.

7. Discussion

Long term empirical trends offer little support for Neo-Malthusian worldviews. Yes, global population has continued to rise, as has affluence, output and consumption. But metals, food and energy are more affordable today than they have been for much of history. More importantly, human well-being has never been higher. Moreover, population is no longer increasing exponentially. In fact, there are signs that it could plateau, and possibly even decline in the coming decades.

Initially in the arc of development, environmental quality indeed suffered, but by virtually every critical measure – hunger, malnutrition, mortality, education, income, liberty, leisure, material goods, mobility, life expectancy – human well-being advanced. In the U.S., for instance, this advance has been more or less continuous since the 1850s, despite the waxing and waning of a variety of environmental problems in the interim. And

this is also true for the world as a whole, at least since the 1950s (Goklany 2007a).

The improvements in human well-being despite increased population suggest that contrary to Neo-Malthusian claims e.g., Diamond (2005, p. 505), affluence and technology have solved more problems than they have created.

Historically, in the richer countries hunger and water related diseases were conquered first, then indoor air pollution, and finally outdoor air pollution. Once richer countries learned to cope with water related diseases such as cholera and dysentery (through knowledge of basic hygiene, a better understanding of the causes of these diseases, better access to safe water and sanitation, draining of swamps, and so forth), there was little *public* emphasis on other environmental problems. Despite that, *private* actions for the most part cleaned up indoor air pollution. These actions, including voluntary switching to cleaner fuels and installation of more efficient combustion appliances, were enabled by greater prosperity and technological change, and driven by each household's natural desire to advance its own quality of life (Goklany 2007a, pp. 79–100).

Similar economic and behavioral forces were also at work for outdoor air pollution, and the pollution intensity of the economy declined, but not rapidly enough even though, in retrospect, many of the traditional air pollutants were in the midst of, or had even gone through, their environmental transitions (Goklany 2007a, pp. 130–139, 146–151, 191–201). In the U.S., in the wake of the prosperity of the 1960s and early 1970s and once the privations of the Great Depression and World War II had become distant, the clamor for governmental intervention grew. The resulting regulations helped maintain the momentum, although they do not seem to have accelerated, the underlying rate of improvement driven by the imperative of economic efficiency in a relatively free market system, and compounded by the transition from a manufacturing economy to a service and knowledge based economy (Goklany 2007a, pp. 232–234).¹⁰ Consequently, environmental quality is much better now than in previous decades. Carbon dioxide emissions, however, continue to grow. But this is due to the fact that it is a late arrival to society's list of environmental problems – in fact, its importance, given other global problems, is still contested – and, in any case, there's been insufficient time to address it economically (Lomborg 2004; Goklany 2005, 2007a; Nordhaus 2008).

Today's developing countries have been following the path laid down by the early developers. Many of them have lower environmental quality than previously, but

because of the diffusion of technology (which includes knowledge) from developed countries, they are farther along than early trailblazers such as the U.S. at the same level of economic development. For instance, in 2006 when GDP per capita for low income countries was \$1,327, their life expectancy was 60.4 years, a level that the U.S. first reached in 1921, when its GDP per capita was \$5,300. Even Sub-Saharan Africa, the world's developmental laggard, is today ahead of where the U.S. used to be! In 2006, its per capita GDP was at the same level as the U.S. in 1820 but the U.S. did not reach Sub-Saharan Africa's current infant mortality level until 1917, and life expectancy until 1902 (estimated from World Bank 2008a; Maddison 2003, GGDC 2008; USBC 2008).

It can not be overemphasized that despite any environmental deterioration that may have occurred, the well-being of the vast majority of the world's human population has been improving continually over the past several decades, as indicated not only by life expectancy, but by other critical measures of well-being, including poverty, mortality rates, food supplies, education, child labor, and so forth (Goklany 2007a).

Why does reality not mirror Neo-Malthusian concerns?

First, much of the environmental and Neo-Malthusian narrative implicitly or explicitly equates human well-being with environmental well-being. While the latter may be a component of the former, the two aren't the same. Few inside and even fewer outside rich countries would rank environmental indicators among the most important indicators of human well-being,¹¹ except perhaps for access to safe water and sanitation.¹² In fact, the most critical indicators of human well-being – life expectancy, mortality rates, prevalence of hunger and malnutrition, literacy, education, child labor, or poverty – generally improved even during periods when other environmental indicators were deteriorating (e.g., Figure 3), indicating a lack of correlation between the two over the long term. In fact, long term trends are consistent with the environmental transition hypothesis in that in its early stages, economic and technological development is negatively correlated with environmental quality, whereas at high levels of development the correlation is positive (Goklany 2007a).

Second, as already emphasized, population growth has slowed. It is no longer growing exponentially. And affluence and technology have much to do with that (Figure 2).

Neo-Malthusians also overlook the fact that in many respects affluence, technology and human well-being reinforce each other in what has been called the cycle of

progress (Goklany 2007a, pp. 79–97). If existing technologies are not up to the task of reducing impacts or otherwise improving the quality of life, it is possible with wealth and human capital to improve existing technologies or create new ones that will. HIV/AIDS is a case in point.

When HIV/AIDS appeared on the scene, it was totally unanticipated. It was, for practical purposes, a death sentence for those who contracted it. It took the wealth and human capital of the most developed countries to launch a response. Out of this came an understanding of the disease and the development of various therapies. Once among the top ten killers in the U.S., today HIV ranks nineteenth (counting all cancers and cardiovascular diseases as individual categories). From 1995 to 2004, age-adjusted death rates due to HIV declined by over 70 percent (USBC 2008). The rich countries have figured out how to cope with it, and developing countries are benefiting from the technologies that the former were able to develop because they had the necessary economic and human resources, and institutions at their disposal.

Third, both technology and affluence are necessary because while technology provides the methods to reduce environmental problems, affluence provides the means to afford them. In fact, access to HIV therapies in many developing countries is much higher because of wealthy charities and governments of the developed countries (Goklany 2007a, pp. 79–97).

Fourth, there is a secular component to technological change (see Figures 2 and 4), so that it ought to advance even if affluence does not, provided we are open to scientific and technological inquiry. Thus, with secular technological change and the mutually reinforcing advances in economic development, the ability to reduce untoward impacts and enhance the quality of life has also grown rapidly.

These factors acting in concert over the long haul, have enabled technology for the most part to improve faster than either population or affluence and helped keep environmental damage in check (e.g., for cropland) or even reverse it (e.g., for water pollution, and indoor and traditional outdoor air pollution), particularly in the richer countries (see Table 2).

Table 2 also shows that in the long run, technology has often reduced impacts by an order of magnitude or more. Thus, notwithstanding plausible arguments that technological change would eventually increase environmental impacts, historical data suggest that, in fact, technological change *ultimately* reduces impacts, provided technology is not rejected or compromised via subsidies

Table 2: **Changes in population, affluence and technology for various indicators**

Indicator	Area	Period	Population (P)	Affluence(A = GDP/P)	P x A = GDP	Impact (I)	Technology factor (T)	Technological change Total ΔT in % ΔT, in %/year	
LAND (habitat converted to cropland)									
cropland planted	U.S.	1910–2006	3.22	6.24	20.08	1.00	0.050	−95.0	−3.1
cropland	World	1950–2005	2.56	3.32	8.49	1.34	0.157	−84.3	−3.3
cropland	India	1961–2005	2.43	3.19	7.77	1.05	0.136	−86.4	−4.4
cropland	China	1961–2005	1.97	10.44	20.57	1.49	0.072	−92.8	−5.8
WATER WITHDRAWAL & USE									
Water withdrawal	U.S.	1950–2000	1.86	2.97	5.52	2.26	0.403	−59.7	−1.8
Water withdrawal	World	1900–1995	3.16	6.27	19.8	6.54	2.07	107	0.08
Water consumption	World	1900–1995	3.16	6.27	19.8	6.27	1.98	98.5	0.07
WATER (deaths due to water related diseases)*									
Malaria	U.S.	1900–1970	2.68			0.000	0.000	−100	
typhoid and paratyphoid	U.S.	1900–1997	3.73			0.000	0.000	−100	
GI diseases	U.S.	1900–1970	2.68			0.004	0.002	−99.8	−8.6
dysentery	U.S.	1900–1998	3.78			0.014	0.004	−99.6	−5.5
AIR (indoor air pollution; residential emissions per occupied household)									
SO ₂	U.S.	1940–2002	2.17	4.07	8.83	0.02	0.002	−99.8	−9.5
VOC	U.S.	1940–2002	2.17	4.07	8.83	0.14	0.015	−98.5	−6.5
NO _x	U.S.	1940–2002	2.17	4.07	8.83	0.39	0.044	−95.6	−4.9
PM-10	U.S.	1940–2002	2.17	4.07	8.83	0.05	0.006	−99.4	−8.0
CO	U.S.	1940–2002	2.17	4.07	8.83	0.05	0.006	−99.4	−7.9
AIR (national annual emissions)									
SO ₂	U.S.	1900–2003	3.80	7.08	26.93	1.60	0.059	−94.1	−2.7
VOC	U.S.	1900–2003	3.80	7.08	26.93	1.89	0.070	−93.0	−2.5
NO _x	U.S.	1900–2003	3.80	7.08	26.93	7.94	0.295	−70.5	−1.2
PM-10	U.S.	1940–2002	2.17	4.07	8.83	0.29	0.033	−96.7	−5.4
CO	U.S.	1940–2003	2.17	4.07	8.83	1.14	0.127	−87.3	−3.2
Lead	U.S.	1970–2000	1.38	1.89	2.60	0.02	0.007	−99.3	−15.1
GLOBAL WARMING (extreme weather events, deaths, based on 10–year averages)*									
Deaths due to climate-related disasters	World	1900/09– 1997/2006	3.67			0.17	0.047	−95.3	−3.1
Deaths from hurricanes	U.S.	1900/09– 1997/2006	3.44			0.20	0.053	−94.7	−4.6

Indicator	Area	Period	Population (P)	Affluence(A = GDP/P)	P x A = GDP	Impact (I)	Technology factor (T)	Technological change	
								Total ΔT in %	ΔT , in %/year
Deaths from floods	U.S.	1903/12–1997/2006	3.25			2.85	0.842	–15.8	–0.3
Deaths from tornados	U.S.	1917/26–1997/2006	2.65			0.02	0.075	–92.5	–4.1
Deaths from lightning	U.S.	1959/68–1997/2006	1.51			0.37	0.246	–75.4	–2.2

GLOBAL WARMING (carbon dioxide emissions from combustion and industrial sources)

CO ₂	U.S.	1900–2004	3.84	7.28	27.91	9.12	0.327	–67.3	–1.1
CO ₂	U.S.	1950–2004	1.92	3.11	5.99	2.38	0.398	–60.2	–1.7
CO ₂	World	1900–2004	4.06	5.37	21.80	14.81	0.680	–32.0	–0.4
CO ₂	World	1950–2004	2.51	3.21	8.06	4.85	0.602	–39.8	–0.9
CO ₂	China	1950–2004	2.37	11.74	27.81	63.66	2.29	128.9	1.5
CO ₂	China	Since economic liberalization 1979–2004	1.34	5.06	6.76	3.31	0.49	–51.1	–1.3
CO ₂	India	1950–2004	2.97	3.63	10.77	20.16	1.87	87.1	1.2
CO ₂	India	Since economic liberalization 1991–2004	1.24	1.73	2.16	1.84	0.85	–14.8	–1.1

*Death associated with these indicators are expected to increase with population but not with affluence (except through its effect on technology, which is captured in the T-factor). Therefore, the values of A and P x A are not relevant in these cases, and)T = percent reduction in death rates over this period. Deaths due to malaria are from USBC (1954) and Newman et al. (2004).

(which usually flow from the general public to politically favored elements of society).

To summarize, population, affluence and technology are not independent of each other. Moreover, technology is a function of time. Therefore, in the IPAT equation, the dependence of the I term on the P, A and T terms is not fixed. It evolves over time. And the Neo-Malthusian mistake has been to assume that the relationship is fixed, or if it is not, then it changes for the worse.

A corollary to this is that projections of future impacts spanning a few decades but which do not account for technological change as a function of time and affluence, more likely than not, will overestimate impacts, perhaps by orders of magnitude. In fact, this is one reason why many estimates of the future impacts of climate change are suspect, because most do not account for changes in adaptive capacity either due to secular technological change or increases in economic development (IPCC 2007, Figure SPM.2; Goklany 2007d; Reiter 2007; Southgate and Sohngen 2007)).

8. Conclusion

Contrary to Neo-Malthusian fears, population is no longer growing exponentially. Second, from a historical perspective, food, energy and materials are more affordable today than they have been for much of human history. Third, despite unprecedented growth in population, affluence, consumption and technological change, human well-being has never been higher, and in the last century it advanced whether trends in environmental quality were up or down.

These outcomes were all possible because of greater economic and technological development, and, more importantly, the institutions that undergird such development (Goklany 2007a). Together, they steadily improved human well-being over the last century. With respect to the environment, however, their record is mixed. Initially, in the rich countries, they exacerbated environmental problems, but eventually they provided the methods and means for cleaning up the environment.

That is, they went from being part of the problem to becoming part of the solution.

Developing countries, on the other hand, have yet to make that transition for many environmental indicators in many places, although technological diffusion, combined with a little bit of affluence, has allowed them to move ahead of developed countries at equivalent levels of development.

In general, the world seems to have made the environmental transitions for access to safe water and sanitation, and lead in gasoline, and seems to be on the verge of a transition for cropland and water withdrawals.

So much for the past and present; what about the future?

Humanity needs to improve the well-being of the billions in developing countries that still suffer from poverty and poverty-related problems such as hunger, malnutrition, contaminated water, malaria, and other diseases, while, over the next half century, also accommodating an additional three billion people and containing environmental impacts.

However, just as today's population couldn't be sustained and well-being improved with yesterday's technology (Table 2), tomorrow's population cannot be sustained or its well-being advanced with today's technology. Economic and technological development have brought us this far, and they are also necessary to move us forward.

Without them, poverty, and all its consequences, cannot be reduced; the world will have to postpone the transition for cropland; more land and water habitat will be diverted to meet human needs; and we will be in a poorer position to cope with new and unanticipated challenges that the rest of nature may throw our way, including novel or resurgent diseases (such as another AIDS, or worse) or climatic changes.

But neither economic nor technological development is guaranteed. Many policy preferences of some environmentalists and Neo-Malthusians, founded on their skepticism of affluence and technology, would only make progress toward a better quality of life and a more sustainable environment harder. Their fears could become self-fulfilling prophecies. Inkings of this can be seen in their antipathy toward genetically modified crops which delays progress in reducing worldwide hunger and malnutrition even as it postpones an environmental transition for cropland and the development of a more environmentally benign agriculture; in the (fortunately) largely unsuccessful efforts to subordinate human well-being to environmental quality that were used to justify restrictions on the use of DDT for public

health purposes; in their opposition to the development of natural resources even under strict environmental supervision, which reduces supplies and increases prices; in the hostility to energy development whether it is fossil fuels or nuclear, and which legitimizes dubious alternatives such as land and water hungry biofuels, solar farms, and dams; and at their dismay at the development of China and India as they finally raise themselves from a poverty that the richer nations escaped from a century ago (Goklany 2007a; Boqiang 2007).

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Notes

1. The other two indicators are affluence (as measured by GDP per capita), and literacy (or some combined measure for literacy and schooling of education).
2. Goklany (2007b) shows that a similar relationship holds for cross country TFR data for 1960 and 2000 using GDP in constant dollars per market exchange rates (MXR), whereas Figure 1 uses PPP-adjusted GDP.
3. Time series analysis frequently uses time as a crude proxy for technology. See, e.g., Bhattarai and Hammig (2001: 1000), Shafik (1994: 759), Grossman and Krueger (1995: 361), and Goklany (2007b). The broader the definition of technology, the better time serves as a proxy and, as noted in the Introduction, technology is indeed defined broadly in this paper because it includes both hardware and software (including knowledge, institutions and rules of behavior).
4. Time series from these sources were linearly extrapolated to 2008.
5. Figure 8 uses the price of regular leaded gasoline from 1949–1975, the arithmetical average of regular leaded and regular unleaded gasoline for 1976–1990, and regular unleaded for 1991–2008. Nominal gasoline prices are from DOE (2008, 2009). All other economic data are from BEA (2009). Specifically, the real price of gasoline is calculated using the implicit GDP price

- deflator from Tables 1.1.9 for 1949–2008. Real disposable income per capita is from BEA (2009), Table 2.1.
6. However, it should be noted that the price deflator used in calculating the ‘real’ price may not adequately take into account the expansion of the money supply in the past decade.
 7. 2008 saw a very rapid increase in regular unleaded gasoline prices during the first half of the year (from \$3.11 per (U.S.) gallon for the week ending 7 January to \$4.11 for the week ending on 7 July) followed by an unprecedented drop during the remainder of the year. During the week ending 5 January 2009, the price was \$1.68. At its peak (during the week ending July 7, 2008), the U.S. unleaded gasoline price was \$4.11 per gallon, and the affordability index was at 1.35.
 8. Generally the impacts of an air pollutant are more directly related to its concentration in the ambient air rather than the total mass of its emissions. Thus, the pollutant’s outdoor (ambient) concentration, which is measured in terms of the volume or mass of the pollutant in a given volume of air (specified in terms of parts per million, ppm, or micrograms per cubic metre of air, respectively) is a much better indicator of its public health impact than its gross emissions. In recognition of this, the “ambient *air quality* standard” for any pollutant is almost universally specified in terms of ppm or micrograms per cubic metre rather than in terms of the mass of emissions. Consequently, it is possible to improve air quality without reducing overall emissions. This could be achieved, for example, through better dispersal of the pollutant in the air through, for instance, discharging exhaust gases containing emissions into the air via higher chimneys or at high velocities or high temperatures.
 9. Mortality rate is the number of people dying due to extreme weather events divided by the total population exposed to the events.
 10. The improvements due to increasing economic efficiency and the shift from manufacturing to service and knowledge based economies are also reflected in Figures 15 through 17.
 11. The UNDP’s Human Development Index, for instance, is based on three indicators: life expectancy, per capita income and some combined measure of education and literacy (UNDP 2008).
 12. This also helps explain why these environmental problems are among the first to be solved, and why lack of such access trends downwards with economic development (Shafik 2004), indicating that virtually every country has gone past its environmental transition for these indicators (Goklany 2007a).

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Population Growth, Increases in Agricultural Production and Trends in Food Prices

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Abstract

During the second half of the twentieth century, human numbers and food demand grew at an unprecedented pace, yet food supplies increased even faster. Demographic expansion is now slackening, due to dramatic reductions in human fertility in Asia, Latin America, and other parts of the world. However, demand for edible goods will continue to go up, mainly because improved living standards are causing per-capita consumption to rise. To avoid mounting food scarcity, the geographic expansion of agriculture at the expense of forests and other habitats, or both, effective investment in research and development, especially in agricultural biotechnology, is needed so that per-hectare yields can continue increasing.

Since the middle of the twentieth century, food demand has increased at an unprecedented pace. Most of the growth has been demographic, with human numbers rising from 2.47 billion in 1950 to 6.06 billion in 2000 and 6.70 billion today. But living standards have also improved in recent decades – especially in Asia, where more than half the human population resides. As a result, what we eat has changed substantially. For example, fruits and vegetables are now a more important part of the diet than historically. In addition, consumption of livestock products has increased, which has driven up the demand for corn and other feed grains eaten by cattle, pigs, chickens, and other livestock.

However, contrary to predictions of the pessimists, rising numbers and growing appetites have not led to an unmeasured expansion of farmland and pasture. Instead, agricultural yields have increased, thanks to the

Green Revolution and other technological advances. For the world as a whole, per-hectare output of cereals, which account for more than half the food people eat if the grain fed to livestock is factored in, had risen by the late 1990s to 3.0 metric tons, which was double the average yield in the early 1960s (Southgate, Graham, and Tweeten 2007, p. 58). Primarily because of yield growth, food supplies increased faster than food demand throughout this period.

Market trends constitute irrefutable proof that food grew less scarce, not more so, during the second half of the twentieth century. Prices of corn, rice, and other staple grains were 75 percent lower in the middle 1980s than in 1950. Real prices then stayed at low levels for two decades. Most of the three-quarters decline occurred during the Green Revolution, which began in the middle 1960s and lasted for more than 15 years.

The benefits of cheaper food have been far-reaching and profound. Certainly, billions of people around the world who try to subsist on a dollar or two a day have been able to eat better. Also, cheaper food has enabled people to consume more non-food items, thereby stimulating the economic diversification that is intrinsic to economic development. Furthermore, households have been able to save more, which has accelerated investment and economic growth.

However, commodity prices have recently been rising again – and this may continue for some time (though the very high prices of 2008 were probably driven in large part by the excessive supply of money and speculative purchases). One reason is that demand for food is continuing to grow, in large part because of improved living standards and diets. In light of demand growth, greater support for technological improvement, which has been the main reason why food supplies have increased faster than demand, is absolutely essential. Sadly, this support has been sorely lacking for many years. Barring a renewed

commitment to technological improvement, including the widest possible use of agricultural biotechnology, there is little chance that food prices will return to the low levels which were taken for granted just a few years ago. As a result, food insecurity could well worsen south of the Sahara and in other impoverished settings.

Demand trends

To this day, the thinking of many people about changes over time in food demand derives entirely from a simplistic understanding of the demographic analysis of Thomas Robert Malthus (1798/1963). According to this view, total consumption of edible goods is directly proportional to human numbers, which rise exponentially whenever food supplies exceed what people require for bare subsistence.

This view neglects the increases in consumption that coincide with a sustained improvement in living standards, which Malthus acknowledged could happen but did not examine in detail. Also unappreciated is the deceleration in population growth that has happened in recent decades. Understanding this deceleration requires a little knowledge of demographic transition, to which I now turn.

Demographic transition is a feature of modern times, something that began in a few parts of Europe during the 1700s and was under way throughout the world by the middle of the twentieth century. Before the transition, yearly birth rates differed little from yearly death rates and both rates were very high by today's standards, equal to $3\frac{1}{2}$ to 5 percent. Well into the transition, birth and death rates are in line with each other again, though closer to 1 percent per annum.¹

The entire process got under way because death rates fall. That is, the beginning of the transition was marked by an "escape from hunger and premature death," to quote the title of a recent book by Nobel-laureate economist Robert Fogel (2004). With birth rates not declining as rapidly as death rates from pre-transition levels, natural increase was inevitable. As Nicholas Eberstadt, of the American Enterprise Institute, puts it: "Rapid population growth commenced not because human beings suddenly started breeding like rabbits but rather because they stopped dying like flies" (2007, p. 7).

As death rates have fallen, people have chosen to have fewer children. Driving this decline in total fertility rates (i.e., the number of births per woman) has been a number of interrelated trends: improved living standards, urbanization, and a declining infant mortality

(which diminishes a household's need to have an "extra" child or two in order to end up with the desired number of offspring). Nothing affects child-bearing more than female economic empowerment, as indicated by educational attainment and workforce participation. This empowerment raises the opportunity costs of the time that women spend bearing and raising children.

Evidence abounds that a revolution in human fertility has occurred in recent decades. As is widely known, the number of births per woman fell below the replacement rate (about 2.1) in China several years ago and currently stands at 1.8. However, many developing nations have comparable fertility rates, even without anything resembling China's one-child-per-family policy. Among these nations are Chile (2.0 births per woman), Thailand (1.8), Tunisia (2.0), and Vietnam (2.1). The number of births per woman in Eastern Europe and many parts of the Former Soviet Union has fallen to, or even below, numbers on the other side of the old Iron Curtain. There are 1.3 births per woman in Russia and the Czech Republic – indistinguishable from total fertility rates in Germany, Italy, and Spain. Sub-Saharan Africa is the only part of the world where total fertility rates have not declined very much from pre-transition levels; on average, women in the region bear 5.2 children (World Bank 2008).

Even after human fertility has fallen to or below the replacement level, births continue to exceed deaths for a while. This is because the containment of infectious diseases which occurs at the onset of demographic transition creates demographic momentum. To be specific, infants and small children, who in a former age would have succumbed to one communicable illness or another, instead survive. Fifteen or more years later, total fertility rates have declined, but births remain numerous because there are more young people of child-bearing age. As long as human fertility is sustained at the replacement level, demographic momentum gradually dissipates. As this happens, natural increase dwindles to zero.

Demographic trends in Mexico (World Bank 2008) illustrate this general pattern. By the early 1960s, mortality had abated significantly, yet the country's fertility rate (6.9) was close to the pre-transition norm. Death rates remained at very low levels during the next two decades and the number of births per woman fell dramatically, to 4.4 in the early 1980s. Yet the Mexican population grew from 37 to 69 million, largely because of gathering demographic momentum. Today, human numbers, which have reached 105 million, continue to go up, albeit at a much slower pace. Natural increase is not an outcome of elevated fertility. With women only bearing 2.2 children

Table 1: **Increase in food demand, 2000 to 2050**

<i>Scenario</i>	<i>Change</i>
Human population equals 7.87 billion in 2050 and annual growth in per-capita consumption averages 0.4 percent.	59 percent
Human population equals 9.32 billion in 2050 and annual growth in per-capita consumption averages:	
0.2 percent	70
0.3 percent	79
0.4 percent	88
Human population equals 10.93 billion in 2050 and annual growth in per-capita consumption averages 0.2 percent.	99

Source: Southgate, Graham, and Tweeten (2007), p. 33.

on average, births exceed deaths almost entirely because of demographic momentum.

In affluent nations and in quite a few developing countries, the demographic transition is further along than in Mexico. Elsewhere, including in Sub-Saharan Africa, the process is at an earlier stage. However, demographic realities immediately to the south of the United States are broadly representative of realities in the developing world as a whole, which accounted for 80 percent of the increase in the human population during the twentieth century. To summarize, natural increase, which is being driven more and more by demographic momentum as human fertility continues to decline, is decelerating. There is little prospect of the human population doubling in four or five decades, as happened during the second half of the twentieth century (UNEP 2009a).

As population growth decelerates, changes in per-capita consumption resulting from income growth are having a correspondingly greater impact on trends in food demand. Drawing on demographic projections issued by the U.N. Population Division (UNPD) in 2001 and making different assumptions about annual increases in per-capita consumption, Southgate, Graham, and Tweeten (2007) have estimated demand growth during the first half of the twenty-first century. The results are reported in Table 1.

A median forecast of the increase in food demand occurring between 2000 and 2050 is obtained by supposing that human numbers will grow from 6.06 billion to 9.32 billion during this period and that per-capita consumption will rise by 0.3 percent per annum, which is consistent with long-term trends (UNDP 2009b). Note that, with these assumptions, food demand will be four-fifths higher in 2050 than in 2000 even with population growth of 50 percent.

Needless to say, something less than the median

forecast is obtained if per-capita consumption grows a little more slowly. Likewise, demand will be at a higher level in 2050 if human diets improve at a faster pace. To obtain a lower-bound forecast of food demand in 2050, it is appropriate to combine the lowest of the three UNPD demographic projections (7.87 billion) with 0.4 percent annual growth in per-capita consumption. This is because a sharp deceleration in population growth is likely to be observed only if living standards (and therefore female economic empowerment, urbanization, and other factors associated with low fertility) improve dramatically, in which case average food consumption will also go up rapidly. Under this scenario, the global population will reach a peak around the middle of this century and then begin a gradual decline. Yet if this happens, which many people concerned about population growth would regard as ideal, demand growth during the first half of this century will still approach 60 percent.

Food demand will go up more if there is a larger increase in human numbers. As indicated in Table 1, such an increase would probably coincide with slower improvement in human diets. If this happens, food demand in 2050 will be twice the level observed at the turn of the twenty-first century. This represents an upper bound on projected demand.

Trends in supply and prices

As noted earlier, increases in population and food demand were unprecedented during the second half of the twentieth century, when our numbers more than doubled and incomes rose noticeably in Asia and other parts of the developing world. Yet food grew less scarce, not more so, because supplies were increasing at a faster pace.

For some commodities, supply growth was largely a

consequence of increases in cultivated area. For example, plantings of soybeans and other oil crops grew by 94 percent between 1961 and 2001. Likewise, land used to produce fruits and vegetables at the turn of the twenty-first century was nearly double the area used for this purpose four decades earlier. These increases in land use, which coincided with yield growth, were needed to keep up with burgeoning demands for oil crops, fruits, and vegetables, which were in turn an outcome of dietary diversification and other changes resulting from improved living standards (Southgate, Graham, and Tweeten 2007, pp. 53–54).

In contrast, the area planted to cereals in 2001 – 676 million hectares, which represented three-fifths of the 1,114 million hectares planted to non-industrial crops (e.g., cotton and sugar) throughout the world – was less than 5 percent greater than the 648 million hectares used for cereal production in 1961, when 923 million hectares were used to produce non-industrial crops (Southgate, Graham, and Tweeten 2007, pp. 53–54).

Increases in agricultural land use, generally, and in the area sown to grain, specifically, were greatly exceeded by growth in human numbers and food demand. Yet output went up even faster, almost entirely because of yield improvement. In 1961, the global average yield of cereals was a little less than 1.5 tons per hectare – comparable to the level maintained in the United States from the middle 1860s, when the U.S. Department of Agriculture began collecting and publishing nationwide data, through the middle 1930s, when U.S. farmers began raising yields by using inputs such as hybrid seeds and chemical fertilizer. During the next four decades, production per hectare went up steadily. As mentioned in the introduction, the average cereal yield for the world as a whole rose above 3.0 tons at the end of the twentieth century.

For more than fifteen years beginning in the middle 1960s, improvements in cereal yields were concentrated in south and southeast Asia, thanks to the Green Revolution. This advance, which was made possible by agricultural research and testing carried out over many years, thanks to support provided initially by the Rockefeller and Ford Foundations and later by donor agencies such as the World Bank and U.S. Agency for International Development, resulted in new varieties of rice and wheat. These new varieties produced more grain than traditional strains when fertilizer and irrigation water were applied to farm fields (Dalrymple 1985).

The Green Revolution has been closely scrutinized. As it was occurring and even for a few years afterward, concerns were expressed about the impacts on small farmers, who would have suffered economic losses had

they not adopted improved crop varieties and had commodity prices fallen because larger producers were doing so. But this did not occur. To the contrary, small farmers made use of Green Revolution technology about as readily as other growers did. Furthermore, the technological advance was enormously beneficial for landless people in the countryside, who as a rule comprise the poorest segment of the rural population. This is because they found it easier to find employment on the farms of other people and because they could purchase food at lower prices (Dalrymple 1985; Southgate, Graham, and Tweeten 2007, pp. 59–60).

The environmental consequences of the Green Revolution have been criticized. For example, some of the fertilizer and other chemical inputs that farmers have applied to their fields have found their way into rivers, lakes, and streams, thereby causing pollution. In addition, irrigation development has in some places led to the depletion of hydrologic resources. While they do not deny these impacts, Southgate, Graham and Tweeten (2007) point out that much environmental damage is mainly a consequence of misguided policies. The subsidized prices at which agricultural chemicals have been sold, to accelerate the Green Revolution, have caused these inputs to be wasted and misallocated. By the same token, pricing water at a fraction of the cost of delivering this resource to farm fields has created widespread inefficiencies and environmental damage (p. 111).

There is an entirely different complaint about the Green Revolution, which is that it has had very little impact on Sub-Saharan Africa. However, it is difficult to quarrel with the decision four or five decades ago to focus agricultural improvements on staple grains grown under irrigated conditions in Asia. The population of that continent comprised an even larger portion of the human race then than it does today. Moreover, it was the poorest part of the world during the 1960s. Sub-Saharan Africa, where much of the population subsists on root crops, plantains, and other things grown under rain-fed conditions, may be in greater need of a Green Revolution today. But increasing irrigated yields of rice and other staples of Asian diets was considered by many to be the top priority forty years ago.

The varying impacts of the Green Revolution in different parts of the world are indicated in Table 2. Per-capita food production rose by nearly three-quarters in Asia between the early 1960s and the turn of the twenty-first century. Though not as dramatic, the relative improvement in South America was still sizable. In contrast, per-capita production in Africa was 6 percent lower in 1981 than it had been twenty years earlier and

Table 2: **Changes in per-capita food production since the early 1960s**

	As of 1981, %	As of 2001, %
Africa	-6	-10
Asia	+14	+73
South America	+15	+44
World	+12	+26

Source: Southgate, Graham, and Tweeten (2007), p. 67.

the decline continued during the next two decades. The latter continent was the major exception of the global trend during the second half of the twentieth century toward greater availability.

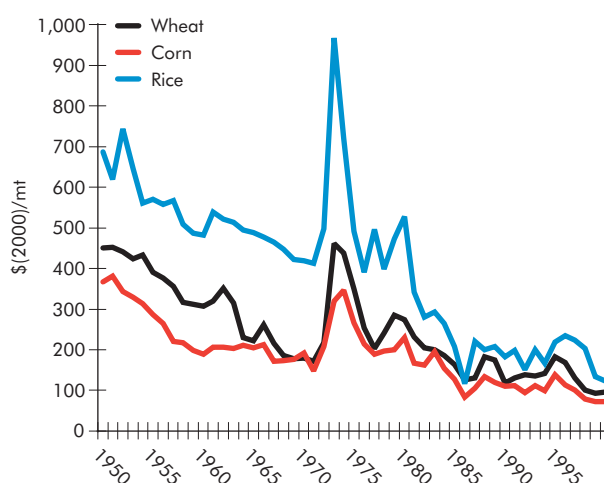
The price adjustments that occurred as grain supplies grew faster than food demand are reported in Figure 1. Much to the benefit of Paul Ehrlich, the Club of Rome, and others who, three or four decades ago, sold a lot of books by predicting imminent food shortages, economic collapse, and related ills, prices of agricultural commodities spiked in the 1970s. However, this was not a result of fundamental shifts in demand and supply. Instead, events in the Soviet Union were largely to blame. Reluctant to cut consumers' supplies of food in the face of poor grain harvests and the expanded feeding of livestock, communist authorities abandoned their long-standing policy against importing grain and increased purchases substantially in international markets. Demand also went up because of increased lending to Latin America and other developing regions, which used a portion of borrowed monies to import more food.

Demand shocks caused prices of wheat, rice, and corn to rise by 100 percent or more in the middle 1970s. However, market values did not stay high for long. After the early 1980s, real prices were back on a long-term declining path. As shown in Figure 1, inflation-adjusted values of staple grains were 75 percent lower in the mid-1980s than in 1950, with most of the decline occurring after the Green Revolution began in the middle 1960s.

Shortly before the recent run-up in prices of agricultural commodities, Southgate, Graham, and Tweeten (2007) assessed the prospects for continuation of the trends reported in Figure 1. They assumed that agricultural land use would not vary appreciably during the twenty-first century and that the yield growth registered since the early 1960s would continue through 2050. They also supposed that any gap of 1 percentage point between demand growth and supply growth would result in a price change of 2 percent, because neither consumption nor production is very sensitive to price changes (p. 87). The results of combining these assumptions with the demand forecasts in Table 1 are presented in Table 3.

If these results are any guide, there is little prospect that real prices of agricultural commodities will continue falling at the pace observed during the second half of the twentieth century. A modest decline – 26 percent over five decades – will occur if the human population rises to 7.87 billion in 2050, even if annual growth in per-capita consumption accelerates from 0.3 to 0.4 percent (Scenario 1). If per-capita consumption continues to increase by 0.3 percent per annum and population rises to 9.32 billion, then inflation-adjusted prices in the middle of this century will be 14 percent greater than in 2000 (Scenario 2). Yet another possibility is faster demographic expansion and slower growth in per-capita consumption. Under these circumstances, real prices in 2050 will be more than 50 percent above their level at the turn of the twenty-first century (Scenario 3).

Southgate, Graham, and Tweeten (2007) caution that their projections depend on continued growth in yields, which is not guaranteed by any means. Particularly worrying, they note, is that support for agricultural research and development, which grew dramatically during the 1960s, 1970s, and 1980s and which made the

Figure 1 **Real prices of rice, wheat, and corn, 1950 to 2000**

Source: Southgate, Graham, and Tweeten (2007), p. 84

Table 3: **Changes in real food prices, 2000 to 2050**

<i>Scenario</i>	<i>Change in real prices, %</i>
(1) Human population equals 7.87 billion in 2050 and annual growth in per-capita consumption averages 0.4 percent.	-26
(2) Human population equals 9.32 billion in 2050 and annual growth in per-capita consumption averages 0.3 percent	+14
(3) Human population equals 10.93 billion in 2050 and annual growth in per-capita consumption averages 0.2 percent.	+54

Green Revolution possible, has not increased in recent years (pp. 64–65). Pardey, Alston and Jones (2008) document that private-sector spending agricultural biotechnology has gone up, almost entirely in the United States and other rich nations. Meanwhile, budgets for agriculture's science and technology base have actually declined in many parts of the world since the 1980s. Since many years typically elapse between scientists' discoveries in the laboratory and farmers' adoption of new technologies made possible by those discoveries, continued growth in agricultural yields has been jeopardized because of declining support for research and development – and opposition to biotech-derived foods.

Alleviating food scarcity

For the first time since the 1970s, prices of agricultural commodities rose by more than 100 percent in just a few months in late 2007 and the first half of 2008. The market value of soybeans, for example, was under \$6/bushel in early 2007 – little changed from what it was two years earlier. A year or so later, soybean prices climbed above \$12/bushel.

Much of this increase was a consequence of monetary expansion in the United States. Taking a comprehensive view, one can say that the monetization of fiscal deficits in the country, which a few years ago caused real estate values to inflate, resulted in 2007 and 2008 in higher prices of food, oil, and other primary commodities.

In addition to macroeconomic imbalances, subsidies to biofuels also contributed to higher prices of agricultural commodities. A much-cited case in point is the conversion of corn into ethanol in the United States. Since the US accounts for a very large share of global exports, the diversion of one-fourth or more of the country's crop has driven up corn prices, not to mention market values of substitute goods. In addition, enhanced competition for land and other agricultural resources has led to higher commodity prices across the board (Schnepf 2008).

Trade restrictions adopted by at least three dozen

exporting nations in the developing world also adversely affected output and increased prices. These restrictions – such as the taxes that the Argentine government imposes on foreign commodity sales – cause resources to be misallocated and international prices to rise excessively.

No doubt, food prices would not have risen as high if monetary authorities in the United States had counteracted inflation more vigorously, if there had been no subsidies for biofuels development, and if free trade were embraced universally, by exporters and importers alike. But as emphasized in this paper, long-term trends in global commodity markets will depend mainly on relative growth in demand and supply.

There is nothing new about rapid demand growth. To repeat, human numbers increased at an unprecedented rate between 1950 and 2000 and diets improved markedly in many parts of the world. Moreover, there is no reason for food supplies to fall behind food demand, provided that all avenues of technological improvement are fully exploited. In part, this involves taking full advantage of agricultural biotechnology.² But a reversal of the trend in recent decades toward ever-lower support for agricultural research and development is also necessary. At the Rome summit, Secretary General Ban advocated a \$30 billion in annual funding.

In the global food economy, recent history yields clear lessons. Agricultural production has more than kept pace with food demand in the past. It can certainly do so again, provided that governments do not stand in the way of free trade and technological progress.

Notes

1. Demographers emphasize that the absence of natural increase (defined as births minus deaths) does not mean that the transition has come to an end. Instead, post-transition equilibrium has not been reached unless the distribution of the population among different age cohorts has stabilized. As Lee (2003) points out, no such stabilization can be observed in any part of the world, including the dozens of countries where there is little or no natural increase. Thus, demographic transition continues to be a ubiquitous phenomenon.
2. Something that governments must do to foster technological improvement in agriculture is not to impose needless restrictions on the genetically-modified (GM) products created thanks to agricultural biotechnology. Sadly, encumbrances of this sort are still being put in place. Just recently, for example, the German government banned GM corn that has been engineered to resist pests (BBC, 14 April 2009). Since corn growers who do not use this variety must instead apply more pesticides, the environmental consequences of this restriction are undoubtedly negative. So are the production impacts.

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Julian Simon and the “Limits to Growth” Neo-Malthusianism

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Abstract

Julian Simon's work on population, environment and technology is best seen against the rise of Neo-Malthusianism in the second half of the 20th century as embodied in the “limits to growth” movement. Simon went beyond criticizing various components of the neo-Malthusian paradigm. His work articulated the elements of a complex alternative social philosophy in which evolution, social exchange, and creativity play pivotal roles. Human creativity enables human beings to be different than the rest of the animal world and to create complex orders based on ideas and exchange. The institutions humans set up allow them to avoid nature's (Malthusian or neo-Malthusian) traps. Consequently the notion that nature puts a clear-cut, limiting condition on growth is a simplistic and misleading premise for public debates and governmental decisions.

By the time of his death in 1998 at age 65, Julian Simon had already established for himself the reputation of “doomslayer”, “one of those people who took on the thankless task of talking sense on a subject where nonsense is all the rage” and of a man “set out to explain what happened in the real world, not what happens in abstract models or popular hysteria” (Sowell 1998). His crusade against the conventional wisdom was featured in the *New York Times*, the *Washington Post* and the *Boston Globe* and he was considered the man who “thoroughly and often single-handedly capsized the prevailing Malthusian orthodoxy” by routing “nearly every prominent environmental scaremonger of our time” and by reframing “the central debate of our time: whether people are good for our planet or not” (Moore 1998).

Whether one agrees with his views or not, an overview of his key arguments is an important step towards a clearer understanding of the intellectual history and significance of one of the most salient and sensitive themes emerging on the public agenda during the second half of the 20th century.

Julian Simon, who wrote on resources, environment, and population (*The Ultimate Resource*, *Population Matters*, *The Economics of Population Growth*, *Population and Development in Poor Countries*) but also on other subjects, including statistics, research methods, and managerial economics (*Basic Research Methods in Social Science*, *Issues in the Economics of Advertising*, *The Management of Advertising*, *Applied Managerial Economics*), often complained that his work never received the recognition it deserved. Yet, contrary to his own belief, his arguments seem to have had an immense impact by any standards. In fact, he was considered “one of the smartest people in Washington” by *The Washingtonian* magazine while *Fortune* magazine listed him among the “150 Great Minds of the 1990s.” His views on population –i.e. that people are resource creators, not resource destroyers– influenced world leaders such as Ronald Reagan and Pope John Paul II and profoundly shaped the public debate on the issue for years to come (Moore 1998). Of the many virtues he possessed, it was his attitude toward truth and facts that impressed most of his contemporaries (Sowell 1998; Moore 1998). There was nothing more irritating to him than “people who know in advance what the truth is”, who “don't need to avail themselves of any ‘facts.’” Telling in this respect is the story of the evolution of his position. He recalled again and again the fact that when he originally got interested in population issues he had “exactly the opposite belief”, a “card-carrying antigrowth, anti-population zealot”. But when he found that “the data did not support that original belief” his thoughts changed. And, he wrote, “I was

not disposed to close my eyes to the evidence because it did not square with my original beliefs. Rather, it was my beliefs that had to change (Simon 1997, xxviii).

Indeed, the best way to approach Simon's work on population, environment and technology is to see it against the background of his dialogue and debate with the ideas inspiring the rise of Neo-Malthusianism in the second half of the 20th century as part of the "limits to growth" movement. This movement, which was a new chapter in the long running dispute between Malthusians and Cornucopians (Desrochers and Hoffbauer, this issue) can be construed as having commenced with the publication of Rachel Carson's *Silent Spring* (1962) and Paul Ehrlich's *Population Bomb* (1968), and, by many accounts, reached maturity with the publication of *The Limits to Growth* (1972) and its success and huge circulation.. With it a new tradition was born. And in this respect it is no exaggeration to say that Simon was one of the key figures that, together with authors such as Herman Kahn, created a critical counter-tradition by reacting systematically to what they considered to be the errors and even fabrications of works like *The Limits to Growth* (1972), *Global 2000* (1980), and *Beyond the Limits* (1992) – works that were pivotal in defining the main tenets of the neo-Malthusian revival. *The Ultimate Resource* (Simon 1981, 1996) and *The Resourceful Earth* (Simon and Kahn 1984) were thoroughly argued and documented reactions to the questions addressed by the "limits to growth" rhetoric advanced in those works. By mirroring that rhetoric and by responding to it, Simon offered not only a different interpretation to the facts but also he positioned himself as an architect of an alternative vision. This paper will outline the main directions of Simon's criticism of the "limits to growth" school of thought as well as some of the key features of the alternative vision he advanced.

The Resourceful Earth

The Resourceful Earth, a work jointly coordinated and designed by Herman Kahn and Julian Simon, is probably the best vehicle to introduce the alternative pro-growth paradigm, advanced as a counter-reaction to the doomsday neo-Malthusian "limits to growth" ideas. To understand its circumstances and significance one should keep in mind that *The Resourceful Earth* was a point-by-point response to the *Global 2000 Report to the President*. *Global 2000* was supposed to be more than a manifesto and alarm bell. President Carter subsequently asked several government agencies to identify solutions

to the problems identified by that Report. Thus *Global 2000* enjoyed a wide circulation and significant policy influence, marking one of the highest tides of the "limits to growth" neo-Malthusian movement.

The difference between *The Resourceful Earth* and *Global 2000* is drastic, and the outline of these differences constitutes one of the best introductions to the two schools of thought. Quite unsurprisingly, the "Major Findings and Conclusions" of *Global 2000* restated the standard themes of the radical environmentalist movement:

"If present trends continue, the world in 2000 will be more crowded, more polluted, less stable ecologically, and more vulnerable to disruption than the world we live in now. Serious stresses involving population, resources, and environment are clearly visible ahead. Despite greater material output, the world's people will be poorer in many ways than they are today. For hundreds of millions of the desperately poor, the outlook for food and other necessities of life will be no better. For many it will be worse. Barring revolutionary advances in technology, life for most people on earth will be more precarious in 2000 than it is now – unless the nations of the world act decisively to alter current trends". (1980, p. 1)

Taking as a reference point precisely these conclusions, Kahn and Simon rewrote this summary in their *Resourceful Earth* from the perspective of their own analysis and conclusions:

"If present trends continue, the world in 2000 will be less crowded (though more populated), less polluted, more stable ecologically, and less vulnerable to resource-supply disruption than the world we live in now. Stresses involving population, resources, and environment will be less in the future than now... The world's people will be richer in most ways than they are today... The outlook for food and other necessities of life will be better ... life for most people on earth will be less precarious economically than it is now". (Simon and Kahn 1984, p. 2)

Overall, *The Resourceful Earth* was an exercise in point-by-point dismantling of the arguments put forth by *Global 2000*. The global famine was just a myth. In fact, the food supply measured by grain prices and production per consumer had constantly grown in the second

half of the century. Land availability was not a problem for world agriculture. Water scarcity or disappearance was not an imminent global danger “although the world and U.S. situations do call for better institutional management through more rational systems of property rights.” Mineral resources scarcity was a pseudo-problem as their availability increased rather than decreased. Threats of air and water pollution and climate change proved to be exaggerated. Life expectancy did in fact rise throughout the world, and that was a symptom of technological and economic progress. Finally, the birth rate in less developed countries did not explode; rather, it fell – a symptom of modernization and of decreasing child mortality. *The Resourceful Earth* concluded that a lack of empirical data, misinterpretations, faulty trend analysis, and sloppy analytics and generalizations abounded in *Global 2000*. Moreover, from the conceptual standpoint, its authors “relied upon the same old discredited Malthusian theorizing that has led one after another of these studies to make forecasts that were soon falsified by events” (Simon and Kahn 1984, p. 2–3).

In brief, *The Resourceful Earth* challenged in the most forceful and profound way the validity of *Global 2000*. The strategy was to follow closely – step by step – the claims made by that report and to rebut them:

“Our conclusions are reassuring, though not grounds for complacency. Global problems due to physical conditions (as distinguished from those caused by institutional and political conditions) are always possible, but are likely to be less pressing in the future than in the past. Environmental, resource, and population stresses are diminishing, and with the passage of time will have less influence than now upon the quality of human life on our planet. ... Because of increases in knowledge, the earth’s “carrying capacity” has been increasing throughout the decades and centuries and millennia to such an extent that the term “carrying capacity” has by now no useful meaning. These trends strongly suggest a progressive improvement and enrichment of the earth’s natural resource base, and of mankind’s lot on earth.” (Simon and Kahn 1984, p. 45)

To sum up, *The Resourceful Earth* challenges the basic assumptions and conclusions of the Presidential Report. But the most important thing to note is that Simon and his associates did more than elaborate a point by point rejection of the main factual claims and projections made by neo-Malthusian doomsayers. In fact they synthesized

in this work the basic elements for an entire theoretical and normative alternative to that offered by the “limits to growth” movement. The foundations of that approach were firmly in place by then in Simon’s 1974 book on the economics of fertility, his 1977 book on the economics of population growth, and, most especially, in his 1981 book, *The Ultimate Resource*. Did Simon’s analysis proceed from his strongly held moral convictions, or did his convictions arise from his analysis? Most probably a parallel process took place in which analysis reinforced moral convictions and moral convictions fueled analysis. He started by developing a line of criticism that focused on the facts and their interpretation but he went beyond that, to the very foundations of the neo-Malthusian paradigm. In doing that, he articulated the core assumptions and concepts of an alternative paradigm – a social philosophy based on evolution, exchange, knowledge production and creativity. A corollary of this effort was Simon’s constant concern with the place of values and principles in arguments about population and economic growth. The rest of the paper will briefly outline these dimensions of his work seen as building blocks of an alternative to the “limits to growth” perspective.

The critique of Neo-Malthusianism and of the “Limits to Growth” logic

One of the main problems with the “limits to growth” movement was in Simon’s view what he called “the lack of historical perspective.” The neo-Malthusian doomsayers, he explained, usually avoid confronting historical experience by saying that their interest is the future rather than the past. But neglect of the past is utterly unscientific. To be valid, science must be based on experience founded on empirical data; all sound theories ultimately derive from experience and must be tested against it. Simon was keen to note that most people do not know the relevant facts about the trends they are talking about. Yet, the state of the present-day situation cannot be comprehended if one has no idea of what the terms of comparison with the past are.

A good example is the problem of the real price of resources, a problem implicit in many neo-Malthusian arguments. The historical reality is that these prices were higher in the past than now. Or to be more precise – and in the spirit of Simon’s approach –, the reality is that, more often than not, the assumption that the prices will be lower over time, and that the longer the time period examined, the more likely that will be the case, has been correct. But to construct and validate

that piece of knowledge requires not only data but also complicated operations like adjusting for inflation. That makes the opinions about resource scarcity susceptible to misinformation because of the difficulty of checking the ongoing rhetoric against the real trends. The lack of historical perspective is revealed also by the practice of extrapolating from conjunctural trends. This is the practice of looking only at a limited time horizon and then extrapolating from a conjunctural or accidental downturn a bleak future. However, if one looks at the long-run historical trends used typically for that purpose, the downturn is "only a blip on the line." Thus, the lack of historical perspective is amplified by the inability to make the distinction between the long run and the short run. Yet, that distinction is crucial for the understanding of trends and global phenomena. For instance, a negative on the short run may be a positive in the long run. What on the short run may look like overpopulation, in the long run may be a condition for a deeper division of labor and consequently for a higher standard of living. The lack of historical perspective leads to the misunderstanding of both the present and the future (Simon 1999, p. 34).

Another conceptual error identified by Simon at the core of the "limits to growth" ideology was the result of a deeply engrained but highly defective way of thinking about resources. More precisely, the tendency to think of resources as given, autonomous of human productive and creative forces, as if they were independent of human action, and impervious to transformation through technology, choice, and inventiveness (Simon 1999). This "closed system" perspective prepares the way to seduction by neo-Malthusian logic. The "limits to growth" discourse about resources and population has been dominated by the concept of fixity or finiteness of resources. In intellectual history terms, one may say that that is a Malthusian notion. But whether these are ideas that defined Malthus' own thought is up for dispute. Most Malthus scholars would probably argue that neo-Malthusianism evolved from some core ideas developed by Malthus but pushed those ideas beyond thresholds that would have been crossed by Malthus himself. Moreover, wrote Simon, the concept of fixity or finiteness of resources is probably an anthropological constant – a way of thinking that comes naturally to humans. Because most of the things humans like, desire, or need are fixed in the short run, this logic becomes a "natural" way of thinking. One additional reason for the bias toward the closeness assumption might be a combination of epistemic and psychological factors. Many people may find it preferable to adopt a closed-system vision because of

"a natural abhorrence of the loose-endedness of an open system" (Simon 1996, p.78–79).

Irrespective of origins, there is a temptation to consider resources in terms of closed systems. From there, a sense of doom and gloom is inevitable. Simon notes, however, that once resources are seen not in isolation but in relationship with humans and as part of an open and dynamic system, the apparent problem dissolves (Simon 1996, p. 71–83). A sound approach to the problem of resources should be framed in terms of open – not closed – systems. The open-system approach implies optimism. Yet the closed-system vision is tempting because it gives the illusion of easy, calculable, and uncontroversial scientific results. As a parenthesis one should note that an excellent example in this respect is the " $I = P \times A \times T$ " equation, i.e. the formalization of the notion that the Human Impact (I) on the environment equals the product of population (P), affluence (A – consumption per capita) and technology (T – environmental impact per unit of consumption). But assessing such "closed-system" models, Simon asked, "Where is the relevant boundary for our material world?" The ontology implied in creation and discovery in a universe populated not only by matter but also by ideas is different from the ontology assumed by the standard neo-Malthusian logic.

Usually the misunderstanding of the nature of resources, wrote Simon, comes hand in hand with a misunderstanding of the demographic basis of economic development. More people create more technical knowledge and, implicitly, more efficient ways of producing, exchanging, and consuming goods and services, such as economic growth. Indeed one may say that Simon took upon himself a crusade to defeat the neo-Malthusian view of the relation between demography, technology and economic growth. One of his main targets was the widely believed idea that new technical knowledge occurs spontaneously. His point was that the link between needs, social conditions, and growth of knowledge is misunderstood or totally neglected. "A larger population is associated with more knowledge and productivity, because there are more potential inventors and adopters of new technology" (Simon 1990, pp. 200–201). But making this argument is not easy because short-run costs seem so obvious, while benefits are long term, and look rather uncertain. A special problem arises from the fact that the increase in knowledge created by more people is nonmaterial and easy to overlook. "Writers about population growth usually mention a greater number of mouths coming into the world, and sometimes note more pairs of hands, but never mention more brains arriving" (Simon 1999, 35–36). His central

theme was that people are the ultimate resource. "Human beings," he wrote, "are not just more mouths to feed, but are productive and inventive minds that help find creative solutions to man's problems, thus leaving us better off over the long run." He challenged the governmental economic and social statistics tendency to treat people as if they are liabilities and not assets: "Every time a calf is born," he observed, "the per capita GDP of a nation rises. Every time a human baby is born, the per capita GDP falls." (Moore 1998).

Another impediment to clear thinking identified and criticized by Simon was a naïve and utopian vision of human nature. More precisely, it was a belief that love and altruism should be the main motivational source of human action, and that family should be considered the ultimate models for all forms of social arrangements. But this mode of social organization cannot work nearly as effectively outside the kinship bonds, when the parent-offspring type of hierarchical relationship does not exist and when the complexity of choices and the uncertainty related to them go beyond a certain threshold. In these circumstances impersonal mechanisms like markets are the best means of social coordination. Nonetheless, many people resist the idea that markets are the best mode of coordination and social distribution. Impersonal markets lack love and caring. For people that stick to the "love and family" view of social order, the idea that impersonal institutional and market forces solve global problems in the long run and do not increase them becomes difficult to accept (Simon 1999, p. 37–39).

That ties in well with a misplaced faith in planning and control. That faith, wrote Simon, usually comes from fear of anarchy in the absence of a strong central authority. The temptation to dismiss these fears as mere atavistic needs for control should be resisted. Fear of anarchy is a very powerful force in social life. Most of the time it is embodied in the dream of organizing an economy through a simple hierarchical system of central planning, in which all the problems are miraculously solved. That is why, argues Simon, the fight against the mirage of central planning starts with understanding the complexity of patterns of social coordination, cooperation, and collective action. Following Hayek (1955), one could better understand how centralized control in society affects social order. Both Hayek's logic and the historical evidence of socialist experiments demonstrated the limits of the central planning and monocentric social systems. Market arrangements, imperfect as they may be, are more functional and better problem solvers. But the arguments that lead to this conclusion are subtle, and difficult to defend, so "it is not surprising that even

well-educated laypersons often have not thought them through and do not understand them" (Simon 1999, pp. 39–40).

The notion of a centrally directed social order brings with it an implicit elitism. Simon rejected the notion that social elites should act as central planners for the less-educated masses who need guidance in their daily lives because they are unable to make sense of the great picture by themselves. He suspected that this implicit assumption fueled the attitude of many intellectuals and educated people. Yet, these people are rarely open enough, while being politically astute enough, to admit to their belief that "trained intellects" should have an assured position of control in society. Their lack of confidence in the abilities of the poor to run their own lives is a function of their own ignorance of daily resourcefulness, creativity, and ingenuity of people in day-to-day business, and that the uneducated and poor "can really create resources by way of creating new ideas". Failing to understand these simple facts betrays a flawed understanding of society and becomes yet another powerful impediment to clear thinking about population and resources issues (Simon 1999, pp. 41).

Among the catalog of errors that facilitate the spread of gloom and doom ideas, Simon identified a set of common fallacies in policy thinking and institutional impact assessment thinking. For instance, although externalities are widely mentioned as a reason of worries and governmental intervention, people have a very limited understanding of the multiple facets of externalities. The unintended by-products of economic activities could be malignant or benign. The unintended consequences principle works both ways. Seen from a different perspective and using alternative standards, a negative externality may appear as a positive one: "humans' activities tend to increase the order and decrease the randomness of nature... . Humans perceive order, and create it." While on the short run an externality may look all bad, on the long run things may look differently. That means that impact assessment is more complicated than and not as straightforward as the common "externality equals bad thing" equation implies (Simon 1999, p. 41).

Simon was among the first to criticize radical environmentalism for basing its conclusions only on arguments that neglected the logic of opportunity costs, trade-offs, and feasibility. In doing that, he inaugurated a tradition of responding to its proponents and their radical solutions with arguments regarding the costs and feasibility of those solutions and by pointing to the possible trade-offs. Cost-benefit, efficacy, efficiency, and effects-assessment become a part of the debate. In addition, a sound

analysis takes into account "not just ... the obvious and immediate effects of an economic event, but also the indirect and long-run effects as well" (Simon 1998, 681–83). In their view, this is the master element in policy analysis. Simon was in agreement with the economist Henry Hazlitt, who considered that the mark of good applied work was to "look not merely at the immediate but at the longer effects of any act or policy" and to "trace the consequences of that policy not merely for one group but for all groups" (Simon 1998, p. 681). Simon used the case of population economics to illustrate this principle. To understand the real dimensions of the phenomenon one needs to "enlarge the time span" not only by "pushing the historical record back to earlier times than are usually adduced in the discussion" but also by lengthening the horizon within which analyses of the future are made. This "enlargement" is an example of the logic at work. The ultimate goal is to understand not only the immediate action factors and their cost-benefit ratio, but also to take into account the "slower-moving yet fundamental forces" that generate them (Simon 1998, pp. 681–82).

A final example of what Simon considered to be major errors at the core of the neo-Malthusians' paradigm was the lack of understanding of the importance of the distinction between local and general, between the dynamics of specific areas and general trends, between global configurations and the accidental. Acknowledging the inevitability of local problems, he emphasized the huge difference between the global situation and local, specific areas and issues. One needs to keep things in perspective and not exaggerate the nature and significance of local mismanagement situations. They are a misleading base for generalizations in any global assessment:

"Sometimes temporary large-scale problems arise. But the nature of the world's physical conditions and the resilience in a well-functioning economic and social system enable us to overcome such problems, and the solutions usually leave us better off than if the problem had never arisen; that is the great lesson to be learned from human history." (Simon and Kahn 1984, p. 4)

Science, values, environmentalism and humanism

Simon was very unhappy with the way the authority of science was used by many environmentalists. In this respect he identified as one of the most common confusions the belief that some value judgments could be

"scientific" (Simon 1996, p. 556). In other words, that science validates normatively specific ideas or propositions. A typical example was the belief that a recommendation such as that some countries have to reduce their population growth could be based purely on rigorous scientific assessment. And indeed, the claim that such judgments-recommendations are fully "scientific" was an important part of the doomsayers' portfolio (Simon 1996, p. 548). Simon observed, however, that the notion of over-population (or under-population) is hardly a scientific concept.

"Science, in the measure it deals with facts and not with values, can hardly decide where there is a case of overpopulation or one of under-population. Science alone does not, and cannot, tell us whether any population size is too large or too small, or whether the growth rate is too fast or too slow... Social and personal decisions about childbearing, immigration, and death inevitably hinge upon values as well as probable economic consequences. And there is necessarily a moral dimension to these decisions over and beyond whatever insights science may yield." (Simon 1981, p. 344)

By implication, population policies and policies in general cannot be based on scientific studies alone. Values play an important part in this type of decision as in all other cases. This raises the question of how those values are incorporated in policy decisions. Are they smuggled in deliberately, do they insert themselves surreptitiously, or are they decided based on an open discussion and a clearly structured decision process? But a more fundamental question is which specific values are relevant for specific situations.

In his ongoing debate with the "limits to growth" rhetoric, Simon drew attention to two values that, while they often pass unnoticed, create in fact the most basic framework of the debate: the value of progress and the value of human life. Both are as important as they are taken for granted. The idea that progress is desirable is based on the belief that people should have greater access to economic opportunity, better health and material goods and in general to a better standard of living (Simon 1996, p. 50, 54). But the value of progress is obviously derived from the value of man. If human beings have no inherently greater value than any other species and thus in the end are axiologically worthless, then their well-being – which is implied in the notion of progress – is a non-issue.

Therefore, even a cursory examination reveals not

only the deepest normative parameters of the debate but also a hierarchy of values. And in this respect the value of humankind plays a top position. Simon identified the normative positioning on the issue of the value of man as one of the most fundamental issues separating his perspective from the “limits to growth” worldview. From his perspective, the environmentalist movement represented a radical turning point in the history of the way the value of humans and human life was seen.

The radicalism of the environmentalist approach could be fully perceived, he explained, only when put in historical perspective. Traditionally the problem of the numbers of the human population and its normative implications was neither a major philosophical or theological issue nor a matter of general concern. The value of humans was defined on parameters other than the quantitative and the demographic ones. Before the 20th century, the biblical precept that people should be “fruitful and multiply” and “have dominion” over nature was the default belief. Neo-Malthusianism changed that. After it, even the utilitarian philosophy of “the greatest good for the greatest number” wasn’t able to stop a new tradition that questioned the value of more people and openly raised the problem in quantitative terms. A radical departure from the tradition that placed man at the center of the universe and the value of human life at the top took place. The neo-Malthusianism of the environmentalist movement reflected in doctrines such as the “deep green philosophy” radically altered the value and place accorded to humanity: “Ecology teaches us that humankind is not the center of life on the planet. Ecology has taught us that the whole earth is part of our ‘body’ and that we must learn to respect it as we respect life – the whales, the seals, the forests, the seas” (Simon 1996, pp. 551–52).

One thus could see a sharp shift in values from one attitude – human centered – to another – nature centered. That transformation took place in less than one century – actually in only a few decades.

Conventionally, in the Western tradition, nature was seen as something created by God for man, that is, nature was instrumental. It was meant to serve people’s needs and to be an arena or context in which people were supposed to exercise the virtues they were endowed with. Understanding nature was a way to understand the glory of God. As a result of the shift, today the perspective has been transformed radically: nature is supreme. People have been relegated to a secondary role when not considered a downright danger or “cancer for nature.” Simon found vivid illustrations of this transformation by going back to old textbooks and comparing them to new ones.

In doing that Simon makes, indeed, a key value judgment: humans have special value. In the past, he stated, “the descriptions of many birds included evaluations of their effects on humanity in general and on farmers in particular; a bird that helped agriculture was more highly valued than a bird which harmed it.” By contrast, the current textbooks “often evaluate humankind for its effect upon the birds rather than vice versa” (Simon 1996, pp. 551–52).

But while that example may be amusing, the transformation was also marked by more troubling changes of perception. A glance at the more fundamentalist environmentalist rhetoric could easily detect not just a change in the hierarchy of values but also a downright attack on humankind. The likening of the human species to cancer and other “virulent diseases” has been legitimized as a common piece of rhetoric: “... the human species, have become a viral epidemic to the earth ... the AIDS of the earth” and thus its extinction “may not only be inevitable, but a good thing.” Simon, quoting Robert Nelson (1991), pointed out an interesting contradiction. “On the one hand, *Homo sapiens* is said to be no different than other species; on the other hand, it is the only species whom the environmentalists ask to protect other species.” That is to say, they attribute to humans a special duty, but no special privilege (Simon 1996, p. 555).

But, in the end, the problem is not that a transformation has taken place and a rearrangement of the value system has been instituted. The real problem is that the new system is incoherent and that in the absence of a minimal consistency, it descends into arbitrary anti-humanism. This is illustrated by a resurgence of the doctrine of “lives that are not worth living.” That is, a return to a tenet of the old eugenics and population control tradition (Simon 1996, p. 553). Eugenics encompasses not only the beliefs that the human race can, and should, be improved by selective breeding but also an implicit concept of lives that are “not worth living.” To be sure, eugenics comes in many guises and varieties: as population control in the poor countries and among poor persons, as a tenet of the Nazi ideology, in policies encouraging reproduction among high-income, high-education groups and discouraging it among others, in Malthusian and neo-Malthusian programs, and in various forms of preemptive eugenics (Simon 1996, p. 554). This identification of a hard core eugenics element touched on one of the deepest and most sensitive points in the debate about the “limits to growth,” population control authors: what is the value of a person’s life? If preemptive eugenics is practiced, what is to be lost? (Simon 1996, pp. 558–62). The problem was reformulated by Paul Ehrlich

as a version of Pascal's Wager: "If population control is undertaken and is successful in preventing births, but it turns out to be unnecessary, then what is lost?" (Ehrlich 1968, pp. 197–98). Once the issue is framed this way, values get a renewed salience because one's answer to Ehrlich's question obviously depends upon one's values. "If you value additional human lives, and some lives are unnecessarily prevented from being lived, that is an obvious loss" (Simon 1996, pp. 561–62).

Simon went further. For him, the Ehrlich argument "boils down to an inverted (or perverted) Golden Rule: do unto others – prevent their existence – what you are glad no one did to you" (Simon 1996, p. 562). Simon's analysis also reveals a structural identity between the eugenics position and the "compassion" shown by special interest groups and legislators when they use the government "to take taxpayers money in order to give it to some other persons or activities whom they think deserving." This is "charity on the cheap" – "doing good without having to sacrifice from your own pocket to pay for it." The "saving the environment," population-control approach seems to be based on the same logic. That is to say that developed to its final conclusion, the argument also reveals something that looks like a deep hypocrisy on behalf of the promoters of preemptive eugenics (irrespective of the way the concept is operationalized in practice: marriage restriction, compulsory sterilization etc.). Sacrificing lives that might be lived and enjoyed "without first showing the way by sacrificing their own lives," which most probably "they would claim are too valuable to be sacrificed," sounds like a hypocritical and immoral position (Simon 1976, p. 562).

It seems that a troublesome egocentrism infuses the attitude and reasons of precisely those who claim to be animated by the most selfless and generous sentiments. Yet, in most cases there is a method in madness. To get its clue it is necessary to look at how the risk factors are perceived and defined by the "limits to growth" authors. It is clear that they see dangers from the unique perspective of their own persons and interests. In the end, the epistemics of risk assessment becomes secondary. Everything is a story about self-preservation and well-being of their own persons (Simon 1996, p. 565). People with that attitude are prepared to sacrifice massive benefits to others in order to reduce low-probability risks to themselves. The fact that doomsayers are prone to make out of proportion risk evaluations, in which the dangers tend to be exaggerated, might not be a problem as long as those exaggerations affect only them. However, the exaggerations affect other groups in ways the doomsayers do not seem to care about. One thing leads to another and an

exaggerated gloomy forecast of natural resources availability may lead to eugenics implications for groups that have nothing to do either with the resources or the evaluation. This lack of proportion in thought, resulting from egocentrism doubled by an incorrect assessment of the trends and the resulting hysteria, were always just steps away from advocating eugenics. The justification that it is good for the unborn not to live, especially if at birth the child will become part of a poor society or underprivileged group, is a very troubling argument because it leads to slippery slopes with all sorts of implications for humanity and life on Earth.

An alternative vision: evolution, social exchange, and creativity

Julian Simon's argument went beyond criticizing various components of the neo-Malthusian paradigm inspiring the "limits to growth" movement. His work articulated the elements of a complex social philosophy in which evolution, social exchange, and creativity play pivotal roles. His starting point was the standard economic history observation that "in two centuries, daily life changed more than in the seven thousand years before" (Mokyr 1990, in Simon 2000). Simon's analysis concentrated on this break with the past starting about 1750 or 1800. For him the study of the leap above the previous centuries and millennia in mortality rate, household consumption level, literacy rate, speeds of travel and communication was the key in understanding not only past social change but also the current "predicament" of the world. The answer to the question of what force(s) caused this "sudden breakthrough" to occur precisely when it did – and not earlier or later in history – is essential.

Elaborating the argument, Simon agreed that the technology level resulting from the accumulation of knowledge played an important part. But what produced the accumulated knowledge? In his view the necessary conditions of change was the total quantity of humanity. Utilization of technology "had to wait on the accumulation of the nexus of human numbers and knowledge." New knowledge doesn't mean automatic progress. New and innovative knowledge "can remain dormant for a long time" if "demographic conditions are not appropriate for its adoption," hence "the gain in knowledge would not necessarily be converted into an increase in progress." "Sudden Modern Progress" depended on "the number of people endowed with intellect and training who lived thereafter, together with the amount of technology in existence at the particular moment" (Simon

2000, pp. 13–14). The technology level and the standard of living would have stayed low if the total population “had remained at the few hundreds of millions that existed at that time” (Simon 2000, p. 21).

Simon takes as an axiom the fact that the historical evidence is unambiguous in showing how in the past, new knowledge, new inventions, and human ingenuity have increased the access to resources, the safety and the comfort of humans. That bolsters the legitimacy of the argument that sees humankind and social order “as part of the long evolutionary chain dating from the simplest plants and animals” – a history of “increasing complexity of construction and greater capacity to deal actively with the environment” (Simon 1996, pp. 74–83). But what if the convergence of various areas of improvement (security, comfort, life expectation, knowledge) is just an accident? Is the improvement trend in social evolution a mere coincidence? Simon realized that a general theory explaining these correlated phenomena would be a decisive argument against an “accidental” explanation. He was confident he had such a theory: the uniting thread was the dynamic relationship between an evolving and adapting social order and the environment. The general theory could be found in applications of evolutionary social theory. Humankind has evolved “sets of rules and patterns of living which are consistent with survival and growth rather than with decline and extinction.” As such, they are “an aspect of the evolutionary selection for survival among past societies.” Specific rules, institutions, and living patterns that increase chances for survival get selected and therefore “the patterns we have inherited constitute a machinery for continued survival and growth” (Simon 1996, pp. 73–75). Among them are uncertainty coping institutions, institutions of coordination and cooperation, institutions that create and manage knowledge, and the institutions of voluntary exchange. “The market system is part of that evolution, of course. But it is not the whole of it” (Simon 1996, pp. 74–75).

In other words, humanity has developed institutions, rules, and patterns of behavior that lead to an increase of available resources. The extension of the resource base and the improvements resulting from that were not the result of accidents but a response to a survival challenge. If that challenge had not been met, either humankind would have stalled in a stationary state or the increase in human population would have led to a crisis and perhaps its extinction. Instead, population growth was accompanied by a growing mastery of nature and its resources. The two reinforced each other and thus, humans managed both to increase both their population and their quality

of life. In this process, human numbers and institutions are key in making knowledge and technology work to create wealth and prosperity.

“One cannot disentangle from human numbers the effects of the human brain and its contents – call it human capital – any more than one can disentangle the effects of the human digestive or procreative anatomy from human numbers. It is a crucial element of the model ... that population growth and density affect the structures of markets, law, tradition, and political institutions. If this had not been so, structures incompatible with an improvement in technology and the long-run standard of living could have remained in place indefinitely, thereby preventing further progress.” (Simon 2000, pp. 17–18)

While knowledge is the driver, the role of institutions and demographics is critical. Institutions create incentives: they may encourage the production of new knowledge or they may hamper it. But the gains of knowledge are not necessarily converted to economic growth. New knowledge “can remain dormant for a long time” if “demographic conditions are not appropriate for its adoption at the time” and if institutions hamper the initiative that would put that knowledge to work for the benefit of the population. “It is not only the human mind and the human spirit that are crucial, but also the framework of society.” In fact, “the political-economic organization of a country has the most influence upon its economic progress” (Simon 1996, p. 588).

Therefore, a double creativity is at work in human history: the creativity of technical inventions and the creativity leading to institutional inventions that shape society in ways that encourage the production and successful application of knowledge. If that perspective is correct, then two main conclusions come forward. The first is that humans should be seen as fundamentally creators rather than destroyers. This propensity toward creative adaptation is spontaneous and intrinsic to humans as social beings. Humans continuously alter the fabric of the universe and of nature, bringing to life new combinations of elements and new things. Our whole evolution up to this point shows that human groups spontaneously evolve patterns of behavior, as well as patterns of training people for that behavior, which tend on balance to lead people to create rather than destroy. Humans are, on balance, builders rather than destroyers. The evidence is clear: the civilization which our ancestors have bequeathed to us contains more created works than the

civilization they were bequeathed. In short, humankind has evolved into creators and problem solvers (Simon 1996, p. 75).

The second conclusion is a corollary of the thesis emphasizing what a distinct and special ontological realm human society is. The complex social order involving language and institutions is the background condition of human creativity and growth of knowledge is the ultimate new thing created by humankind. Social exchange creates, maintains and extends this order. Identifying social exchange as a central principle was a relatively easy task, since that conceptual territory had already been charted by F. A. Hayek (1978) and Simon fully acknowledged his debt and incorporated Hayek's language. Division of labor, comparative advantage and other similar phenomena are all captured by an analytical focus on social exchange: "exchange mechanism evolves everywhere as a way of handling differences in abilities among persons, in order to improve our capacities to construct and create new goods as well as to distribute existing goods" (Simon 1996, pp. 73–83). In a word, social exchange is the fuel and facilitator of human creativity. And thus creativity and social exchange are two elements brought into existence by humankind that if properly taken into account, change the way we understand the universe and our relationship with it. This perspective contains simultaneously a social theory, an anthropology, and a philosophy – all of them in direct contradiction with the social theory, anthropology, and philosophy implied in the views of the "limits to growth" doomsayers. As a social philosophy, Simon's perspective emphasizes the dynamic and creative nature of social order seen as a complex set of problem-solving institutional and social devices growing on an intricate system of social exchange relationships. As an anthropology, it rebuts the view of the average human as destroyer and emphasizes the intrinsic creativity of the human species. Finally, as a social theory it explains why the "constructive patterns of behavior must have been the dominant part of our individual-cum-social nature in order for us to have survived to this point" (Simon 1996, pp. 73–77).

And thus, we have reached the point that allows us to identify one of the major ironies of Simon's views: the human capacity to be creative and to create a distinct ontological realm somehow escapes the evolutionary account of institutional development. Everything is evolution: except human creativity, which enables human beings to be different than the rest of the animal world and to create complex orders based on ideas and exchange. One could easily agree that humans are different, and that their specific difference enables them

to set up institutions that allow them to avoid nature's (Malthusian or neo-Malthusian) traps. However it is difficult not to notice the tension between the argument that the development of the institutions was the product of evolution (not of human planning and control) and the argument that human creativity in technology is the pivotal factor that allows humans to escape those traps.

Conclusions

Julian Simon's criticism of neo-Malthusianism targeted the conceptual, empirical and philosophical flaws of the "limits to growth" paradigm. His critique led him to develop the elements of an alternative paradigm incorporating a radically different vision. And thus, we end up by being confronted with two competing perspectives. On the one hand is the pessimism of neo-Malthusianism. On the other is the confidence that "the nature of the physical world permits continued improvement in humankind's economic lot in the long run, indefinitely". Simon wanted the public to adjudicate between the two based not on emotions and mass media campaigns but on facts and analysis. Whether his view was the correct one was, is and most probably will continue to be a matter of debate. Yet he was convinced that his was a more realistic perspective and that sooner or later people would embrace it. Its appeal was not, however, to utopian optimism. In fact, Simon distanced himself from the charge of "utopian thinking":

"To describe those who believe that the natural resources are available in practically limitless abundance, someone has coined the phrase "cornucopians," to contrast with "doomsdayers." But please notice: The school of thought that I represent here is not cornucopian. I do not believe that nature is limitlessly bountiful. I believe instead that the possibilities in the world are sufficiently great so that with ... human imagination and human enterprise ... we and our descendants can manipulate the elements in such fashion that we can have all ... we need and desire." (Simon 1981, p. 41)

To sum up, Julian Simon strongly believed that the notion that nature puts a clear-cut, limiting condition on growth is a simplistic and misleading premise for public debates and governmental decisions. He was convinced that both facts and theory were on his side. But ultimately his views were rooted in deep moral convictions. Simon was always eager to denounce the anti-humanism

of those who think “that additional poor persons in this generation do make others poorer in this and future generations,” that human lives matter less than lives of animals or that humans are the cancer of the Earth. But more than anything, he wanted to demonstrate that altruism is not the monopoly of any particular political economic philosophy and that staunch supporters of free markets, like himself, are true altruists. Simon took pride in his own altruism, a “cosmopolitan view of human beings”: “The lives of people of other countries, ethnicities, and religions matter to me”, he wrote, “irrespective of the fates of the groups to which they belong. I take pride and pleasure in the human race (...)” (Simon 1996, p. 558).

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Land Conflict and Genocide in Rwanda

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Abstract

In his 2005 best-selling book *Collapse*, Jared Diamond argues that some societies “choose to fail or succeed.” Diamond contends that when populations rise, some societies overuse resources which, in turn, leads to environmental degradation and, ultimately, social collapse. One of the cases he explores in his book is the 1994 genocide in Rwanda, which he calls a modern day Malthusian crisis. However, the arguments he employs to explain why Rwandan society was unable to peacefully and effectively manage rising population pressures overlook a host of political factors that limited the ability of people to respond to increased competition for land in pre-genocide Rwanda. In particular, by focusing on land-related conflict Diamond overlooks factors that kept Rwandans on rural land: lack of a formal land market that would allow people to sell land and move to more urbanized areas, government policies that limited the movement of citizens from the countryside to urban centers, tightly controlled markets that limited entrepreneurial opportunities for people who might wish to leave farms, and a general pro-rural ideology imposed by the pre-genocide Habyarimana government. Unlike citizens in many other densely populated countries such as Belgium, Hong Kong, and Singapore, Rwandans had only limited freedom to deal with rising population pressures. While land conflict was an important feature of pre-genocide Rwanda it was not the primary impetus for violence and genocide. A more nuanced interpretation of Rwanda's genocide would see that government policies that limited land sales, freedom of movement and labor opportunities contributed in important ways to discontent among Rwandans.

2009 is the fifteenth anniversary of the Rwandan genocide. As people look back to that horrific event and ask, once again, “why did it happen?” and “how can it be prevented in the future?”, it may be useful to revisit one of the more popular explanations for Rwanda's tragedy, which is this: Rwanda's people were victims of a Malthusian crisis. The most notable advocate of this account for the Rwandan genocide is Jared Diamond.

In his 2005 best-selling book *Collapse*, Jared Diamond asks why some societies “choose to fail or succeed.” His basic argument is that societies that make wise choices about resource use and population control flourish, while those that choose poorly fail, often spectacularly.

The book focuses on problems associated with population growth. Diamond argues that population pressure and the environmental degradation that may accompany a rise in population are important catalysts for social change. When populations grow, people adopt more intensive agricultural techniques in order to feed themselves. They innovate and find ways to increase crop yields through the use of irrigation, fertilizers, terracing, and other technologies. However, a rising population also places pressure on the stock of fertile land. As fertile land becomes increasingly scarce, people bring marginal land under cultivation. They also shorten the fallow period, which drains the soil of nutrients. The result can be environmental havoc: valuable ecosystems are destroyed, soils are depleted, and resources are overused. People and the environment suffer; societal collapse often follows from environmental collapse.

Diamond does not argue that this path to self-destruction is inevitable. Instead, he says that other factors contribute in important ways to the ability of particular groups of people at particular times in history to respond effectively to the twin, and related, problems of increasing population and land scarcity. Factors such as the presence or absence of hostile neighbors and/or friendly trading partners, cultural and political values, and shifts in climate patterns also contribute to a society's

responsiveness to the challenges of a rising population (2005, pp. 14–15).

Recognizing that groups of people respond differently to these challenges, the key question should be: “why?” Why do some groups of people develop successful strategies for dealing with these problems, while other groups do not? Why, for example, does a country like Belgium, which is small and densely populated by ethnically and religiously diverse people become peaceful and wealthy while Rwanda, another small and densely populated country remains poor and suffers cycles of violence? The answers Diamond provides are neither sufficient nor satisfying.

Putting collapse into a context

Diamond defines “collapse” as “a drastic decrease in human population size and/or political/economic/social complexity, over a considerable area, for an extended time (2005, p. 3). He sees Rwanda’s 1994 genocide as a modern example of a society collapsing tragically and dramatically. The Rwandan genocide has the dubious distinction of being the fastest in the 20th century: upwards of 800,000 people lost their lives in a mere 100 days. Millions were displaced, property and infrastructure was destroyed and the economy contracted by 50 percent. There is little question that in 1994 Rwandan society experienced something like collapse.

But why, to use Diamond’s own language, did Rwandans “choose” to fail? Why did the society implode? Diamond presents his case in Chapter 10, which is entitled: “Malthus in Africa: Rwanda’s Genocide” in which he argues that the genocide can be understood, in part, as a society-wide response to high fertility rates coupled with land scarcity. Too many people and limited fertile land were, Diamond posits, key variables in decoding the Rwandan disaster.

Analyzing the terrible events of 1994, Diamond does recognize that Rwanda’s mass violence was driven, organized, and encouraged by Hutu elites who were desperate to keep the reins of political control firmly within their grasp (Hintjens 1999, p. 247). But, he also believes that land scarcity coupled with low agricultural productivity actually drove people to murder. How? Drawing heavily on the work of André and Platteau (1997), Diamond argues that ordinary citizens participated in the violence because they were desperate and lured by property. If you ran off, or killed, a Tutsi (or a Hutu for that matter) you might just get the missing or dead person’s land. This would help you feed your family and perhaps

earn some income from the sale of crops such as coffee or tea. Alternately, running off or killing people would keep these competitors for scarce resources from taking your land.

Diamond is not alone in making this argument. Prunier (1995, p. 142) writes that poor Rwandan farmers, who lived in a highly centralized, authoritarian society, had a tradition of obeying superiors. These superiors told them that Tutsis were evil and a very real threat to their own lives. Farmers would have believed such assertions, but also another element might have been involved in convincing people to kill: “all these people who were about to be killed had land and at times cows. And somebody had to get these lands and those cows after their owners were dead.” And Pottier (2006, p. 510) writes that “ordinary people also killed for economic gain, often for access to a victim’s land.”

The problem with this argument is not that it is implausible but that it ignores the underlying causes of land conflict in Rwanda as well as the political economy factors that drove the Habyarimana government to repress its citizens and demonize opponents. Diamond’s analysis fails to develop a critical understanding of the role that Rwandan institutions and policies played in shaping a particularly authoritarian, inflexible, and anti-urban society. And it is these institutional and policy components that help explain why Belgium – with its high population and scarce land – is peaceful and wealthy while Rwanda is not.

In addition, more recent research (Strauss 2006, p. 136, p. 149) suggests that the lure of material gain played little role in prompting genocidal behavior and that few *genocidaires* actually took property during the genocide. Upon closer examination, the shortcomings in Diamond’s argument that Rwanda represents a modern day “Malthusian crisis” become clear. An examination of the way political economy shapes the choices dictators make, and the institutional factors that limited the growth of land markets, labor mobility, and off-farm job opportunities in Rwanda, provides a more nuanced understanding of why land was a source of conflict in Rwanda. Before examining Diamond’s analysis of the Rwandan genocide in detail, however, a brief history of the country is presented.

A short history of Rwanda

Rwanda is a small land-locked nation in central Africa. Today, close to nine million people live in the densely populated country. The vast majority of the population

is, and has always been poor and rural; they earn meager livings from subsistence farming.

The population is a mix of people – Hutus, Tutsis, and Twa. Mix is the operative word, as the people in Rwanda speak the same language (Kinyarwanda), many are co-religionists (Roman Catholic), and they share a common culture. Prunier (1995, p. 5) writes:

“The first explorers who reached Rwanda and Burundi were immediately struck by the fact that the population though linguistically and culturally homogenous, was divided into three groups, the Hutu, the Tutsi and the Twa... They shared the same Bantu language, lived side by side with each other without any ‘Hutuland’ or ‘Tutsiland’ and often intermarried. But they were neither similar nor equal.”

The perceived ethnic differences made a strong impression on early European colonists who wrote histories of the region in which the Tutsis were identified as superior Nilotic outsiders who brought a sophisticated kingship system to Rwanda. When the Tutsis, who were primarily pastoralists, arrived in the area that became Rwanda they found settled farmers (Uvin 1997, p. 92). These farmers were Bantus who tended to be poorer (or have fewer cattle) than the Tutsis. However, Schoenbrun (1998, p. 74) notes that people in western Great Lakes region (near Lake Kivu in western Rwanda) were grazing and breeding dairy cattle more than 2,000 years ago, so the distinction between Tutsi pastoralists and Hutu farmers may well have been overemphasized in some literature. Nonetheless, by the 19th century a strong, centralized Tutsi kingdom existed in and most Hutus were subservient to Tutsi masters (Prunier 2005, pp. 16–23).

In the late nineteenth century, Germans colonized this Tutsi kingdom, and incorporated it into German East Africa in 1890. Following the end of World War I, a League of Nations mandate transferred control of Rwanda and Burundi (Ruanda-Urundi) from Germany to Belgium.

Under Belgian rule Rwanda developed into a politically centralized, neo-traditionalist and overwhelmingly Catholic society. Prunier argues that it also became quite brutal. He writes (1995, p. 35) that:

“Between 1920 and 1940, the burden of taxation and forced labour by the native population increased considerably. Men were almost constantly under mobilization to build permanent structures, to dig anti-erosion terraces, to grow

compulsory crops (coffee for export, manioc and sweet potatoes for food security), to plant trees or to build and maintain roads. These various activities could swallow up to 50–60% of a man’s time. Those who did not comply were abused and brutally beaten. The result was a manpower exodus towards the British colonies, especially Uganda where there was plenty of work.”

It was under Belgian rule that the government first issued citizens identity cards that specified their ethnicity as Hutu, Tutsi, or Twa. These distinctions enabled Belgian administrators to fill civil service jobs and school positions with Tutsis. This policy resulted in economic and political marginalization for most Hutus (Newbury 1995, p. 12; Uvin 1997, p. 95).

In the 1950s, the colonial government introduced some political reforms aimed at improving the lot of Hutus. These reforms may have been an attempt, on the part of the Belgians, to lessen ethnic tensions or it may have been a way to promote loyalty in a group that then might favor a continued Belgian presence in the country. Not surprisingly, Tutsis resisted these changes, seeing in them a threat to their privileged status. In response to the Belgian reforms, a Tutsi-led independence movement emerged and the Tutsi king called for the Belgians to leave the country.

At the same time Hutus, with growing support from the Roman Catholic Church in Rwanda, issued a manifesto (known as the Hutu Manifesto) that called for greater Hutu voice and political power. In 1959, after the Tutsi king died under mysterious conditions, Hutus staged a revolution. Both groups reacted violently, and thousands of Tutsis were killed and close to 100,000 were displaced to neighboring countries.

The Hutu revolution lasted until the country gained its independence from Belgium in July, 1962. Gregoire Kayibanda, a Hutu from southern Rwanda, became the president and prime minister of the new country. Porter (2006, p. 3) notes:

“Rwanda quickly became a single-party state with a highly centralized and authoritarian administration under the control of Hutu elite from south-central Rwanda ... *Following independence, the state took ownership over all land.* An ethnic quota system determined access to education and employment in the civil service, and it was virtually impossible for Tutsis to attain high-level positions in government or the military” (emphasis added).

In 1963, exiled Tutsis unsuccessfully invaded the country. This led to further retaliatory attacks against Tutsis, in which thousands of Tutsis were killed. Another round of retaliatory killings against Tutsis took place in the early 1970s, in response to the mass murder of hundreds of thousands of Hutus in neighboring Burundi (Lemarchand 1997, pp. 321–338).

In 1973, General Juvénal Habyarimana led a *coup d'état* and took control of the country. Habyarimana was from northwest Rwanda, and under his leadership Hutus from this area quickly gained control of important government offices and the economic benefits these offices presented. Habyarimana controlled the levers of a single-party state in which the government became extraordinarily powerful and sought control over “every aspect of Rwandan society.” (Porter 2006, p. 4). Verwimp (2003, p. 163) describes the political changes:

“From 1974 to 1976, Habyarimana consolidated his political power. He outlawed political parties and created his own Revolutionary Movement for Development (MRND) ... the MRND was a truly totalitarian party: every Rwandan had to be a member of the MRND ... Habyarimana institutionalized *Umuganda*, the compulsory communal labour, and had peasants participate in village animation sessions to honor him ... All citizens were under tight administrative control. Every 5 years the president was re-elected with 99% of the vote.”

Newbury (1995, p. 14) notes that some improvements were made during Habyarimana's early tenure: “during the first decade of his rule, Habyarimana could point to important achievements of his government in several sectors: in the development of infrastructure (roads in particular), in the expansion of schools and health centers, in reforestation programs, and in attempts to promote increased agricultural production.” Rwanda's economic growth rates were generally good during the 1960s and 1970s. However, by the mid to late-1980s the country's economic situation had begun to deteriorate and by the early 1990s it had become dire.

The economic crisis of the late 1980s and early 1990s was the result of several factors: first, Rwanda was heavily dependent on export revenue from the sale of coffee and tea and the prices for both commodities fell sharply during this period. Uvin (1997, p. 106) points out that “coffee export receipts fell from \$144 mio (*sec*) in 1985 (an exceptionally good year) to \$30 mio (*sec*) in 1993.” Second, after 1990, the government diverted its limited resources to the war effort, fighting the invading

Rwandan Patriotic Front (RPF). Cannon (2005, p. 6) says Habyarimana diverted upwards of 40 percent of the national budget to military purposes between 1990 and 1994. And third, in 1990 the government agreed to a structural adjustment program that led to a 40 percent currency devaluation, higher prices, higher taxes, and increased fees for a variety of services (education, health, etc.) These elements added up to increasing poverty and hardship for the vast majority of Rwanda's citizens (World Bank 1994, *iii*).

The 1990 invasion of the RPF plunged the country into civil war for three years and precipitated a political crisis: political moderates (who supported a power-sharing arrangement with the Tutsi-led RPF) broke away from the government and formed an opposition. This opposition threatened the monopoly hold on power of ruling elites. Unsurprisingly, some officials within the government vehemently resisted calls to work with either the opposition or the RPF to create a transition government.

Nonetheless, in 1993 the Habyarimana government did sign the Arusha Accords, which led to a cease fire between the government and the RPF. The terms of the Accords required that the Habyarimana government rewrite the constitution, provide a number of ministries to opposition politicians, integrate the RPF and Rwandan armies, and create a power-sharing agreement with Tutsis.

The Accords were never fully implemented and in 1993 violence erupted once again in the capital city of Kigali. In response, the RPF launched a new assault on the government. The United Nations began peacekeeping operations in August 1993, but these proved disastrously inadequate. Finally, in April 1994 President Habyarimana's plane was shot down by a rocket launched from near Kigali airport. It remains unclear who was responsible for this attack. During the evening of April 6–7, the killings began in Kigali and within days the genocide was well underway across the country. In July, the RPF finally brought the killing to a halt and drove the Hutu government into exile. By the time the violence stopped, close to one million people were dead; nearly two million had left the country; and close to one million were internally displaced. Nearly 40 percent of the pre-war population was missing; the country was devastated.

In July 1994, the RPF created a coalition national unity government, with a Hutu president, Pasteur Bizimungu, in a key leadership role. Following the genocide, the international community responded with a humanitarian effort directed by the United Nations, which lasted until 1996. In late 1996, hundreds of thousands

of refugees from Zaire (now Congo) and Tanzania returned to the country. International war crimes trials began in Tanzania in 1997. In 2000 President Bizimungu resigned and Paul Kagame was sworn in as President. In 2003, multi-party elections were held. President Kagame's Rwanda Patriotic Front won in a landslide, and a new constitution was adopted.

The RPF remains in power today. It is often criticized (Reyntjens 2004, p. 177; Pottier, 2006, p. 510) for increasingly authoritarian tendencies – particularly in terms of limiting freedom of the press and opposition voices – but the government has also tried to improve the economy and strengthen the private sector and it has implemented a system of local courts, called *gacaca*, in an attempt to promote reconciliation while also addressing the problem of how best to deal with over 100,000 alleged perpetrators (Boudreaux and Ahluwalia 2009, pp. 165–172).

What Diamond argues

As noted above, Jared Diamond sees in Rwanda a modern example of societal collapse. He also suggests that problems associated with population growth help explain why Rwandans murdered each other on such a massive scale. His thesis is that “modern Rwanda illustrates a case where Malthus's worst-case scenario does seem to have been right” (2005, p. 313). He argues that a rising population led to unsustainable resource use which in turn created conflict. If conflict can not be managed peacefully and through courts, it may, Diamond argues, be managed in “nastier” ways (2005, p. 313), such as mass killings and this helps explain the Rwandan genocide.¹

Diamond rejects early explanations of the genocide in which the killings were explained solely in terms of tribal and ethnic hatred. He agrees with Alison Des Forges, late author of the respected work *Leave None to Tell the Story*, that a small group of Hutu political elite, who were opposed to the power sharing agreement worked out in the Arusha Accords, purposefully planned and put the genocide into motion in a desperate attempt to retain power.

However, Diamond also believes that while this analysis is “correct and accounts in large degree for Rwanda's tragedy... there is also evidence that other considerations contributed as well.” (2005, p. 318). This is surely right. Given that so many civilians participated in the killing, it is important to try to understand their motivation. Would ordinary people kill neighbors, friends,

even family members, just because a group of politicians ordered them to do so?

Diamond believes the answer to this question is “no.” Rather, what drove ordinary Rwandans to become killers was economic desperation. In 1994 95 percent of the population lived in rural areas (World Bank 1994, xi). By the early 1990s the average Rwandan farmer had access to only a small plot of land: approximately 80 percent of farms in 1994 were less than 2 hectares. Nearly 20 percent of farms were less than 0.37 hectares. Only 20 percent of farms were larger than 1.90 hectares (World Bank 1994, p. 79). And in 1994, this small amount of land needed to feed an average family of 4.9 people in rural areas and 5.6 people in urban areas (World Bank 1994, p. 62). By 1990 the average population density of the country was 760 people per square mile or, 280 per square kilometer – higher than the population density of the UK, although not as high as that in Holland (Diamond 2005, p. 319). This translated into a great many mouths to feed and limited capacity to actually feed them.

Although food production in Rwanda rose in the 1960s and 70s, by the 1980s this increase stopped and poverty rates increased. The World Bank notes, in its 1994 report, that “Rwandan farmers have historically defied predictions of disaster by keeping food production ahead of population through a variety of measures” but that this success stalled in the early 1990s because of increasing land scarcity, low use of fertilizers to improve soil fertility, a high risk environment due to thin markets, lack of irrigation, and little intercropping, and excessive government intervention in favor of coffee and in opposition to other crops, including food crops (1994, vii). By the late 1980s the country was experiencing localized famine. Poverty was worst in the south central region of the country while the northwest (home region of President Habyarimana) was the most “well-off.” (1994, iv).

Despite their efforts, Rwandan farmers were not able to boost agricultural productivity in proportion with population increases. Population rates continued to increase and families had to divide land into extremely small pieces when children married, making a bad situation worse over time. In other words, Diamond is certainly right that there was significant population pressure in Rwanda. The vast majority of people had access to only very small parcels of land (Newbury 1995, p. 14). Because of this, land was used intensively, overused, and marginal lands were brought under cultivation. Environmental degradation does seem to have occurred (Mushaha 2006, p. 6) and it seems reasonable to assume that some people coveted other people's land.

However, taking all of this as a given, some questions

arise that Diamond never asks. For example, if things were so bad in the countryside, why didn't Rwandans do what rural people the world over do in difficult times? That is, why didn't Rwandans leave the countryside and move to the cities or emigrate (of course, tens of thousands involuntarily fled earlier violence)? In a situation of rising land scarcity, what political pressures kept smallholder farmers on their land? Alternately, why didn't more efficient farmers buy land from less efficient farmers and develop a commercial agriculture sector that would feed the nation – as happened in places like Belgium and the United States? Why didn't people find off-farm jobs to supplement their incomes? And finally, why didn't Rwandans limit their birth rates? What kind of family policy existed in Rwanda before the genocide?

Diamond does not ask these questions. As a result, he overlooks important institutional issues that limited the ability of ordinary Rwandans to respond in more peaceable ways to rising land scarcity. Population pressure *was* real in Rwanda, but Rwandans had a very constrained set of options available for dealing with the problem of large families, small farms, and falling productivity. To the extent that Rwandans “chose” failure and societal collapse, it was in very large part because their government prevented them from developing successful alternate strategies for dealing with land conflict and rising poverty.

Limited options, lots of conflict

If ordinary Rwandans killed for land we must think carefully about why this would be so.² Why weren't people able to work out their land conflicts peacefully? Why was violence an acceptable strategy for so many?

One reason is the various legal restrictions that Rwandan governments created, over the course of decades, that limited individual freedom in general and the operation of local markets in particular. Because of government actions, Rwandans were unable to make use of some of the strategies that people living in other high population/high density environments adopt to allocate scarce land and to create non-agricultural jobs. History, legislation, and regulation, coupled with the leadership's incentives to retain power, combined to worsen ethnic tensions among people competing for land, while also making it very difficult for Rwandans to sell land, to relocate at will, and to find jobs in urban areas. These problems were exacerbated by a pre-genocide ideology that lauded rural life. Taken all together, they help us to understand better why land became a contested resource in Rwanda.

Choosing repression

As discussed above, the Habyarimana government was a tightly controlled totalitarian political system. The government kept a firm grasp on the political arena, limited civil society, and controlled the economy. In other words, the Habyarimana government was extremely repressive, controlling virtually all aspects of the lives of its citizens.

In his work on the political economy of dictatorships, Ronald Wintrobe (1998, p. 5) argues that citizens and dictators engage in a kind of rational exchange. Citizens exchange loyalty to the regime for some set of favors (for example, a generally good economy, low food prices, less expensive foreign imports, access to credit, etc.) that the regime controls (1998, pp. 46–49). When the “supply” of loyalty is high (because citizens are willing to cooperate with the regime) the benefits each citizen receives is lower than it otherwise would be – the regime doesn't need to distribute as many rents to citizens.

However, if citizens become dissatisfied with a regime they might choose to support opposition candidates, who offer different favors/rents. When citizens choose to support political opponents, a leader must make a choice: offer the desired benefits and retain loyalty or use repression to raise the cost of opposition. When repression increases citizens bear higher costs of opposing the government (time in jail, torture, exile, etc.) By using repressive tactics, regimes get the loyalty they need to stay in power. The Habyarimana regime used repression to maintain loyalty throughout much of its rule. We can understand the tight control of civil, political, and economic life in Rwanda as an effort of the government to maintain political power.

Given the deteriorating economic conditions of the late 1980s and early 1990s the perceived need to ratchet up repression in Rwanda rose. As revenues from the sale of coffee and tea fell, as expenses related to war rose, and as a program of fiscal austerity was imposed by the IMF (though never fully implemented) the government was less able to provide benefits to citizens and supporters. Loyalty to the regime was at serious risk and an opposition formed. In order to retain power the government chose to increase already significant levels of repression, increase anti-Tutsi rhetoric, and increase the costs associated with opposition. To discuss the genocide without discussing these crucial political elements is to leave much of the story untold.

Limited markets for land

In the pre-colonial era, the Tutsi king owned the land in the area he and his court controlled (Pottier 2006, p. 513). Prunier writes that under the pre-colonial government a chief of land was responsible for allocating land; interestingly, this chief according to Prunier, “was often” a Hutu (Prunier 1995, pp. 11, 27). Land could not be alienated but could be inherited, (by male heirs) or acquired through clearing unused land, and it could also be leased in exchange for labor and gifts. In the northwest, Hutu-dominated area of the country, land was held in what Pottier describes as “corporate lineages in a system of clientship” (2006, p. 513). Under this system, similar to much customary land law in Africa, the original settler would allocate land to family members and to non-family clients. Clients would lease allocated land for a payment. However, across the bulk of the country, land was allocated by central authorities who held ultimate title to the land.

Under colonial rule, the Belgians continued to recognize customary land law, but also introduced law that allowed the foreigners to purchase land. Musahara writes that “until independence in 1962, an indigenous or customary tenure system existed alongside codified land tenure rules for land owned by foreigners” (2006, p. 4). The Rwanda Constitution of 1962 retained Belgian rules for land tenure, which meant that all unoccupied land belonged to the state, and the government (specifically, the Minister of Agriculture) was required to approve all contracts for the sale or gifting of land.

A 1976 land law imposed further restrictions on the sale of land in Rwanda. Land held under customary law needed the Minister’s approval for sale, but now also required an “opinion” from a local community council (Musahara 2006, p. 5). Further, no sales could be approved if the seller owned less than 2 hectares or if the buyer owned more than 2 hectares. Given that the average size of a family land holding shrank from 2 hectares in 1949 to 1.2 hectares by 1970, these limitations would have imposed significant restrictions on formal transfers of land. Pottier points out that: “[t]he [1976] decree also thwarted the development of an open land market ...” (2006, p. 514). Sales did take place, however, and these seem to have resulted in urban elites consolidating land-holdings. By the mid-1980s, 50 percent of Rwanda’s agriculturally productive land was held on 182 farms, out of a total of more than 1,000,000 farms in the country (Bigaza, Abong, and Mukarubuga 2002, p. 69).

Thus, before the genocide the vast majority of Rwandans had access to scattered, very small plots of land that

they inherited from family or that the state allocated to them for use. In the past, the land market was quite small, but by the 1980s and certainly after the genocide, significantly more people have acquired land by purchasing it, informally and illegally if necessary (Musahara 2006, p. 9; Pottier 2006, p. 514).

Before the genocide the ultimate title to land remained in the hands of government.³ Land markets in Rwanda have never evolved in the way they have in the developed world. As population pressure was rising in Rwanda one would expect individuals would create more individualized rights to land in order to better internalize the rising value of the land (Boudreaux 2005, p. 91). However, this option was severely constricted because government controlled the sale of land. Smallholders who wanted to sell their property and move to urban areas were prohibited from doing so by law (unless they had “connections”). Additionally, regulations limiting movement of people made it difficult for people to leave their villages and move to cities. One of the reasons there was “unbearable” stress on land resources was that markets in land were not allowed to develop. A tightly fettered market contributed to the problem of “land scarcity” in Rwanda.

Regulation limited people’s freedom to move

One of the most startling figures about Rwanda is that in 1994, 95% of the population was rural – this was the lowest degree of urbanization in the world at that time (Verwimp 2000, p. 348). One is immediately struck by the oddness of this number. In a densely populated small country, why were so many people living in the country and not in urban areas?

The answer, overlooked by Diamond, is that *people were not allowed to move to cities* (Verwimp 2000, p. 339). In its 1993 *Human Rights Country Report on Rwanda*, the US Department of State wrote:

“Freedom of movement and residence [in Rwanda] are restricted by laws and regulations which require all residents to hold national identity cards and residence and work permits. Police conduct periodic checks, especially in urban areas, and return all those not registered in the locality to their own commune. Property owners who do not require tenants to show valid documentation are subject to fines and even imprisonment. Undocumented tenants are subject to expulsion.” (1994)

Official ideologies of agricultural self-sufficiency and

the virtues of peasant life (discussed below) combined with a desire to limit the growth of informal, slum settlements (which are more difficult for government to control than are poor rural citizens), led the Rwanda government to promote a set of anti-urban-growth policies that coercively kept people in rural areas. In its 1994 report, the World Bank (1994, p. 34) wrote:

“A web of regulations exist limiting the size of urban areas, through residence and work permits, land tenure regulations, business registration and bureaucratic instruments. These regulations have the effect of increasing the number of poor people in the country, and increasing the poverty gap as well. Poverty increases as pressure on rural land increases and people are not able to move to cities (or other rural areas for that matter) to relieve the pressure and are thus trapped in increasing poverty.”

People were required by legislation to apply to local government officials for residence permits if they stayed more than three days away from their primary place of residence. Prunier writes that: “Unless there was good reason, such as going to school or getting a job, the authorization to change residence would not be granted – unless, of course, one had friends in high places. Administrative control was probably the tightest in the world among non-communist countries” (1995, p. 77).

Giving local officials the authority to approve or reject permits created opportunities for corruption and limited people’s freedom to move. With a rising population and a small land area, Rwandans surely needed to leave the countryside and move into cities to find alternative means of making a living. However, the World Bank reports that the Habyarimana government’s fear of slums led to policies that kept citizens in the countryside rather than allowing for potentially chaotic urban development (1994, p. 41).

But it is precisely urban development that allows for a broad and deep division of labor and thereby increases opportunities for people to earn higher off-farm income. Verwimp points out that: “we know that migration, and especially temporary employment in cities, is an important strategy to cope with poverty” (2000, p. 340). Yet, urban development was purposefully thwarted in pre-genocide Rwanda. Migration into cities from the countryside was, according to the World Bank, “made difficult by laws and regulations restricting labor mobility. Migration towards neighboring countries is limited either by political reasons or by the absorptive capacity

of neighboring regions” (1994, p. 21). A typical strategy for dealing with rising population and increasing land scarcity – movement to urban areas – was off limits to most Rwandans.

Limited job opportunities

The business environment in pre-genocide Rwanda was not conducive to job creation and strong economic growth. The country was heavily dependent on agriculture as a source of export revenue. In 1994 90 percent of the active labor force still worked in agriculture and agriculture provided 40% of GDP (World Bank 1994, xi). Services provided another 40 percent of GDP in 1994 and the industrial sector represented the rest of the economy. The World Bank report noted that:

“Local entrepreneurship is not well developed, except for a small informal sector. In addition to the physical constraints – Rwanda is land-locked and hilly – the major obstacles to private sector development are the presence of the state as a privileged competitor and a disabling environment characterized by an inadequate incentive system and pervasive government interference in virtually all aspects of economic life.” (1994, xi)

So not only was there a dysfunctional land market and restrictions on people’s freedom to move within the country, the government interfered with many aspects of the economy. As noted above, government regulation restricted the movement of people into urban areas, so market centers were few and relatively small. The pre-genocide government also required entrepreneurs, even very small-scale traders such as fruit and vegetable vendors, to obtain trading licenses (World Bank 1994, viii). The government required farmers to devote a portion (one-quarter) of their planting to coffee production. Intercropping was forbidden by law – which meant farmers had few opportunities to grow crops for the local market (Boudreaux 2007, p. 5). All these restrictions constrained local entrepreneurship.

The World Bank report nicely summarizes the reasons for limited growth and job creation in pre-genocide Rwanda:

“Rwanda’s macroeconomic and regulatory framework has not been conducive to the onset of sustainable labor intensive growth ... in the past because the Government has historically tended

to: (a) heavily regulate the economy from artisans to air transport; (b) maintain artificially high exchange rates; (c) restrict free movements of population and labor; (d) control cropping patterns (forbidding cutting down coffee trees); and (e) control social behavior.” (1994, p. 14)

The Report argues that this restrictive environment limited economic growth, made it more difficult for poor people to find better alternatives to subsistence farming, slowed the growth of urban areas, made schooling expensive and “made it difficult to set up new businesses.” Had the government interfered less with the economy and had it allowed people to move the stresses caused by land scarcity would have been mitigated. Instead, the government made it difficult and costly for people to build new businesses, to employ and fire workers, and to develop alternative livelihood strategies to subsistence farming.

Rural ideology

Philip Verwimp summarizes the Habyarimana regime’s economic ideology in the following way:

“Habyarimana’s macro-economic ideology, as derived from his speeches, is as follows. Rwanda is a peasant economy and should remain so; in fact, all Rwandans should be peasants. Agricultural manual labor is the only source of value and thus all human and physical activity should be concentrated in rural areas.” (2000, p. 340)

Given this policy preference, it is natural that the Habyarimana government “followed a consistent policy to make peasants stay in the rural areas. They had to remain in an agricultural setting” (2000, p. 339). The Hutu peasantry was glorified; intellectuals and bourgeois merchants were vilified.

The Habyarimana government stressed the need for Rwanda to find a path to “auto-development” through agricultural self-sufficiency and the export of primary commodities such as coffee and tea. Ensuring that the country could feed itself and still earn export revenue to pay for needed imports (such as fuel) and luxury items were the twin policy goals. As in many African countries, the government forced smallholder farmers to sell these export commodities at artificially low prices. The government then sold coffee and tea at higher world market prices and used the “profit” for its own ends.

In order to promote the virtues of hard work the

government implemented a policy known as *umuganda*. Under *umuganda* all Rwandans (except those with powerful friends or connections) had to “volunteer” one day per week to do work for the local government. Verwimp writes that: “[ac]cording to him (Habyarimana)... those not performing agricultural work, the ‘non-peasants,’ are harmful to society... only the Hutu peasant, the one tilling the land, is productive and good for society” (2000, p. 335). This coercive requirement was, in part, designed to humiliate intellectuals, forcing them to do “real” work. It also provided another way for the government to control the population and finally, it allowed the government to accomplish some development goals, such as building infrastructure (2000, pp. 344, 346).

What was the outcome of this particular “development ideology?” Verwimp says “the policies that Habyarimana executed during his reign, served his two main objectives at the same time: Rwanda would remain a poor rural society based on agriculture, and he would stay in power” (2000, p. 356). Tragically, the policies created to fulfill Habyarimana’s dream of an agrarian utopia contributed to the nightmare of the genocide.

Oddly enough, as Verwimp points out, Habyarimana himself was a somewhat conflicted Malthusian (2006, pp. 4–6). Convinced that Rwanda’s rising population was a concern, especially as agricultural productivity was not keeping pace with population growth, he nonetheless rejected the use of “fast solutions” (family planning methods) because they were un-Rwandan (2006, p. 4). Not only was family planning not provided by the government, but there is evidence that may actually have sought to prohibit it: in some instances the government may have supported attacks on pharmacies selling condoms (Prunier 1995, pp. 88–89). The idea was to ensure that Rwandans would have large families, work the land (providing food for all), and so preserve “Rwandan” values. Sadly, another strategy that Rwandans might have used to better control their environment, family planning, was off limits thanks to government policies.

Conclusion

The history of Rwanda is one of deep government intrusion into people’s lives. Under colonial and post-colonial governments citizens have had only limited freedom to speak, to challenge authority, to trade, to build a new and different life. The kinds of freedoms that have allowed citizens of other small, densely populated countries to allocate scarce land and create off-farm employment were simply not available to the vast majority of Rwandans

before the genocide. Pre-genocide governments robbed Rwandans of the chance to adapt and deal with land scarcity and food security in a peaceful manner.

More specifically, the Habyarimana regime actively repressed the citizenry, glorified the peasantry, rural life, and agricultural labor. It denigrated urban life, markets, and intellectual labor, and imposed policies that kept people in the countryside, kept cities artificially small, and limited the growth of markets. Given these policies, can it really be argued that the Rwandan “society” “chose” failure, “chose” environmental degradation and, ultimately, collapse?

Rwandan *society* did not make these choices. Instead, an authoritarian leader and his cronies, desirous of maintaining political power, chose to impose on the citizens policies that made it impossible to trade land effectively, to move, to find work, to make use of family planning, and to manage conflict peaceably. It is more appropriate to attribute the collapse in Rwanda to a highly repressive political environment purposefully manufactured by a dictator and designed to keep him and his party in power.

Collapse in Rwanda should not be seen as the result of greed or of too many people on too little land. Given freedom, people find ways to cope with high population density – as the history of the West shows. Other factors were at work. These political factors blocked the development, in Rwanda, of alternative coping strategies to population pressure and land scarcity. Unfortunately, in his analysis of the Rwandan genocide Diamond neither recognizes nor acknowledges how the political environment, made manifest in a set of harmful policies, contributed to a staggering social and economic crisis.

Notes

1. The claim that if a problem cannot be managed peacefully it will oftentimes be “managed” through the use of violence is tautological. Higher population density does not necessarily lead to violence, as we can see from countries such as Belgium and Hong Kong. This suggests other explanations are in play and that the Malthusian explanation is limited at best.
2. In his thoughtful, carefully researched book *The Order of Genocide*, Scott Straus reports the results of survey work he did in Rwanda with over 200 *genocidaires* – individuals convicted of perpetrating genocide. He finds, no surprise, that most of his respondents were farmers with little education. When he asked respondents why they participated in the killing, 64.1 percent said they killed people “because they feared the negative

consequences from other Hutus of not participating” (Straus 2006, pp. 135–36). Another 12.9 percent said they killed out of “obedience.” Only 5.2 percent said they killed for material gain. When asked, “Did you take any property during the genocide (including food)?” 77.3 percent responded “no.” (2006, p. 149). Recognizing that killers might provide unreliable answers to such questions, he triangulates his data through use of qualitative interviews and regression analysis. Straus’ work raises questions about the role of land “hunger” as a motive for violence during the genocide.

3. The government issued a new Land Law in 2005 that provides a process for titling land. However, implementing this law has been a slow process and a number of potentially troubling issues associated with the security of land rights of smallholders, women’s rights to land, and the potential for increased conflict have not adequately been addressed. For a discussion of some of these concerns see Johan Pottier, “Land Reform for Peace? Rwanda’s 2005 Land Law in Context.”

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The Post War Intellectual Roots of the Population Bomb. Fairfield Osborn's 'Our Plundered Planet' and William Vogt's 'Road to Survival' in Retrospect

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Abstract

This paper traces the “intellectual roots” of *The Population Bomb* by discussing two now largely forgotten 1948 best-sellers, Fairfield Osborn's *Our Plundered Planet* and William Vogt's *Road to Survival*. These books launched a Malthusian revival in the post War era and profoundly influenced a young Paul Ehrlich, whose own best-seller epitomised this movement, both in content and rhetorical style. Our paper is structured as follows. We first discuss the traditional opposition between so-called Malthusians and Cornucopians. This is followed by an overview of Osborn and Vogt's life and work, and a more detailed survey of their basic arguments on environmental destruction, population growth, economic development, technological change and the basic institutions of a market economy. A review of reactions to both books upon their publication follows. Our concluding thought is that, at the time of writing *The Population Bomb*, Paul and Anne Ehrlich should have been more cautious and revised their tone and rhetoric, in light of the undeniable and already apparent errors and shortcomings of Osborn and Vogt's analyses.

“The postwar population explosion hysteria initiated by Guy Irving Burch and Elmer Pendell in 1945, injected by Burch and Vogt into the body of Fairfield Osborn's benignly intentioned books on natural conservation, and carried to full intellectual fruition by the Paddocks, Ehrlich and Hardin, succeeded far beyond the wildest hopes of the old-time eugenicists who started it all. Out of it came not only mass movements, such as Zero Population Growth, Inc., with chapters of active members in many American cities, but also new causes for older conservationist societies, such as the venerable Sierra Club.”

Allan Chase, 1977, p. 406

Introduction

Suggesting that the ‘population bomb’ had already gone off, Paul Ehrlich famously began the first chapter of his best-seller by saying that if he had long understood the population explosion “intellectually,” he had come to understand it “emotionally one stinking hot night in Delhi a few years ago” (Ehrlich 1968, p. 1). The purpose of mentioning his now infamous Indian trip and other direct experiences, such as the caterpillars that, as a child he was unable to nurture into butterflies due to DDT spraying on local foliage, is obvious; he needed to provide his target audience, the American readership, with captivating examples of the fate they would inevitably suffer unless they drastically curtailed population growth in their own country. The fact that *The Population Bomb* sold over three million copies by 1990 is a testament to Paul and his wife Anne's capacity to reach out and touch a broad audience.¹

What is less well remembered today about the

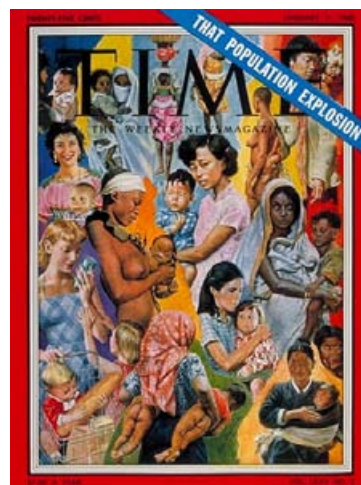
“Both [Osborn and Vogt] are barking up the right tree. They have put their finger on the soil and water robber. This robber is an economic and business system which makes it profitable to destroy the elements that give us our food, our clothes, our houses and our gadgets – and, of course, ultimately ourselves.”

Angus McDonald, 1948, p. 26

Ehrlich's early contribution is the context in which their 'intellectual' understanding of the alleged social, economic and environmental impacts of population growth came about. Despite a now widespread popular perception that theirs was a pioneering or innovative work,² *The Population Bomb* is actually best understood as "climaxing and in a sense terminating the debate of the 1950s and 1960s" (Luten 1986, p. 298). As Rubin (1994, p. 78) observed, the book originally drew little attention for "throughout the sixties, it appears that everybody was concerned about overpopulation" and its basic arguments were by then "familiar" as they had been vigorously promoted in previous decades by several population control and environmental activists. For example, the expressions "population bomb" and "population explosion" were first introduced in the early 1950s by the businessman and population control activist Hugh Everett Moore (1954) in a twenty-two page pamphlet similarly titled "The Population Bomb!" that by 1967 had gone through thirteen editions and a print run of nearly a million and a half copies (Kasun 1999; Robertson 2005).³ Several individuals borrowed Moore's title in their own writings. Among the most prominent were the Commissioner of the United States Bureau of Reclamation Michael W. Straus (1955, p. 15) who used it in his book *Why Not Survive?*; the Stanford professor of chemistry J. Murray Luck (1957, p. 906) who discussed the concept in a presidential address on "Man against his Environment" delivered before the Pacific Division of the American Association for the Advancement of Science in 1957 that was later published in *Science*; and the director of the Population Reference Bureau Robert C. Cook (1956) who authored an article with this title in the *Bulletin of the Atomic Scientists*. The expression "population explosion" was for its part so widely used that it even graced the cover page of a 1960 issue of *Time* magazine (figure 1).⁴ Not surprisingly in an age where A- and H-bombs were on everyone's minds, several authors also referred to the "P-bomb" (Slick 1958; Troebst 1962; Fabre-Luce 1964).

Radical prescriptions to cure the alleged threat of overpopulation were also common before the Ehrlichs had any popular impact on the issue. For example, one year before the publication of the couple's best-seller, the brothers William and Paul Paddock's (1967) in their book *Famine 1975!* promoted the creation of a triage system in which the least fit individuals in countries such as India, Egypt and Haiti would be allowed to starve in order to save the more robust ones. While few writers supported such extreme measures, the dominant perspective on population and environmental issues had by

Figure 1 **Cover of Time Magazine, January 11 1960**



Source: <http://www.time.com/time/covers/0,16641,19600111,00.html>

then become highly pessimistic. Milliman (1963, p. 74) summarized it as follows five years before the Ehrlich's book: "1) Natural resources are disappearing rapidly; 2) this disappearance is totally undesirable; 3) the major reason for this disappearance is the greed of individuals pursuing selfish and profit motives; 4) the result is that the well-being of posterity is being sacrificed for the satisfaction of the whims of present generations."

The institutional origins, outlook, and educational efforts of the immediate post World War II era environmental and population writers and activists who shaped the worldview of the Ehrlichs and other prominent 1960s writers, however, are now largely forgotten or judged inconsequential. Typical in this respect is the population economist Julian Simon (1998, ix) who observes that, apart from "a brief double flip-flop" by the economist John Maynard Keynes, "not much of note" happened in the field of population economics between the contributions of Marx and Engels and those published in the 1960s. As the historian Thomas B. Robertson (2005, pp. 5–6) perceptively observes: "Although one can hardly pick up an environmental book from the late 1960s and early 1970s that does not warn about overpopulation, it is surprisingly easy to find a history of the movement that barely mentions overpopulation" and emphasizes instead factors ranging from the search for better environmental amenities (clear rivers, clean air and more green spaces and parks) and the destruction associated with suburban sprawl to pesticide use, nuclear weapons and the rise of ecological science. "Indeed," the historian adds, "Malthusianism has received nothing like

the attention given (deservedly) to [these] other major issues.”⁵

Yet, the debate on population was really reignited, in 1948, with the publication of two international best-sellers: Fairfield Osborn’s *Our Plundered Planet* and William Vogt’s *Road to Survival*. Following important promotional efforts that included selections in popular book clubs, *Our Plundered Planet* had already been reprinted eight times by the end of its year of publication and was eventually translated into thirteen languages. For its part, Vogt’s book was translated into nine languages while a condensed version (eventually translated into eleven languages) was published in *Readers’ Digest*. According to one estimate, it eventually reached between twenty and thirty million individuals and was the biggest environmental best-seller of all time until the publication of Rachel Carson’s *Silent Spring* in 1962 (Linnér 2003, p. 37), besides being the most important source of inspiration for Moore’s (1954) *Population Bomb!* The great French demographer Alfred Sauvy (1972, p. 968) compared its impact to Malthus’ work, while his colleague Jean Sutter (1955, p. 292) observed that it launched a worldwide discussion on population control. According to the economist Erich Zimmermann (1951, pp. 813–814), both books reached “literally millions” and left “their mark on the minds of many throughout the world.” Although neither contained much that some expert had not already said, they presented for the first time “a certain holistic all-embracing, all-coordinating approach that reveals the woods where other experts pointed to single trees,” and possessed “an eloquence born of evangelistic zeal that few experts can muster” (idem).

In the words of Chase (1977, p. 381), “out of *The Road to Survival* and its many literary and intellectual descendants” were to come Zero Population Growth as well as a number of other popular movements, along with “some of the most pervasive slogans of modern America.” Because both Osborn’s and Vogt’s books soon became mandatory readings in several institutions of higher education, a “whole generation of impressionable young people were to come under [their] influence... during their most formative years. One of them was a freshman at the University of Pennsylvania, Paul R. Ehrlich” (idem). Interestingly, while Ehrlich “traced his own Malthusian beliefs to a lecture he heard Vogt give when he was attending college in the early 1950s” (Jamison and Eyerman 1995, p. 77), it was ultimately Osborn’s rather than Vogt’s book that was listed in his best-seller’s bibliography, perhaps because, as will be demonstrated later in this essay, it showed less contempt for human life. For Ehrlich, these writers provided “a global framework for

things he had observed as a young naturalist” (Horowitz 2004, p. 192).

Despite a few more in-depth treatments in broader histories of the population control and environmentalist movements (Allen 1977; Linnér 2003; Robertson 2005; Schlosser forthcoming), references to these books are now usually limited to a few paragraphs or footnotes in much larger volumes or are simply not mentioned in otherwise well-documented discussions of the history of modern eco-catastrophism (Bailey 1992). They were nonetheless fundamental in terms of shaping the issues, outlook, and rhetorical style of later writers and activists such as Al Gore who was introduced to these writers while attending a class on “Theology and the Natural Sciences” at Vanderbilt University (Cockburn and St. Clair 2000). Indeed, as Chase (1977, p. 381) observed, “for the next three decades, every argument, every concept, every recommendation made in *The Road to Survival* would become integral to the conventional wisdom of the post-Hiroshima generation of educated Americans,” a statement which remains true to this day if one excludes concerns related to human-induced climate change.⁶

The purpose of this essay is to introduce twenty-first century readers to the now largely forgotten 1948 best-sellers of Osborn and Vogt, in the process making an implicit case that the birth of the modern environmentalist movement, including the intellectual roots of *The Population Bomb*, can actually be traced to the immediate post World War II “overpopulation” concerns rather than to other, less significant, issues. It is structured as follows: The first section discusses briefly the traditional opposition between so-called Malthusians and Cornucopians. This is followed by an overview of Osborn’s and Vogt’s life and work, and a more detailed survey of their basic arguments and rhetoric on environmental destruction, population growth, economic development, technological change and the basic institutions of a market economy. A review of reactions to *Road to Survival* and *Our Plundered Planet* is next. Our concluding thought is that Paul and Anne Ehrlich’s tone and rhetoric should have been considerably more cautious in light of the undeniable and already apparent errors and shortcomings of Osborn’s and Vogt’s analysis at the time they wrote *The Population Bomb*.

1. Malthusians and Cornucopians

Basic concerns regarding resource availability and anthropogenic environmental degradation are at least as old as civilization (Lowenthal 1990; Simon 1998;

Spengler 1998; Tainter 2006, 2008). In the words of the then prominent economist Alfred Marshall (1920, book IV, ch IV, paragraph 3): “The study of the growth of population is often spoken of as though it were a modern one. But in a more or less vague form it has occupied the attention of thoughtful men in all ages of the world.” As Luten (1980, p. 125) later observed, “the question of limits to growth and optimism and pessimism regarding the human prospect [has been] debated [in the last two centuries] without consensus” with interest in the issue “wax[ing] and wan[ing] more times than can be counted.”

On the one hand, writers such as Confucius, Plato and Aristotle anticipated modern concerns, perspectives and concepts ranging from growth-induced depletion of soils, minerals and biomass resources to “ecological balance” and “steady-state economics.” Best remembered today, of course, is the first edition of the English economist Thomas Robert Malthus’ (1766–1834) *Essay on the Principle of Population* (1798) whose contribution is typically (and somewhat unfairly in light of his later writings) summarized as stating that natural checks, such as limited food production capabilities, will inevitably result in famines and wars, which will in turn reduce population sizes to much smaller and ultimately more sustainable levels.⁷

On the other hand, some analysts viewed a growing population as a generally positive thing, as it provided more arms to work and more heads to create new solutions (Simon 1998; Slocombe 1993).⁸ While their social philosophy spanned the political spectrum, they eventually came to be labeled ‘cornucopian’ by allusion to the mythical Greek “horn of plenty” (cornucopia).⁹ For example, the British political economist William Petty (1888, p. 49) wrote in 1682: “[I]t is more likely that one ingenious curious man may rather be found out amongst 4,000,000 than 400 persons.” Friedrich Engels (1844, non-paginated) observed that the “productive power at mankind’s disposal is immeasurable. The productivity of the soil can be increased *ad infinitum* by the application of capital, labour and science.” Another long-standing critique of the Malthusian outlook is its general disregard for the value of (most) human life. In the words of the French mutualist theorist Pierre-Joseph Proudhon (1886, pp. 6–7), it is nothing short of “the theory of political murder; of murder from motives of philanthropy and for love of God”. While Malthusians “act in good faith and from the best intentions in the world” and “ask nothing better than to make the human race happy,” they “cannot conceive how, without some sort of an organization of homicide, a balance between population and

production can exist” (idem).

During most of the nineteenth century, the opening of new territories, technological developments and increasingly large levels of international trade convincingly disproved the most apocalyptic scenarios, at least from a trans-Atlantic perspective (De Steiguer 2006; Foster 1998). As a result, the Malthusian doctrine was “almost universally rejected” by American thinkers at the turn of the twentieth century (Ekirch 1963, p. 40), although this was much less the case in Great Britain (Robertson 2005; 2008). In the words of the US politician John J. Ingalls, it was “a curious fact that with increasing population, creating increased demands, all products of the field and farm have diminished in value, and that with the exhaustion of the public domain farming lands have become more and more unsaleable” (quoted by Tourgee 1896, p. 13). As another contemporary American observer put it:

“The time may come, to be sure, when the Malthusian theory will be revived, but it is not in our day, nor will it be in our century, for scientific thought almost completely overturned the theory and has relieved it of its strength in exciting the fears of economists or of philosophers that the world was gradually but surely coming to that position where it could not supply its population with food, and that some method of checking population must be the resort. The broadening of the area of supply through discovery and the taking up of vast tracts of land were the immediate means of depriving the doctrine of its force, but later on intensive agriculture and the discoveries of science succeeded in relegating the theory to the past.” (Wright 1904, p. 898)

In later decades, orthodox Marxists (Perelman 1972), optimistic economists (Zimmermann 1933; Simon 1996; Bradley 2009) and other writers, the most influential in terms of reaching a broad American audience before the publication of Osborn and Vogt’s best-sellers being perhaps the Harvard geologist Kirtley Fletcher Mather (1944) with his short book *Enough and to Spare*,¹⁰ would present various versions of the Cornucopian perspective.

While resource availability was the traditional concern of [neo] Malthusians, some nineteenth century writers also emphasized the social and economic consequences of ecological degradation. For example, after lamenting the environmental destruction and alleged resulting civilizational collapse of ancient Persia, Egypt and Mesopotamia, the natural historian Felix Leopold Oswald (1879, pp. 35–36) observed that the “physical

laws of God can not be outraged with impunity," that there were "some sins against which not one of the Scriptural codes of the East contains a word of warning" and that the "destruction of forests is such a sin, and its significance is preached by every desolate country on the surface of this planet." The English author and Church of England priest Mark Pattison (1881) observed for his part that he had simply "to utter the fatal phrase, 'sanitary arrangements,'" to remind his readers of how "next to nothing" had been done "to remedy the overgrowing pollution of earth, air, and water by our teeming population" despite much effort on this issue.

In the last quarter of the nineteenth century, individuals later labelled 'conservationists' began to promote the notion that private interests were mismanaging American resources on a large scale and that the best way "of eliminating waste in natural resource use [was] through government intervention" (Mason 1958, p. 160).¹¹ This movement gained much political traction through President Theodore Roosevelt's 1908 Governors' Conference; a gathering convened to "prevent the advent of a woodless age, and defer as long as possible the advent of an ironless age" (Roosevelt quoted by Nolan 1958, p. 51). The dominant perspective at this meeting was summed up as follows by Frederick Winslow Taylor (1911, non-paginated) in the introduction to his best-selling *Principles of Scientific Management*: "We can see our forests vanishing, our water-powers going to waste, our soil being carried by floods into the sea; and the end of our coal and our iron is in sight." The next year, the President of the New York Zoological Society (and Fairfield Osborn's father) Henry Fairfield Osborn similarly observed that, with the exception of conservation areas, nowhere was "nature being destroyed so rapidly as in the United States." As he put it, not only did "vulgar advertisements hide the landscape," but "air and water are polluted, rivers and streams serve as sewers and dumping grounds, forests are swept away and fishes are driven from the streams. Many birds are becoming extinct, and certain mammals are on the verge of extermination."¹²

It is probably fair to say, however, that it was not until the publication of Osborn's and Vogt's books that a Malthusian revival took hold of a significant segment of the American population. As the historian Samuel P. Hays (1958, pp. 41–42) observed a decade after their original publication:

"[On] the whole the atmosphere of the years since World War II has shifted, I believe, from optimism to a guarded pessimism. We think less of possibilities and more of limits; we think less in terms of

human betterment, and more in terms of human survival. The unlimited horizons of technology are less often in our minds today than the compulsive use of technology in a race toward world suicide. This new emphasis appeared soon after World War II in two popular books, William Vogt's *Road to Survival* and Fairfield Osborn's *Our Plundered Planet*, both of them infused with Malthusian pessimism, both emphasizing the enormous problem of population growth and the world's limited food supply. Both warned that technology was not enough; resources were not unlimited; the pressure of population itself must be reduced. The increasing emphasis on national security augmented this sense of the limits, rather than of the opportunities of resources, of the need to husband rather than to develop, of the need to stockpile and save."

2. Biographies and backgrounds

Life and work

William Vogt was born on May 15, 1902, in Minneola, New York. After graduating with honors in 1925 from St. Stephens (now Bard) College, he was, among other things, an early opponent of marshland drainage for mosquito control and later assumed a series of positions that gave him the opportunity to further pursue his interests in birds and the environment. In 1942, the focus of his career shifted from studying animals to man, when as Associate Director of the Division of Science and Education of the Office of the Coordinator in Inter-American Affairs, and then with his appointment as Chief of the Conservation Section of the Pan American Union, he was given the opportunity to study the relationship between climate, population and resources, as well as directly observe the devastating and widespread poverty of various Latin American countries. These experiences formed the background to the perspective he later elaborated on in his *Road to Survival*, a book motivated by his strong belief that then-current trends in fertility and economic growth were rapidly destroying the environment and undermining the quality of life of future generations. Vogt's most significant contribution was to link environmental and perceived overpopulation problems, warning in no uncertain terms that current trends would deliver future wars, hunger, disease and civilizational collapse.

The publication of the *Road to Survival* soon provided Vogt with the credibility to contribute to population

debates in various high profile roles. From 1951 to 1962, he served as a National Director of the Planned Parenthood Federation of America. In 1964, he became the Secretary of the Conservation Foundation, and until his last days, served as a representative of the International Union for the Conservation of Nature and Natural Resources to the United Nations. Upon his death on July 11, 1968, he was remembered for the provocative questions he had dared to ask and for tackling a subject matter that remained shrouded in controversy.¹³

For his part, Henry Fairfield Osborn Jr. was born on January 15, 1887, in Princeton, New Jersey. Writing under the name Fairfield Osborn and known as “Fair” to his friends, he was part of the wealthy and influential Osborn clan and the son of Henry Fairfield Osborn, a prominent paleontologist, eugenicist and “distinguished Aryan enthusiast” (Gibson 2002, p. 38).¹⁴ Osborn Jr. originally became interested in science after accompanying his father on field trips throughout his youth. After obtaining his Bachelor of Arts from Princeton University, he went on to study biology at Cambridge University, but then pursued a career in international business. Towards the end of the First World War, he served briefly as a Captain in the United States Army, after which he returned to private enterprise. In 1935, he retired and devoted himself to environmental causes. He continued in his capacity as secretary and board member of the New York Zoological Society, a position he held from 1923 until 1940, when he was named president and board member, a position he held for the rest of his life.

Like Vogt, Osborn’s public profile increased dramatically with the publication of *Our Plundered Planet*. He is also remembered for being an early opponent of synthetic pesticide use, for producing several films dealing with endangered species, flood control and water resources, as well as for his second book, *The Limits of the Earth* (1953), and a collection of short essays he edited under the title of *Our Crowded Planet* (1962). From 1948 to 1961, he served as the first president of the Conservation Foundation, an organization he founded with a number of like-minded colleagues to raise awareness about ecological problems. Upon retiring as president, he served as chairman of the board of this organization from 1962 to 1969. From 1950 to 1957, Osborn was also a member of the Conservation Advisory Committee for the U.S. Department of the Interior, while simultaneously serving on the Planning Committee of the Economic and Social Council of the United Nations. In 1965, he helped establish the Institute for Research in Animal Behavior. Upon his death in New York City on September 16th, 1969, he was remembered for playing a valuable role in a number of conservation

organizations and for his outreach initiatives to warn of the dangers of uncontrolled population growth and to promote responsible natural resource consumption.¹⁵

Despite coming from very different backgrounds, Vogt and Osborn became inextricably linked by the commonality of their work and recognized the benefits of working together to achieve their shared goals.

‘Proto-environmentalist’ Influences¹⁶

While Vogt and Osborn’s books were important influences on the development of later environmental thought, they were, like future generations of environmental activists, part of a long lineage that could be traced back to Malthus, his predecessors and his intellectual progeny, as well as writers and activists such as Ralph Waldo Emerson, Henry Thoreau, George Perkins Marsh, John Muir, Gifford Pinchot and Aldo Leopold. Both men claimed similar mentors, friends and intellectual frameworks, as well as of having been inspired by books such as Guy I. Burch and Elmer Pendell’s overpopulation tract *Population Roads to Peace or War* (1945) and Paul Sears’ analysis of dust bowls in *Deserts on the March* (1935). Also notable was G. V. Jacks and R. O. Whyte’s (1939) *The Rape of the Earth: A World Survey of Soil Erosion*,¹⁷ a synthesis of a large literature that essentially blamed unsophisticated cultivators for initiating a cycle of forest clearance, shifting agriculture, and the creation of grasslands through repeated burning, which eventually led to widespread soil erosion and exhaustion, ultimately resulting in desertification.¹⁸

Another important strand of policy writings was the game-management literature of the 1930s that documented and discussed early and well-publicized conservation experiments, such as in the Kaibab forest on the north rim of the Grand Canyon, where ecosystems collapsed due to a population explosion of herbivores that were no longer kept in check after their predators had been systematically removed (McCormick 1989; 2005). Various New Deal initiatives in the public planning of land use and restoration, such as the creation of the Tennessee Valley Authority, the Civilian Conservation Corps and various policies to address the “dust bowls” of the time, were also influential on their thinking.

Osborn and Vogt’s intellectual outlooks, however, were formed not only by Conservation thinking and New Deal experiments, but also by one of the most influential movements of the first half of the twentieth century, eugenics.

Eugenics

In his classic *The Republic*, written in about 380 B.C., Plato suggested that improving society was in and of itself insufficient without the development of what would later be known as 'genetically improved' human beings. Modern 'eugenics' (in Greek, 'good breeding') would be founded on this premise by Sir Francis Galton in his 1883 book, *Inquiries into Human Nature*, in which he argued on behalf of improving human populations' intelligence, cultural talents, physical strength and dexterity, which he thought to some extent 'breedable.' More importantly, Galton believed that mankind was beginning to interfere with the mechanisms of natural selection through improved public health measures and, as a result, that coercive approaches were required to stave off its perceived deterioration and improve its chances of survival. In short, while Darwin imported concepts from the field of economics and applied them to biology, his cousin Francis Galton proposed that concepts from biology could form the basis of social engineering policies.¹⁹

During the late nineteenth and early twentieth centuries, eugenicists were eager to transform their movement from a purely academic exercise to a practical one through the creation of numerous academic and policy organizations in order to legitimize their science and to lobby governments to implement policies consistent with their theories. While it is beyond the scope of this paper to look into the history of this movement, a brief overview of some remarks made in 1932 by Osborn's father, Henry Fairfield Osborn, is instructive in terms of understanding the growing affinities between eugenicists and conservationists. The older Osborn first observed that eugenics was a "long known and universal law, namely the survival of the fittest and elimination of the unfittest" (quoted by Gibson 2002, p. 37). Attention to this natural law was made mandatory by numerous crises, chief among which were 'over-population' and the "over-destruction of natural resources, now actually world-wide" (idem). The solution, not surprisingly, was "prolonged and intelligent and humane birth selection aided by humane birth control" (idem). In the end, suffice it to say that the 'practical excesses' that it inspired in Nazi Germany's "centers of applied eugenics" (Chase 1977, p. 366) such as Auschwitz, delivered a major blow to both the field and humanity itself.²⁰

In the years following the Second World War, new technologies and medications developed to reduce mortality in environments ranging from tropical islands to mosquito infected marshlands in temperate countries

were about to be exported to less developed regions, virtually guaranteeing a new burst of population growth that would contribute significantly to the large numbers already added in the wake of the Industrial Revolution and nineteenth century globalization (Kasun 2001). Some leaders of the eugenics movement seized on these developments to regain some legitimacy and, in the words of one critic, soon developed "a new package wrapper for their old bill of goods" (Chase 1977, p. 369), i.e., the unsustainable demands these new mouths would soon place on already rapidly depleting natural resources and amenities. Osborn Jr. and Vogt, both previously involved in the eugenics movement, would pioneer the development of what would later be referred to as "neo-Malthusian ecology" (Foster 1998). The eugenics roots of modern environmentalism, however, would quickly (and conveniently) be forgotten in later years, despite the fact that any writing or movement that sprang from such a lineage should have been examined carefully. With these considerations in mind, we now turn to a brief summary of Osborn's and Vogt's rhetoric and key arguments.

3. Scope and urgency of environmental crisis in Osborn's and Vogt's work

Neither Vogt nor Osborn needed a picture of the Earth from space to describe a finite and increasingly fragile planet that was being ransacked by an ever increasing number of (if only temporarily wealthier) human beings. In Osborn's (p. 33) words, "so it is that the earth is constantly becoming smaller, or rather our knowledge of it is leading us to think of it as diminishing rapidly, which, after all, amounts to one and the same thing." Vogt (p. 285) echoed this sentiment, writing that humanity formed "an earth-company, and the lot of the Indiana farmer can no longer be isolated from that of the Bantu," a fact that was true not only in a "mystical" brotherhood-like sense where the suffering of starving babies half-way around the world should concern Americans, but "in a direct, physical sense" as environmental degradation on the other side of the globe ultimately affected the living standards of citizens located in the most advanced economies.

Osborn

Osborn's underlying premise was that human beings had allowed themselves to be blindsided by their own

accomplishments, and were unaware of the true extent of the damage inflicted on the planet in the process. Even specialists in a wide range of disciplines – from agronomy, biology and chemistry to politics and economics – while familiar with specific issues within the confines of their own expertise, lacked the necessary global perspective to fully appreciate the scope of the catastrophe. As such, it was “amazing how far one has to travel to find a person, even among those most widely informed, who is aware of the processes of mounting destruction that we are inflicting upon our life sources” (p. 194). So damaging was this widespread phenomenon that he deemed it “eventually [more] deadly” than the Second World War (p. vii), for “man’s destructiveness has turned not only upon himself but upon his own good earth – the well-spring of life” (p. 11).

Of course, humanity’s misuse of the land dated back to the “earliest periods of human history” (p. 89), leaving in its wake a “very large proportion of the originally habitable areas” already so misused that it was “sterile, barren [and] beyond reclamation” (p. 36). Recent acts of destruction, however, were unsurpassed in scale, and it had “been estimated that there has been a greater loss of productive soil in the last few decades than the accumulated loss in all previous time” (p. 69). Even recent accomplishments in the world’s agricultural superpower, the United States, was one “great illusion” for the “story of our nation in the last century as regards the use of forests, grasslands, wildlife and water sources is the most violent and the most destructive of any written in the long history of civilization” (p. 175). It was therefore futile to cling “to the feeling [that] there must be some continent where the relationship between man and nature is not out of balance” (p. 166). In this context, man’s “avoidance of the day of atonement that is drawing nearer as each year passes” implied that he had to quickly learn “to work with nature in understanding rather than in conflict” (p. 5). Failure to change would not only “point to widespread misery such as human beings have not yet experienced,” it would also, in the end, threaten “even man’s very survival” (p. ix). Humanity had “now arrived at the day when the books should be balanced” (p. 43).

Vogt

Vogt’s thesis was perhaps expressed most concisely by the influential financier and political advisor Bernard Baruch in his foreword to *Road to Survival*: “Because of the great abundance of the earth’s resources we have taken them

for granted. But now, over most of the globe... we are face to face with a serious depletion of ‘resource capital.’ More than one country is already bankrupt.” While such bankruptcy had “wiped out civilizations in the past; there [was] no reason for thinking we can escape the same fate, unless we change our ways” (p. ix). Decreasing returns could be found everywhere, for widespread mismanagement had reduced much of the earth’s productivity to such an extent that “what one man-hour of labor could formerly produce, now requires ten, fifty, or even a hundred man-hours” (idem).

Vogt’s conviction that past beliefs in progress or admonitions to be fruitful and multiply could provide no useful guidance for the postwar era is pervasive throughout his book. Dominant ideas evolved twenty centuries ago, while “magnificent in their days,” had now become “millstones about [human] necks” and would most certainly turn out to be “idiotic in an overpeopled, atomic age, with much of the world a shambles” (p. 56). “We must accept change,” he wrote, and “adjust our lives to it, if we are to survive,” while a failure to understand some basic relationships “of man with his environment” would “almost certainly smash our civilization” (p. xiii).

Indeed, not unlike a parasite whose destructiveness “is limited by the absence of intelligence,” humans used their brains to “tear down,” basically becoming organisms willing to enrich their lives, at least temporarily, “by destroying the environment indispensable to [their] survival” (p. 95). For example,

“The end of the Babylonian Empire is usually written in terms of wars with the Persians. Little or no weight is given to the fact that Ur, the great city of Abraham and once a thriving seaport, now lies 150 miles within a sterile desert. The goat and the ax, driving the sands down to the coast, were far more destructive weapons than the horses and javelins of the conqueror Cyrus. Hannibal had an empire worth fighting for, and the means of supporting a powerful army. Today the very habitat of the elephants that were his tanks and half-tracks has been overwhelmed by desert sand, and even the elephants are no more. Cato, in his bitterest brooding, could not have foreseen such utter destruction. The history of Babylon, Assyria, Carthage, China, Spain, Britain – and of the United States – is meaningless unless it is related to the way the peoples of these countries have treated the plants on which they depend. Indeed, most of the history that has been written on these areas gives a picture as distorted as a Picasso drawing, because it blindly

ignores the part that plants and their habitats have played in man's story." (Vogt, p. 19)

A similar fate plagued the native inhabitants of areas later known as Mexico, Honduras and Guatemala, where the "populations exceeded the carrying capacity of the land" after they had abandoned hunting and turned towards agriculture (Vogt, p. 40). None, however, had done more damage than the Europeans, "one of the most destructive groups of human beings that have ever raped the earth" (p. 114). Throughout the nineteenth and twentieth centuries, they had destroyed the environment "with the seemingly calculated inexorability of a Panzer division" (p. 32). Their destructive behaviour had global repercussions. For example: "never before [had] the hydrologic cycle been badly dislocated in the presence of so many hundreds of millions people" (pp. 102–3). It was indeed possible that, in the course of modern American history, more "billions of dollars [had] been spent in an effort to compensate for the abuse of resources than have gone into all our battle budgets, including those of World War II" (p. 123).

If humans were wreaking havoc everywhere, only rarely had they ever learned to stabilize or rebuild. Typically, ecological collapse inexorably followed so-called "civilizational progress." With rare exceptions, man had "taken the bounty of the earth and made little or no return" (p. 110). Where he had not lost water and soil, he had "overgrazed and overcropped, and by the removal of animals and plants, [had] carried away important soil minerals, broken down the all-important soil structure, and generally exhausted the environment" (idem).

In short, mankind had for all intents and purposes "backed itself into an ecological trap" while, figuratively speaking, living on promissory notes (p. 284). All over the world, however, the "notes [were] falling due" and payment could not "be postponed much longer." Fortunately, there was still an option between "payment and utterly disastrous bankruptcy on a world scale." In Vogt's opinion, it was certainly "more intelligent to pull in our belts and accept a longer period of austerity and rebuilding than to wait for a catastrophic crash of our civilization" (p. 284), earnestly believing that "a fall in living standards [was] unavoidable" (p. 80). Indeed, the human race was "caught in a situation as concrete as a pair of shoes two sizes too small" and there was no need to blame "economic systems, the weather, back luck, or callous saints" (p. 288). Unless the human race rapidly readjusted its way of living to "the imperatives imposed by the *limited* resources of [its] environment" it might as well give up all hope of continuing to enjoy a civilized

existence. "Like Gadarene swine, we shall rush down a war-torn slope to a barbarian existence in the blackened rubble" (idem).

This state of affairs, of course, called not only for clear-head analysis, but also for immediate and drastic actions. We now turn to a brief summary of Osborn and Vogt's diagnosis and remedies.

4. Causes of environmental crisis in Osborn's and Vogt's work

Osborn and Vogt's central argument was obviously along the lines of 'insufficient resources and too many people,' but in their minds a catastrophic situation had been made even worse by technological developments and greed. As Osborn (p. 201) put it, "the tide of the earth's population is rising, the reservoir of the earth's living resources is falling." In Vogt's (p. 194) terms, "the earth is not made of rubber; it cannot be stretched; the human race, every nation, is limited in the number of acres it possesses. And as the number of human beings *increases*, the relative amount of productive earth *decreases*, by that amount."

Resource scarcity

Like several writers before and after them, Osborn and Vogt viewed the physical finiteness of the Earth and its ecosystems as imposing some absolute limits on the scale and scope of human development. Unfortunately, in Osborn's (p. 41) opinion, "most people still have the notion that the living resources of the earth are illimitable and that they can be drawn upon as if there were an endless reserve." And yet, if population pressures and their attendant appetites for resources had "long been recognized as one of the major causes of war," there was "scarcely any recognition of the self-evident fact that such pressures are the major cause of the world-wide depletion of the natural living resources of the earth" (idem). Indeed, there could be little doubt that in light of trends then observable, such disturbances "will unquestionably increase in violence, even to the point of social disintegration" (Osborn, p. 30).

Perhaps most damaging was humanity's historical lack of understanding of rainfall and water management. This had not only "wasted millions of acres of land, caused sharp drops in crop yields, raised the crests of floods, starved cattle, spread deserts over the face of the earth, and launched ancient wars," but also led to such

mistaken beliefs as the notion that the “European and American economic system is applicable to the rest of the world,” a delusion that was at best, the “hidden seed of future wars” (such as when “the petroleum famine overtakes us, or as the necessity of importing gasoline or refining it from coal or shale boosts its price” (Vogt, p. 147)) and at worst, would result in “the collapse of our civilization” (Vogt, p. 81).

Of course, the main reason why the Europeans – and to a lesser extent the Japanese, who possessed the “inconsiderable psychological advantage of being accustomed to a lower standard of living” (Vogt, p. 72) – had in time “enrolled under the banner of Dr. Pangloss”²¹ (Vogt, p. 68) rather than the theories of the “clear-sighted English clergyman” Dr. Malthus (p. 72) is that they had been awash in “the bounty from the New World cornucopia” (p. 63) and had increasingly come to depend on imports from distant lands ranging from Africa to Australia and Latin America. Unbeknown to most of them, however, was that sugar production “was wearing out the soil in the West Indies and coffee... ripping down hillsides from Guatemala to Brazil” (p. 63), while other imports came at the cost of “gullies in Georgia, dongas in South Africa, barrancas in El Salvador, floods in Missouri, [and] dust storms in the Tasman Sea” (Vogt, p. 68).

Overpopulation

Osborn and Vogt saw population growth as the main cause of environmental destruction. Once, Osborn (p. 91) believed, “man’s numbers were limited, and up to historic times he had plenty of land to support him adequately without allowing that land to become depleted,” or, in Vogt’s (p. 94) opinion, at least for “extremely long periods of time.” This balance was lost as the development of agriculture and the “inclination of people to concentrate” in some geographical areas became clear (Osborn, p. 92). The “violent explosive upsurge in human numbers” (Osborn, p. 39) that coincided with the end of widespread and recurring famines in some parts of the world throughout the early decades of the nineteenth century, however, was the most worrisome development of all.

According to Vogt (p. 287), the “history of the future” – or at least the coming decades – had already been written. This basic idea could be conveyed using a simple graph with one curve being the human population that, “after centuries of relative equilibrium, suddenly began to mount, and in the past fifty years had been climbing at a vertiginous rate.” The other curve would symbolize

natural resources such as the “area and thickness of our topsoil, the abundance of our forests, available waters, life-giving grasslands, and the biophysical web that hold them together.” With the exception of “local depressions,” this curve had also maintained a “high degree of regularity through the centuries,” but it too had begun to sharply diverge, “especially during the past hundred and fifty years,” after which it “plung[ed] downward like a rapid.” The fact that these two curves “have long since crossed” and were ever more rapidly “drawing apart,” was becoming increasingly more obvious with each passing day (*idem*).

In places like Mexico, “the pressure of an increasing population, combined with the mounting injury to existing cultivable areas by erosion, is forcing people to use land that is totally unadapted to the growing of crops and at the same time is compelling the country to rely on imports for much of its basic food supply” (Osborn, p. 170). While its situation might not have seemed as dire to the casual observer, “unfortunately... in spite of the war, the German massacres, and localized malnutrition, the population of Europe, excluding Russia, increased by 11,000,000 people between 1936 and 1946” (Vogt, p. 199). Even a resource rich country like the United States was already “overpopulated from the standpoint of per capita economic welfare” and could conceivably benefit from reducing its population by a third – from 150 million individuals to 100 million (Vogt, p. 147). Indeed, Osborn (p. 40) feared an increase in conflicts and bloodshed at the prospect that the world’s population would reach the three billion mark by the middle of the twenty-first century. Be that as it may, the “mounting destruction... inflict[ed] upon our life sources” and the “vast surges and pressures of increasing populations” were “conditions that need to be thought of together, not separately” (Osborn, pp. 194–195).

Not surprisingly, both Osborn and Vogt’s writings on population and resource availability reflected the thinking of wildlife managers. For example, Vogt (p. 206) chastised the authors of a report written for the UN Food and Agricultural Organization on the prospects of post-WWII Greece because it didn’t contain any “suggestion that a positive effort be made to reduce the breeding of the Greeks. How a group of scientists would justify such an omission on any rational grounds it would be interesting to know; such neglect would disqualify a wildlife manager in our most backward states!” The logical conclusion that could be derived from this premise was that rich countries like the United States “should [not] subsidize the unchecked spawning” of the inhabitants of poor countries like India and China until they had

adopted a “rational population policy” (Vogt, p. 77). Indeed, a high death rate could even be considered “one of the greatest national asset” of poor economies (Vogt, p. 186), while pests like tsetse flies and malaria carrying mosquitoes²² could be thought of as “blessings in disguise” as well as the “protector of important resources” (Vogt, pp. 28–31). Failure to keep populations in check would deliver results similar to those observed earlier in the British Raj:

“Before the imposition of *Pax Britannica*, India had an estimated population of less than 100 million people. It was in check by disease, famine, and fighting. Within a remarkably short period the British checked the fighting and contributed considerably to making famines ineffectual, by building irrigation works, providing means of food storage, and importing food during periods of starvation. Some industrialization and improved medicine and sanitation did the rest. While economic and sanitary conditions were being “improved,” the Indians went to their accustomed way, breeding with the irresponsibility of codfish; as Chandrasekhar points out, sex play is the national sport. By 1850 the population had increased 50 per cent; by 1950, according to State Department estimates, the population of India will be over 432,000,000. The dilemma is neatly stated by Dr. Chandrasekhar, who says: “India’s population today exceeds 400 millions and at the lowest minimum of 1,400 calories she can only feed less than 300 million people!... more than a hundred million people... are either starving or on the brink of starvation.” (Vogt, pp. 226–227)

Fortunately, “British withdrawal from India may well result in the reversal of the population trend that this country so badly needs if her people are ever to achieve a reasonably decent standard of living” (Vogt, p. 237). Similar results could be observed in African colonies where Europeans had “temporarily removed the Malthusian checks” when they had “put down tribal wars, destroyed predators [and] moved enough food about the continent to check famine” without substituting “constructive measures to balance [their] destruction of the old order” (Vogt, p. 260). The introduction of new cultivars was similarly destructive in the long run. For example, Vogt (p. 33) believed that corn had probably caused more misery than syphilis, another potent contribution of the New World.

Measures to alleviate human suffering, such as the

“flank attack on the tsetse fly with DDT or some other insecticide” carried out by “ecologically ignorant sanitarians, entomologists, and medical men” (Vogt, p. 257), was therefore worse than doing nothing. In chilling paragraphs reminiscent of what would later come to be known as “lifeboat ethics” and the “economics of spaceship earth,”²³ Vogt (p. 13) didn’t see “any kindness in keeping people from dying of malaria so that they could die more slowly of starvation.” Indeed, the modern medical profession was setting the stage for a disaster of epic proportions by continuing to believe that it had “a duty to keep alive as many people as possible” and, “through medical care and improve sanitation,” being responsible “for more millions living more years in increasing misery” (p. 48). Actually, public sanitation and agricultural improvement campaigns in places like El Salvador, India and Puerto Rico, amounted to nothing short of “brutally misguided well-doing” (p. 179). One should instead take inspiration from Ancient Greece where the constant threat of overpopulation was “purposefully reduced” through “prostitution, infanticide, emigration and colonization” (p. 58) and conclude that if the conflict between communists and nationalists would in all likelihood result in the “horror of extensive famines in China within the next few years” it might well be, from a broader perspective, “not only desirable but indispensable” (Vogt, p. 238).

5. Economic development in Osborn’s and Vogt’s work

Osborn and Vogt’s writings reflected the dislike of the profit motive and technological change that was characteristic of proto-environmentalist writings. Not surprisingly, they similarly called for more and better public management rather than greater reliance on market incentives. Interestingly, however, they also discussed concepts later known as the ‘Tragedy of the Commons’ and ‘perverse subsidies.’

Technological change

Both Osborn and Vogt shared a profound scepticism – if not overt dislike – of the alleged benefits of most scientific advances and technological innovations, at least inasmuch as they could be conceived by some as helping to reconcile economic development, population growth and environmental remediation. Apart from the fact that the development of sanitary technologies increased the

number of hungry mouths, the most damaging historically had been “the four fundamental tools of modern culture,” namely fire, the plough, the axe and the firearm. Despite short-term benefits, each of these had over time resulted in “despoiled forests, erosion, wildlife extermination, overgrazing, and the dropping of water tables” and the consequent reduction of productivity in “some of the most fertile and productive regions of the earth” to levels almost comparable to those observed in “the Gobi or the tundras in Siberia” (Vogt, p. 33).

Recent technological developments only aggravated these trends. According to Osborn (p. 201), “technologists may outdo themselves in the creation of artificial substitutes for natural subsistence, and new areas, such as those in tropical or subtropical regions, may be adapted to human use, but even such recourses or developments cannot be expected to offset the present terrific attack upon the natural life-giving elements of the earth.” Vogt (p. 147) similarly considered agricultural mechanization “of dubious value to the land, as it is more purely extractive than older methods” for one did “not find a manure pile outside the tractor shed”; brought lesser quality land under cultivation; was too dependent on rapidly dwindling petroleum reserves; and triggered a drift away from rural to urban areas, thereby reducing “the effectiveness of the self-contained rural population as an economic shock absorber” during future recessions.

The first industrialists could rely on “an abundance of new land and unexploited resources” and had, as a result, “undoubtedly raised potential living standards” if only for a few individuals (Vogt, pp. 74–75). By the middle of the twentieth century, however, worldwide environmental destruction – again, much of which had been instigated and caused by Europeans relying on the lands of others – was too serious to allow this process to go on much longer, as it had been nothing but a “stopgap, a means of postponing the day of reckoning” (Vogt, pp. 77–78). Indeed, “by the use of machine, by exploitation of the world’s resources on a purely extractive basis, [humans] had postponed the meeting at the ecological judgement seat. The handwriting on the wall of five continents now told [humans] that the Day of Judgment is at hand” (Vogt, p. 78).

In Osborn’s (p. 199) words, the “grand and ultimate illusion would be that man could provide a substitute for the elemental workings of nature.” For instance, “chemical fertilizers alone [could never] be thought of as substitutes for the natural processes that account for the fertility of the earth,” for in the long run “life cannot be supported... by artificial processes” (Osborn, p. 68). Even the increased life span observed in many countries was

illusory, for it hid “evidences of a slow, silent, pervading deterioration of human health” through the “appearance of a whole series of ‘new’ illnesses” commonly referred to as “degenerative diseases” (Osborn, p. 85).²⁴

Both Osborn and Vogt essentially viewed industrialization and urbanization as parasitic to natural and agricultural wealth.²⁵ In Vogt’s (pp. 43–44) perspective, the farmer “is far more useful, productive, able and hard-working a member of our society than the vast majority of businessmen” and without the ‘agricultural revolution’ that preceded it by about a century, the industrial revolution “might well have been stillborn” (p. 59). In the meantime, the “growth of cities and extension of highways” shrank the amount of land available, thereby reducing its “potential carrying capacity” (p. 59). Furthermore, had “the parasite of European industrial development not been able to sink its proboscis deep into new lands, world history would have been very different. Enormous populations, heavy industry, social and economic pressures could not possibly have developed into the great carbuncle that exploded as World War I” (Vogt, p. 69).

Interestingly, and despite the fact that the publication of their books coincided with the awarding of the Nobel Prize in Physiology or Medicine to DDT’s inventor Paul Müller, both Osborn and Vogt were highly sceptical of DDT long before the publication of Rachel Carson’s *Silent Spring*. As Osborn (p. 61) put it, while DDT might seem a “cure-all,” some initial experiments had shown it to be “withering to bird life as a result of birds eating the insects that have been impregnated with the chemical.” The careless use of this substance could also result in the destruction of “fishes, frogs and toads, all of which live on insects.” Vogt (p. 30) was somewhat more nuanced when he denounced the “widespread and unselective use of DDT” that destroyed not only pests, but also valuable insects which “pollinate fruit trees and parasitize destructive insects.”

Profits and institutions

While Osborn (p. 183) was emphatic that “the profit motive, if carried to the extreme, has one certain result – the ultimate death of the land,” this perspective is more developed in Vogt’s (pp. 34–37) section on “profits are loss” in which he argues that “the methods of free competition and the application of the profit motive have been disastrous to the land” as people operating under “so-called economic laws” have generally disregarded “the physical and biological laws to which [the land] is

subject. Man assumes that what has been good for industry must necessarily be good for the land. This may prove to be one of the most expensive mistakes in history."

Osborn and Vogt's dislike of free markets stemmed in part from their abhorrence of popular consumerism and its attendant "gadgetry," such as "pulp-paper ordure of 'love' stories, crime tales, and 'comics' valuable enough to justify extirpation of the world's forests" and "unessential electrical knickknacks, industries, and the hydroelectric power necessary to operate them," the result of which being that the United States exhibited "one of the highest insanity rates in the world" (Vogt, p. 38). Of course, these vulgar pleasures resulted in part from the impossibility of assigning "a cash value to the heart's lift at the flash of a scarlet tanager, the outpoured song of the solitaire, the towering of white ibises over the Everglades, or even the homely chattering of the dooryard wren" (Vogt, pp. 129–130). Unfortunately, when touched by colonization, the native population exhibited much the same tendency to show off its newfound wealth, which often took the form of new cattle acquisitions that ultimately resulted in the "destruction of [its] capital, in terms of pasturage, fertility, and available water resources" (Vogt, p. 262).

Also significant in shaping their intellectual outlook was their observation of the environmentally destructive practices of the American "stockmen and sheepherders... [who] deteriorate and destroy the grasses, expedite erosion, and contribute to flood peaks... [and] exist by destroying the means of national survival," the "cut-out-and-get-out lumberman," the "wheatgrower who recklessly sets the trigger for a new dust-bowl explosion," the "hunter or trapper who takes more than his share of *surplus* animals," and "the farmer who exhausts his soil and fails to utilize soil-stabilization methods" (Vogt, p. 145). Of course, "renewable resources" were only renewable inasmuch as they were "managed on a sustainable-yield basis, with the crop restricted to replacement capacity," but unfortunately, Americans had been living on their "resource capital" since 1607 (Vogt, p. 67).

This lack of foresight could also be observed in developments motivated by the "desire for national enrichment" and "the wish to gain profit from the soil" in peripheral economies (Osborn, p. 110). For example, in Egypt, year-round irrigation had been substituted for the traditional basin or flood time irrigation "to support the profit motive, namely the growing of cash crops such as cotton and tobacco for export." As a result, Egyptian soil was "steadily deteriorating" and the "cotton yields are falling!" Similar practices could also be observed in overgrazed grasslands "where herdsmen try to maintain the largest possible number of animals on a limited

range, grazing at all times, seasonable and unseasonable, and so destroy the grass and bushes to such an extent that nothing is left but nearly barren ground" (Osborn, pp. 54–55). In Osborn's (pp. 158–159) opinion, the situation which "better exemplifies the dire consequences of over-using the land for purposes of trade and profits" was the Australian sheep industry where a consistent effort had been made "to gain from the land more than it is capable of producing." Unfortunately, the day "when new fresh lands can be found is now almost over" (Osborn, p. 54).

Apart from 'exporting' the environmental problems of advanced economies, "get rich quick" schemes had also fostered among contemporary Americans a "waster's psychology" that would have "appalled [their] frugal forebears" and was regarded as "lunacy – even criminal lunacy – by people in other parts of the world" (Vogt, p. 67). Among other symptoms of this waster's minder were the "millions of dripping faucets... losing precious water" and the "millions of unneeded electric lights burn[ing], every year, untold thousands of tons of American coal" (Vogt, p. 68).

Osborn and Vogt's take on the environmental impact of the profit motive typically equates free-markets with profits at any costs and by any means, including government subsidies and government-granted privileges, along with environmentally destructive public initiatives that trampled private parties' property rights – in other words, private profits through public losses. Notable examples of this perspective include Vogt's (p. 34) condemnation of businesses that had poisoned "thousands of streams and rivers with industrial wastes" costing "hundreds of cities... millions of dollars so that they may safely drink the waste dumped into the rivers upstream" (p.34), and of typical private farming responses to fluctuating prices: "food prices rise and so does the world demand for food; the farmer overstocks his pastures, plants every available inch of marginal land to cash in 'while the going's good.' Prices fall and he loudly cries that he cannot afford to improve his land; he must have a subsidy" (pp. 34–35).

Both authors also alluded to the impact of land tenure on its management. For example, Osborn (p. 143) observed that historically much European land "was not as a rule held in great tracts by any one person, but was divided up and held in relatively small tracts for the use and benefits of individual owners and their families. Thus, it was protected and cared for." Furthermore, "stone walls as well as thick hedges surrounding most fields have also contributed to the continuance of soil fertility, for there can be little erosion in closely walled fields" (Osborn, p. 153). Of course, other property-rights

based social customs could be damaging to the land, such as a tradition of dividing up the land among children rather than leaving it to one child (Osborn, p. 152).

Vogt (p. 148) similarly recognized that “because sharecroppers and other farm tenants do not have a long-range stake in the land, their tendency – a reflection of our industrial philosophy – is to make as large a profit as possible and to spend on the land as little as possible.” Although he seems to have been supportive of policies that would turn tenants into landowners (p. 148), he was nonetheless more circumspect for, if “in many regions a shift from tenancy to ownership would certainly save large acreages that are becoming marginal, if not desert,” in “other areas, such a change might well tend to have the opposite effect” (p. 28). A case in point was Zapatista’s Mexico where land reform had turned the land over from a few thousand landholders to several hundred times more, but less educated individuals, who were reluctant to change their farming methods. In Vogt’s (p. 173) opinion, “it never occurred to Zapata that ownership of anything as indispensable as land imposes unavoidable responsibility, along with ‘right.’” Indeed, Vogt probably never doubted that professional public land managers freed from political pressures would achieve better results than less-educated private owners, such as could be observed in the nationalization and subsequent management of the Peruvian guano islands (pp. 183–186).²⁶ Interestingly, this seems to have also been Osborn’s (p. 126) perspective when he observed in the Russian context that “cultivating the land in small strips under earlier peasant ownership left the agricultural areas more defenceless against drought than the present-day collective farms” which benefited from “more intelligent methods such as the more extensive planting of winter crops, earlier spring planting and the cultivation of types of crops that are most capable of resisting drought conditions.”

As can be expected, various ‘tragedy of the commons’ scenarios – or more accurately tragedies of open access or mismanaged commons – were also discussed by both authors. For example, Vogt (p. 35) wrote that “industry has been allowed to treat our underground water supplies as though they were inexhaustible, and the prosperity and possibly the existence of many of our cities have been jeopardized through waste of waters,” while “commercial fishermen, assuming the pirate’s prerogative to take whatever he can get, have reduced the populations of several important fishes to a point where it is no longer economically possible to take them.” Indeed, because numerous American landowners had been plunged into bankruptcy by reckless environmental

mismanagement such as “the removal of forest cover on an upper watershed [that] will inevitably damage the water supply in the valley below,” Osborn (pp. 191–192) thought it obvious that there was “nothing revolutionary in the concept that renewable resources are the property of all the people and, therefore, that land use must be co-ordinated into an over-all plan.” Indeed, this principle has been recognized in other democracies, such as in Western Europe, and in the United States through the Tennessee Valley Authority. Actually, there were now real grounds for hope in the United States as within “the last decade more has been accomplished than in all previous years of our history. Federal and state agencies are steadily doing more effective work and unlimited credit should be given to the able and intelligent men who are accomplishing everything within their power to save America for its future children” (Osborn, p. 196). But then Osborn (p. 197) asked rhetorically “Why should government do it?” in the land of free enterprises? Unfortunately, as it turns out, relying upon individual initiative could “only be counted upon when there is general public understanding of a situation and of the means of dealing with it,” but this knowledge was lacking among the increasingly urbanized American population.

Interestingly, both authors were well aware of the reality of political management and the widespread impact of what would now be referred to as ‘rent seeking’ and its attendant ‘perverse subsidies.’²⁷ A well-documented historical case to this effect was the medieval Spanish migratory shepherders’ institution known as the ‘Mesta’ whose members had been granted several privileges at the expense of the settled population by Spanish rulers hungry for wool-derived revenues. These privileges included “cutting small trees and branches to supply their needs in fuel and fodder as they went along” which seems “to have been the beginning of misuse of the untenanted lands through which they passed.” Other privileges included the fact that “common lands in some cases were thrown open to the shepherds, taxes for their use or their non-use were levied, and the money collected reverted to the crown or to political agents of the rulers.” As a result, “everywhere land was overgrazed, forests were burned off to provide extra pasturage, young trees were cut down for fodder or firewood, and the desperate cycle of greed and overuse and erosion was set into motion.” Although the Mesta was eventually overthrown, it was not before “it had in all too real a sense overthrown the balance of man and nature in Spain” (Osborn, pp. 148–151).²⁸

Far from being an exception, the Mesta was a harbinger of things to come, inasmuch as the “people of other

countries are engaged in just this sort of wastage of their prime resources today. They – and this includes us of the United States – are too near to the picture to realize what is happening” (Osborn, p. 151). A case in point was overgrazing in American public lands that had become so worrisome that the Taylor Grazing Act had to be passed in 1934 to rein in abuses. Unfortunately, “powerful minority groups of cattlemen now dominate[d] its administration, their representatives comprising the personnel of the advisory boards that were established in each of the cattle-industry states.” Not surprisingly, the advisory boards had over the years “acquired sufficient power to greatly influence the regulations, as to both the number of cattle that can graze in a region and the fees for grazing rights to be paid by cattle owners,” which as can be expected, did not impact entrenched interests of those influencing the legal framework (Osborn, pp. 183–184). Of course, a ‘floor’ under wool prices and ‘protective’ tariffs only made things worse by preventing “many woolgrowers [from being] forced out of business” (Vogt, p. 43). But while “reducing herds and importing meat and wool from other countries might [have given] the grass a chance to restore itself,” powerful cattle and sheep interests had successfully nullified “such obviously sound attempts to relieve the strain on American ranges” (Vogt, p. 31).

As could be expected, lumber interests were similarly “striving to effect arrangements so that the profits of their corporations may be assured and, if possible, increased” (Osborn, p. 191). Indeed, in Vogt’s (p. 145) perspective, stock raising, hunting and fishing, lumbering and even much of farming had not only “emptied the bank vaults,” but were now trying to remain relevant by “peddling the desks, chairs, and cuspidors” which, “in our national interest” should be “liquidated, at least in part. In the process, a good many people are certain to be hurt, as in any liquidation. But the longer it is postponed the more people will suffer.”

The absurdity of subsidizing environmental destruction and then asking taxpayers to foot the bill for remediation was certainly not lost on either Osborn or Vogt. In the words of the latter, “western senators advocate enormously expensive Valley authorities, [but] continue to foster overgrazing and erosion of valley watersheds by voting for sheepmen’s subsidies!” at a time when the American school system threatened “to break down because we cannot pay teachers a decent wage, or support hospitals to care for the sick, we are urged to spend billions on people too stupid to stay off flood plains, and on damming rivers that have got out of hand largely because of destruction of forests and grasslands” (Vogt, p. 127). In

the long run, it was difficult “to see any justification for [the] support of extractive overcropping” (Vogt, p. 44).

6. Solutions in Osborn’s and Vogt’s work

In light of their diagnosis and formative influences, Osborn and Vogt’s remedies were fairly straightforward if not always spelled out in much detail. Vogt (p. 264) thus wrote that if “economic, political, educational, and other measures” were indispensable, they would only succeed if “population control and conservation [were] included.” Indeed, economic and political prescriptions that ignored “the ecological” dimension may force “the human race deeper into the mire” (idem). In turn, ecological health was dependent on two factors:

- 1 That renewable resources be used to produce as much wealth as possible on a sustained-yield basis. In other words, wise use to support as high a living standard as possible was desirable, but they shouldn’t be exhausted as there could be no artificial substitutes.
- 2 That demand be adjusted to ‘natural’ supply, either by accepting less per capita (lowering living standards) or reducing population. Since civilization at the end of World War II could not survive a *drastic* lowering of standards, the need for population cuts was unavoidable (Vogt, p. 265)

While Osborn shared this prescription (pp. 194–201) and similarly believed that any real solution would “involve complete co-operation on the part of both government and industry, backed by the public’s insistence that the job shall be done” (p. 200), he was even more emphatic on the need to “arouse public opinion” in terms of the seriousness of America’s (and the world’s) environmental crisis.

Such an undertaking would require “the co-ordinated effort of every group, governmental and private, that is dedicated to the cause of conservation” and would need to be “established throughout our educational system so that coming generations will grow up aware of the situation that lies at the root of the well-being of our nation” (idem). Thanks in part to Osborn, Vogt and their followers’ actions, numerous organizations, from grass-root initiatives to the United Nations, would become involved in this outreach effort in following years and decades.

Although they stumbled upon some of the key insights of the perspective later known as “free-market

environmentalism,”²⁹ neither Osborn nor Vogt seemed to have considered the potential environmental benefits of reduced governmental interventions. A case can nonetheless be made that most of the “free-market practices” they denounced, such as financial and land subsidies to railroad, timber, grazing and other interests, as well as overfishing and overgrazing, can ultimately be attributed to failures to develop adequate market institutions such as private property rights or to let the price mechanism determine resource allocation without political interferences – what Bradley (2009) refers to as “political capitalism.”³⁰ For example, Vogt failed to ask why polluting industries could not be sued for the damage they inflicted upon others – as was traditionally the custom in market economies until these rights had been taken away or drastically curbed by politicians seeking to “balance” economic growth and environmental protection – or why agricultural producers had become so dependent on subsidies or were often taking a short-term perspective on the impact of their activities. While he was well aware that the “subsidized industrialist” and the farmer benefiting from subsidy payments were very keen “to protest any real attempt at free enterprise” (p. 43), he was nonetheless always more inclined to favor greater (but obviously better) as opposed to lesser political management.

7. Reactions to Osborn’s and Vogt’s work

Many reviewers, such as Angus McDonald (1948) in *The New Republic*, often jointly praised the authors for their efforts and overall concerns, but some assessments were mixed and a few were extremely critical. As McCormick (2005, p. 139) observes, the two books “received approval from ecologists and adverse criticisms from soil scientists.”³¹ To give a few examples of the (overall more numerous) positive reception of these works, A. G. Hall (1948, p. 310) in *The Scientific Monthly* proclaimed that Osborn had “performed a task equal in importance to that of the prophets of old,” while in his textbook *Economics*, John Ise (1950, p. 37) wrote that “both of these significant books are brilliantly written and should be read by all who are concerned about man’s future.” John Myres (1949, p. 80) in *Man* observed that *Our Plundered Planet* was “dedicated to all who care about tomorrow” and that the book was helpful in instilling responsibility in the public to live in harmony with nature, rather than continue to indulge in the activities that were imperiling the earth. Indeed, most reviews of *Road to Survival* reached a conclusion similar to the *Blackfriars Journal*’s

writer who claimed that Osborn provided his readers with a “valuable insight into the inter-relatedness of those secondary causes as revealed by the findings of the sciences of biology, ecology and agronomy” (Singleton, 1949, p. 493). The fact that Osborn was somewhat more optimistic than Vogt was reflected in generally more sympathetic assessments, even by writers who disagreed with his analysis (Chase, 1977; Zirkle, 1949).

There were nonetheless a few critical reviews. For example, Conway Zirkle (1949, p. 77) took Osborn to task in *Isis* for several factual errors and misunderstandings that could have been avoided with clearer wording and further claimed his statements often strayed from the truth or were overly general in nature without credible facts to support them. Other reviewers highlighted similar points or faulted Osborn and Vogt for their conclusions and lack of concrete solutions. Interestingly, even William Vogt (1948b, p. 510) criticized his friend Osborn on this point, claiming that while he repeatedly addressed the problems associated with overpopulation, he did not provide a viable solution to keep it from happening. More specifically, Brandt (1950, p. 88) considered Vogt’s stance on agricultural practices and soil conservation no longer completely accurate by 1948 in light of recent advances. Taeuber (1949, p. 825) wrote that soil scientists would most likely find fault with Vogt’s interpretation of basic facts, particularly regarding land use, soil wastage, and the availability of large scale resources for agricultural production in Africa and South America. F. Fraser Darling (1948, p. 262) claimed that while the rationale behind population reduction was obvious to most people, for political reasons no country would want to see their population decline, nor suffer the repercussions if it did.

As Cooke (1949) further observed, placing ecology ahead of other disciplines such as engineering, forestry and agricultural science, precluded the development of multifaceted solutions that alone would prove effective and, in the end, amounted to a utopian dream in light of the fact that ecology would never come to dominate public opinion. Fisher (1949) highlighted Vogt and Osborn’s inability to relate conservation economics to economic theory as a major downfall, particularly in terms of attracting effective public support. Taylor (1949, p. 93) was visibly uncomfortable with Vogt’s stance on how little value he assigned to human lives, especially in less advanced parts of the world, but nonetheless considered laudable his suggestion that the United States should make aid contingent upon an active birth control policy. A French reviewer who was visibly upset by Vogt’s characterization of the Soviet Union as a ‘police state’

wrote that the author's methods, basic mistakes and implicit conclusions were not unlike those of the worse geopolitical writings of pre World War II Germany (George 1951, p. 788).

Three contemporary critical discussions of Osborn's and Vogt's books nonetheless stood out.³² The first significant condemnation of Osborn's and (mostly) Vogt's stance was penned by a *Time* anonymous (1948) reviewer who questioned the political implications of their neo-Malthusian stance and views on soil and population growth. As he put it, if even rich nations had too few resources to keep their populations passably well fed, then what should be done if not go out, conquer and clear other lands of their populations? After all, hadn't Germany, a country that had managed to "stretch" the sandy acres of the Prussian plain through innovative farming practices and highly skilled industry, already gone to war twice because of the unwarranted prevalence of the "slice-of-cake [that can't be grown] philosophy" among its people?

According to the reviewer, Vogt's assertions on soil had by then been totally discredited by "real agricultural scientists" who considered "every main article of the Neo-Malthusian creed" as "either false or distorted or unprovable." Arguing that an acre of soil is limited in terms of its production capacity or biotic potential ignored the fact that humans were capable of improving it. Indeed, only individuals who had turned their back on progress could accept the notion that they would have to adapt to soil patterns for survival. The reviewer also refuted the idea that the productive capability of the world's cultivated lands would continue to fall due to erosion and exhaustion. While Vogt was correct to point out that humans did not maintain soils as diligently as perhaps they could have, he had ignored tremendous recent progress in terms of improving soil quality, in the process delivering increased production capabilities, particularly in the United States.

The same writer criticized Vogt's basic outlook on human reproduction, especially his stance that, as long as food is available, humans would reproduce like 'fruit flies.' The basic problem with this argument was that it had long been known that richer people typically tend to have fewer children despite their access to a more abundant food supply, while the exact opposite was true of poorer classes.³³ If Vogt's argumentation was valid, industrialization should have triggered a rapidly increasing birth rate, but this could only be observed in the early stages of the process, whereas a steady decrease in birth rates was observed afterward. Furthermore, Roman Catholic Ireland had by 1948 achieved population

stability and could boast of having one of the lowest birthrates in the world.

In the end, "real scientists" could only find a few iota of truth in Osborn's and Vogt's "errors, prejudices, mysticism and reckless appeals to emotion." Their "static" philosophy, however, gave "great comfort" to the type of state planner who believed that there were only so many resources available and that whatever was available needed to be strictly controlled. The attending result, of course, was that "any group ruled by this static idea will turn its back on progress and become socially reactionary" (idem).

Interestingly, *Time* published soon afterwards a short rebuttal to this essay written by Karl Sax (1948), then director of the Arnold Arboretum at Harvard University, who argued that while Vogt had "exaggerated the dangers of soil erosion," he had "underestimated the difficulties in the adequate control of population growth and the control of 'moral erosion.'" R. J. McGinnis (1948), then editor of the *Farm Quarterly*, similarly argued in another letter to the editors that while most 'soil men' had never taken the Malthusian framework "too literally," it had nonetheless proven useful in "frighten[ing] farmers into soil conservation." The *Time* editors nonetheless stood by the original review essay, pointing out that the scientists consulted in the preparation of the article (in the US Bureau of Plant Industry, Soils and Agricultural Engineering and in the US Soil Conservation Service) strongly disagreed with Vogt's assessment.

Another interesting follow-up to this controversy took place in November 1948, when the editors of *The Nation* contacted Vogt and offered him the opportunity to publish in their magazine a reply to the *Time*'s review. However, since they had not taken an editorial position on the issue, they intended to solicit comments on Vogt's reply in an effort to represent both sides of the debate. The person who soon followed up on their request was the University of Delaware geographer Earl Parker Hanson,³⁴ whose critique of Vogt's response was reportedly vitriolic. Vogt followed up by submitting another lengthy reply, this time to Hanson's piece, which he later refused to shorten at the behest of *The Nation*'s editors, resulting in the cancellation of the project.³⁵ Had this collaboration not fallen through, it may well have been one of the first times that both sides of the issue would have been debated in a public forum, thereby making them accessible to the layman.

Hanson, however, did not let matters rest and soon afterwards published a book titled *New Worlds Emerging* which he described as a rebuttal to Osborn, Vogt and other "Jeremiahs of geography, sociology and economics"

(Hanson 1949, p. 369). The geographer argued, among other things, that “it is never a land that is over-populated, in terms of inhabitants per square mile; it is always an economy, in terms of inhabitants per square meal” (p. 14). Adopting as his motto Robert Thorne’s 1527 observation that “there is no land uninhabitable, nor sea unnavigable,” Hanson emphasized that much was land still available for development in the Amazon basin and in the lower Arctic (such as in Alaska). Denouncing the “hysteria” into which the modern world was “being stampeded... by the dreadful word *erosion*” (p. 135) and the resurgence of the “old, mechanistic Malthusian doctrine” (p. 12), he had no patience for the notions that natural resources should be conserved “not sanely by way of making the most of them, but hysterically, as an isolated party of explorers might hoard and ration its dwindling food supplies” (p. 12); that people should be considered as “liabilities” rather than “assets and potential resources” (p. 13); or that a region would be considered “over-populated” in terms of a population/space ratio alone without factoring in the potential benefits of economic development (p. 14) that would in time produce “more in order to have more to go around” (p. 370). Indeed, throughout history, humanity had met population increases “not in any one way, but by a complex, interrelated application of three distinct lines of effort, namely migration, change of social and economic organization, and technical invention” (p. 14). Hanson was especially critical of Vogt’s “astonishing... tendency to resent all past progress” and lament that “Adam and Eve [had to leave] the Garden of Eden” (p. 371) without understanding that “conservation on large scale... can only be supported by energetic economic development” (p. 372). As he put it:

“To proclaim a numerical limit on the world’s arable lands, while decrying the technical advances with which that limit can be stretched by many millions of acres, is to turn one’s back on reality. Even birth control on a large scale can be accomplished only by raising standards of living through industrialization. Not only do people need money for buying contraceptives, but they need many children for cheap labor so long as they live in poverty and degradation. They will be more likely to think about having fewer children when they are in a position to worry about sending them to college.” (Hanson 1949, p. 272)

In a later paper, Hanson (1951) would describe the “currently popular Vogt school of demographers and conservationists” as postulating the twin bogeymen of

overpopulation and soil erosion as the prices we must pay for conscious efforts to improve human existence” (p. 48) and describe Vogt as the “modern spiritual descendant” of earlier geographical determinists such as Ellsworth Huntington (p. 45). Interestingly, a comparison of Hanson and Vogt’s books was sometimes an essay topic for geography students in the 1950s (Galloway, 2001, p. 246).

Finally, the Brazilian physician and geographer Josué de Castro’s classic (1952) *The Geography of Hunger*³⁶ also became to a large extent a rebuttal to William Vogt, the “standard-bearer of the neo-Malthusians” who were keen to view “famished populations, raising the pressure of the world by their delirium of reproduction [as] criminals” who deserved “an exemplary punishment” and were “condemned to extermination, either by individual starvation or by controlling reproduction until the born-to-starve disappear from the face of the earth” (pp. 16–17). Raising issues similar to their other critics, de Castro adopted Hanson’s perspective and further illustrated it by the purchase “for nearly nothing” of degraded coffee growing land in around São Paulo by Japanese immigrants who, being experienced in working “thankless soils,” had developed from it a “magnificent green belt” which was then contributing much to the food supply (especially in terms of potatoes and vegetables) of the Brazilian industrial heartland (p. 285). De Castro ended his book by highlighting that the “real road to survival [was] still within the sight of man [and was] marked by the confidence he must feel in his own strength.” As he put it:

“The road to survival, therefore, does not lie in the neo-Malthusian prescriptions to eliminate surplus people, nor in birth control, but in the effort to make everybody on the face of the earth productive. Hunger and misery are not caused by the presence of too many people in the world, but rather by having few to produce and many to feed. The neo-Malthusian doctrine of a dehumanized economy, which preaches that the weak and the sick should be left to die, which would help the starving to die more quickly, and which even goes to the extreme of suggesting that medical and sanitary resources should not be made available to the more miserable populations – such policies merely reflect the mean and egotistical sentiments of people living well, terrified by the disquieting presence of those who are living badly.

The world, fortunately, will not let itself be carried

away by such defeatist and disintegrative conceptions. In spite of their scientific aura, these ideas cannot show us a road to survival. They can only point the way to death, to revolution and to war – the road to perdition.” (de Castro 1952, p. 312)

Reflective conclusion

Reviewing the evolution of the different versions of Malthus' *Essay*, Petersen (1969, pp. 142–143) observes that the first edition was written “with an aggressive confidence, a dashing style that passed over exceptions, anomalies, and minor points, and swept on to the main conclusion with youthful confidence” and that it “brought the author immediate fame and notoriety.” In later decades, however, Malthus would painstakingly refine, expand, update and revise his manuscript, acknowledge predecessors and mistakes, answer critics, and reach more sober conclusions, such as the following:

“On the whole, therefore, though our future prospects respecting the mitigation of the evils arising from the principle of population may not be so bright as we could wish, yet they are far from being entirely disheartening, and by no means preclude that gradual and progressive improvement in human satiety, which, before the late wild speculations on this subject, was the object of rational expectation... And although we cannot expect that the virtue and happiness of mankind will keep pace with the brilliant career of physical discovery; yet, if we are not wanting to ourselves, we may confidently indulge the hope that, to no unimportant extent, they will be influenced by its progress and will partake in its success.” (Malthus 1826, Book IV, Chapter XIV)

Paul Ehrlich's 'explosive' public career, and its attendant fame and fortune, similarly took off at a relatively young age in the wake of a powerful call to action that has been described by otherwise well-disposed reviewers as “unscholarly and occasionally in error” (Luten 1986, p. 298). Unlike Malthus's original essay, however, the Ehrlichs's contribution came on the heels of a debate that had been raging for over two centuries in the Western World and at a time when some of the mistaken assumptions and predictions of Fairfield Osborn Jr. and William Vogt were already apparent. To give but one case, Vogt (p. 169) quoted a report according to which Mexico did not possess more than a third of the land required to provide

its inhabitants with a reasonable diet. He further believed that “Mexico's arable land [was] being rapidly washed into the sea” and that the country was becoming steadily poorer “under the pressure of a rapidly growing population.” In the years between the publication of Vogt's and the Ehrlichs's best-sellers, however, significant scientific advances in plant genetics and production methods completely overturned the situation. For example, the Mexican work of American agronomist Norman Borlaug and his team on the development of semi-dwarf high-yield and disease-resistant wheat varieties resulted in the 1963 Mexican wheat crop being six times larger than in 1944. Soon afterwards, Mexico became a wheat exporting country (Anonymous 1986). Of course, a few years later this know-how was transferred to Pakistan and India where they similarly helped to diffuse the local “population bombs” and earned Borlaug the nickname of “Father of the Green Revolution.”

In light of the Mexican and other cases at the time, it is difficult not to conclude that while the Ehrlichs's overall concerns were legitimate, their rhetorical style and exaggerations weren't. Furthermore, unlike Malthus, they were later in life unwilling to revise their position in light of new evidence and always refused to debate face-to-face their main critic, the economist Julian Simon.³⁷ One also gets an overwhelming sense of *déjà vu* in their more recent work, such as in, for example, their use of “The Population Explosion” as a book title (Ehrlich and Ehrlich 1990) or in comments that hark back to the old ‘erosion literature,’ such as their observation that “the extraordinary expansion of food production since Malthus's time has been achieved at a heavy cost – the depletion of a one-time inheritance of natural capital crucial to agriculture” that amounted in the mid 1980s to an annual loss of approximately 2.4 billion tons of topsoil and “millions of populations and species of other organisms” (Ehrlich *et al.* 1993, pp. 1–2; see also Ridley, this issue). As such, they stuck to the blueprint laid out by Osborn Jr. and Vogt whose *Time* (1948, non paginated) critic accused of constantly claiming “that new and frightening threats have developed recently.”

As Rubin (1994, p. 79) observes, the only things that really sets apart *The Population Bomb* from other contemporary writings on the alleged population-resource problem is its emotional appeal and alarmist tone. It seems hard to deny that this was indeed the main lesson learned by the present generation of environmental writers from the Ehrlichs's success...

Notes

1. See, among others, Booth and Mongillo (2001), DeLeon (1994), Greene (1994) and Rubin (1994) for various discussions of the impact of *The Population Bomb*. Although the name of Paul Ehrlich is the only one appearing on the cover of the book, his wife Anne is described as a virtual co-author in the *Acknowledgements* section. Because of this and their later collaboration on numerous projects, references to the “Ehrlichs’s” book will be made throughout this essay.
2. For example, Yale Law School professor Douglas Kysar (2003, p. 224) describes *The Population Bomb* as “a work that attempted to revive Malthusian concerns about population growth”; the economist Jason Scorse (2008, p. 109) contends that “population growth and its impact on the environment has been a hot topic for decades, ever since Paul Ehrlich’s the ‘Population Bomb’ was published in 1968”; and the sociologist William Catton (2001, p. 234) quotes the population biologist Arthur S. Bougey as having credited *The Population Bomb* with having “helped revive attention to warnings about overpopulation.”
3. Moore would later give the Ehrlichs permission to use his original title. Apart from his population control activism, Moore (1887–1972) is best remembered as the Dixie Cup Company founder and president. For a brief biographical sketch, see the Lafayette College’s special archives devoted to the company and its creator <<http://www.lafayette.edu/~library/special/dixie/bio.html>>
4. Books published before 1968 whose title referred to a “population explosion” include Sax (1956), Fagley (1960), Lenica and Sauvy (1962), McCormack (1963), Nevett (1964), Park (1965) and Green (1966). Authors who used this expression in the collection of essays published by Osborn (1962) include the historian Arnold Toynbee; the biologist Julian Huxley; the food policy analyst, FAO director and Nobel Peace Prize winner Lord Boyd Orr; the lawyer Grenville Clark; the soil scientist Walter C. Lowdermilk; the Bishop of the Episcopal Diocese of California James A. Pike; and the essayist Joseph Wood Krutch.
5. Apart from Robertson (2005; 2008), various mentions and some discussions of key individuals and organizations can be found in Allen (1977), Buell (2003), Chase (1977), Cockburn and St Clair (2000), Gibson (2002), Gottlieb (2005), Horowitz (2004), Jamison and Eyerman (1995), Linnér (2003), Luten (1986), McCormick (1989; 2005), Miller and Santos (1999), Rubin (1994), and Schlosser (forthcoming).
6. While neither Vogt nor Osborn gave much credence to the idea, anthropogenic influences on the climate have been a reason for concern since before the eighteen century (von Storch and Stehr 2006).
7. There is much debate as to whether or not, and if so, how much, Malthus reached more optimistic conclusions in later editions of his treatise (Malthus 1826; Petersen 1969; Luten 1986; Bradley 2009).
8. Of course, military rulers were always partial to a growing population from which new soldiers could be drawn.
9. Although now mostly associated with the later work of economist Julian Simon (1996), the expression “cornucopian” was already widespread in the 1950s to characterize individuals who believed that technological innovation could provide a growing population with increasingly abundant food and other valuable resources (Ciriacy-Wantrup 1952; Ordway Jr 1953; Chandrasekhar 1954). For Simon’s own misgivings about the term, see Dragos Aligica (this issue).
10. Mather’s (1944) book’s dust jacket cover reads as follows: “A leading American scientist surveys the resources of the earth and concludes that they are adequate to provide the basis for both freedom and security for all mankind. In a book that challenges the spirit as well as the mind, he shows that progress in co-operation will determine man’s survival.”
11. According to Dana (1958, p. 25): “Conservation as an organized movement, although not under that label, started in 1873, when the American Association for the Advancement of Science appointed a committee “to memorialize Congress and the several State legislatures upon the importance of promoting the cultivation of timber and the preservation of forests, and to recommend proper legislation for securing these objects.” This action was motivated by fear of a future timber famine and by the conviction that such a famine could be averted only by governmental action.”
12. Osborn’s words were written in the foreword to William Hornaday’s (1913, chapter 11, non-paginated) *Our Vanishing Wild Life* in which the author recommended, among other things, the prohibition of firearms for aliens whose origins could be traced back to “the lower classes of southern Europe.” Worse among those were the Italians who, “wherever they settle... root out the native American and take his place and his income. Toward wild life the Italian laborer is a human mongoose. Give him power to act, and he will quickly exterminate every wild thing that wears feathers or hair. To our songbirds he is literally a ‘pestilence that walketh at noonday.’” Of course, “the great increase in the slaughter of song birds for food, by the negroes and poor whites of the South” had also become “an unbearable scourge to our migratory birds.”
13. See Gibson (2002), Glacken (1969), McCormick (2005), Peterson (2005), Robertson (2005) and Sterling et al. (1997).
14. The Osborns were descendants of John Jay and Cornelius Vanderbilt, while J.P. Morgan was an uncle to

- Osborn's father. They were also closely associated with other major American families, such as the Rockefeller's (Gibson 2002). Indeed, Osborn Jr. played a major role in shaping Laurance S. Rockefeller's environmental outlook and activities (Winks 1997). According to all the sources consulted in the preparation of this essay, Osborn Jr. rejected the racist outlook of his father.
15. See also Abernathy (1997), Gibson (2002), Robertson (2005), Smith (2005) and Sterling et al. (1997).
 16. The influences discussed in this section are based on the content of the texts, footnotes, bibliographies and recommended readings found in both books. See also Abernathy (1997), Chase (1977), Linnér (2003, pp. 119–120); Reardon (2006, p. 10) and Vogt (1948b, p. 510).
 17. The title of the American edition was the more prudish "Vanishing Lands: A World Survey of Soil Erosion."
 18. See Hammond *et al.* (1978), McCormick (1989), and Williams (2003). Hard-liners in this movement often likened native farmers to careless, irresponsible and destructive children. As one of them put it, children were not "allowed to play with fire" even though they "may very much like to see the flame." Similarly, more enlightened administrators should not allow natives to "play fast and loose with their priceless treasures... well knowing that the country will be permanently injured thereby" (Unwin 1920, p. 92, quoted by Williams 2003, p. 402).
 19. See Bajema (1976), Berson and Cruz (2001), Chase (1977), Itzkoff and Lynn (1991) and Stepan, 1991.
 20. See Carlson (2001), Chase (1977), Connelly (2008), Gibson (2002), Kasanen (this issue) and Morawski (1984).
 21. Dr. Pangloss is a fictional character in Voltaire's *Candide* novel whose naïve optimism is summed up by his motto "All is for the best in the best of all possible worlds."
 22. The case of rodents was viewed as more complex, inasmuch as their presence was more a consequence of man's maltreatment of the land.
 23. The 'lifeboat ethics' is a metaphor for resource distribution proposed by the ecologist Garrett Hardin (1974) in which a lifeboat bearing 50 people with room for a few more is in an ocean surrounded by a hundred swimmers. The "ethics" of the situation stems from the dilemma of whether or not (and under what circumstances) swimmers should be taken aboard. The 'economics of spaceship earth' metaphor is now mostly associated with the economist Kenneth E. Boulding (1966) to refer to the notion of the earth as a spaceship devoid of unlimited resources in which men must find their place in a cyclical ecological system.
 24. The thought that these diseases were becoming more prevalent because other, more lethal, diseases had been successfully addressed doesn't seem to have occurred to Osborn.
 25. Readers familiar with the history of economic thought will recognize echoes of the physiocratic perspective in Osborn and Vogt's writings. Interestingly, Vogt (p. 63) had this to say on the issue: "The physiocrats had perceived the difference between the symbolic level and reality, but they were submerged in 'progress' and 'prosperity.'"
 26. Vogt had been a salaried employee of the *Compañía Administradora del Guano* where he was hired as an ornithologist to study guano producing birds and to develop ways to maximize outputs (McCormick 2005; Robertson 2005).
 27. Rent-seeking occurs when an individual, organization or firm seeks to earn money by manipulating the economic and/or legal environment rather than through trade and the creation of wealth. 'Perverse subsidies' have both economic and environmentally negative impacts.
 28. Of course, other factors at the time, such as the building of a large Spanish naval force, also played a role in the destruction of the Spanish environment.
 29. Anderson and Leal (2001) is the most influential text in this perspective. Stroup (2008) is a concise discussion.
 30. As Bradley (2009, 3) puts it: "Unlike free-market capitalism, political capitalism is a variant of the mixed economy, in which business interests routinely seek, obtain and use government intervention for their own advantage, at the expense of consumers, taxpayers, and/or competitors."
 31. A prime example of the former would be Leopold (1948). The quotes discussed in this section are taken for the most part from the academic literature. Robertson (2005) provides more detail on the reception of these books in the popular press.
 32. One could argue that some later reports sponsored by the US government and Resources for the Future (Bradley 2009) were to some extent indirect answers to Osborn and Vogt. For the purpose of our discussion, however, we limit ourselves to direct criticisms of their work.
 33. The "lower fertility of the upper classes" was already apparent to Adam Smith and Thomas Robert Malthus (Petersen 1969, p. 151).
 34. Mather's (2003, p. 6) history of this university's department of geography and geology provides much biographical information on Hanson's career up to his resignation from its chairmanship in 1956, including the fact that he "did not hesitate to express his own views with force, to argue with acknowledged experts in their fields, and to press hard for his own beliefs."
 35. From Vogt, William. Correspondence, 1948–1949; Nation (New York, N.Y. : 1865). Records: Guide; Houghton Library, Harvard College Library, Harvard University; Call No.: MS Am 2302 (4577) <http://oasis.lib.harvard.edu/oasis/deliver/~hou00189>

36. The first edition of *Geography of Hunger* was published in Portuguese in 1946, but the English translation followed the publication of Osborn's and Vogt's books and was modified to address their writings.
37. According to Simon (1996: 605): "Ehrlich and I have never debated face to face. He says that he has refused because I am a 'fringe character'."

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Population Growth and Cities

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Abstract

The growth of urban populations throughout the world has led to calls for government regulation to prevent urban sprawl and create land-use patterns that are less auto-dependent. Such regulations are costly: by significantly increasing the cost of housing, they turn urban areas in to enclaves for a wealthy elite. At the same time, the regulations have little effect on transportation patterns. Despite having more compact cities, Europeans drive for 79 percent of their travel, compared with 84 percent in the United States. Rather than increasing regulation, urban leaders should focus on reducing it in order to create opportunities for people of all incomes to build wealth.

Sometime in 2008, says the United Nations, the number of people living in urban areas outnumbered those living in rural areas for the first time in history.¹ As recently as 1950, less than 30 percent of the world's people lived in urban areas. By 2050, the U.N. predicts, it will be 70 percent.²

In much of the developed world, the economic prospects of urbanites tend to be much greater than those of ruralites. So increasing urbanization could be considered good news. But not everyone sees it that way. According to the WorldWatch Institute, "Unplanned and chaotic urbanization is taking a huge toll on human health and the quality of the environment, contributing to social, ecological, and economic instability in many countries" (Knickerbocker, January 12, 2007).

For more than 60 years, various national, state, and local governments have used the supposed dire consequences of "unplanned and chaotic" urban development to justify government plans that trample on private property rights and limit the housing and transportation choices of urban residents. Rather than improve human

health and the quality of the environment, these plans all too often represent little more than an elitist view of how people should live – or, worse, how *other* people should live.

This paper will review urban planning and land-use regulation in the United States and several other countries to show that the benefits of such regulation are far outweighed by the costs. These costs include unaffordable housing, increased congestion, and the pollution that is associated with that congestion.

Stages of urban development

The world's cities can best be understood as growing in four stages: preindustrial, pedestrian, streetcar and automobile. In the preindustrial stage – which, in the developed world, is roughly before 1820 – cities were centers of trade, government, or religion. At least some preindustrial cities had medium to low population densities: Angkor, Cambodia, was apparently no denser than a modern American suburb (Pringle, October 24, 2005). Markets and residential uses tended to be mixed throughout the city.

Only a small minority of preindustrial peoples lived in cities. Agriculture was very labor intensive, so it took the work of several farmers to feed one urban resident. In addition, cities were not very attractive places to live. Due to crowded conditions, poor sanitation, and primitive medicine, long-term death rates in most such cities were higher than birth rates; only through immigration from rural areas were cities able to maintain their populations. Virtually no remnants of preindustrial cities can be found in the developed world, though versions of them are common in the undeveloped world.

The industrial era saw increased mechanization of agriculture and other rural occupations, eventually allowing one farmer to feed several urban residents. This generated a surplus of rural labor, and those ruralites migrated to the cities to find factory and other work.

Meanwhile, great concentrations of factory and office jobs led to major changes in urban form. Until about 1890, all but the wealthiest urbanites were limited to foot travel, so cities grew very dense to allow factory and office workers to live within walking distance of their jobs. Such cities tended to be heavily polluted and living conditions, particularly for working class families, were poor. Since upper floors were only accessed by stairs, most buildings were no more than four- to five-stories tall, yet some tenements crowded more than 100,000 people into a square mile of land. Remnants of such pedestrian cities can be found in Brooklyn, Philadelphia, San Francisco, and a few other older American cities, as well as in inner Paris and many other European cities.

Steam-powered commuter trains in the 1840s, horsecars in the 1850s, and cable cars in the 1870s allowed progressively more people to escape these dense cities. But it was not until perfection of the electric-powered streetcar in the late 1880s that large numbers of people could live far enough away from urban employment centers that they could live in single-family homes rather than apartments.

Within two short decades, streetcars could be found throughout the industrial world. More than 700 American cities had streetcar lines in 1910, many of which were built by real estate developers seeking to give homebuyers access to their neighborhoods. In this way, the streetcar gave rise to the *streetcar suburb*: gridded streets of single-family homes, typically on 5,000-square-foot (464-square-meter) lots (Jackson 1985, pp. 118–120). Small grocery stores and other shops often located on the streetcar lines, while the homes would cluster on nearby streets up to a quarter mile away from the streetcars.

Most streetcar suburbs were eventually annexed by the cities and now form the bulk of residential areas in many American central cities. Population densities in streetcar suburbs were much lower than pedestrian-era tenements, but at about 5,000 people per square mile or more they were much higher than modern suburbs. About 40 to 45 percent of American families owned their own homes in the streetcar era, suggesting that homeownership was accessible to the middle class but not the working class (U.S. Census Bureau. 2003).

Eventually, most industrial cities had networks of streetcar lines about a half-mile apart radiating away from downtown concentrations of offices, stores, and factories. Thanks to the development of the electric elevator, which also dates to the 1880s, the downtowns became noted for their high-rise towers. Factories were often vertical assembly plants, with initial work being

done on the top floors, major assembly on the middle floors, and finish work on the bottom floors.

For many people, the *monocentric* streetcar city, characterized by downtown high rises surrounded by moderately dense neighborhoods of single-family homes, remains the indelible image of what a city should be. Yet the market-driven industrial world built such cities for, at most, about 40 years – 1880 to 1920 – before new technologies rendered this urban form obsolete.

Those new technologies were the automobile and, just as important, the moving assembly line, which was first used by Henry Ford to build Model Ts in 1913. This assembly line so speeded production that Ford doubled worker pay even as he cut the price of his autos in half, thus making cars affordable to the workers who built them.

Because moving assembly lines were horizontal, not vertical, they required lots of land. So, as other industries adopted assembly line techniques, factories moved away from downtowns to suburban areas where land was less expensive. Urban areas thus became *polycentric*, with several to many different job centers.

Job decentralization gave factory workers an even greater incentive to own automobiles. Those autos, in turn, gave working-class families access to affordable single-family homes of their own. Freed from the constraints of the streetcar grid, new suburbs often had larger lots, meandering streets and cul de sacs, and a stricter separation of housing and other uses.

Suburban backlash

In the early 1900s, urban planners and intellectuals hoped that suburbs would improve the lives and lifestyles of working class families, some of which had been crowded in two-families-per-room tenements. But when in the 1920s the working class, whose values differed from the elites in many ways, actually arrived in the suburbs, the intellectuals recoiled.

“Architects entranced with the flat-roofed, cement apartment houses of 1930s Berlin reeled from steadfast urban love of single-family, pitched-roof houses,” Harvard historian John Stilgoe observed, while “city planners championing great boulevards and public parks learned of gardeners anxious to shape their own private spaces” (Stilgoe 1988, p. 4). As a result, “urban writers, especially in New York, turn[ed] on the suburbs as the home of narrow-mindedness” (Joad 1937, pp. 72–73). This attitude continues to this day as New Yorker James Howard Kunstler relentlessly attacks the suburbs as “a

trashy and preposterous human habitat with no future” (1993, p. 105).

Similarly, planning historian Peter Hall has shown that, in Britain, the suburbs generated “a terror of what Anthony King has called the democratization of the countryside: the lower-middle-class and working-class invasion of an area that had hitherto been the preserve of an aristocratic and upper-middle-class elite” (Hall 2002, p. 84). By the 1930s, British suburbs were “universally derided and condemned,” says Hall. “The fact was that the prosecutors were all upper-middle class and the offenders were mostly lower-middle class in a typical such suburb” (*ibid.*, p. 79).

In 1947, critics of the suburbs persuaded the British parliament to pass the Town and Country Planning Act, which established huge greenbelts around cities and built giant blocks of apartments in which to confine the working class. Most western European countries developed similar post-war policies.

The Ideal Communist City, a 1965 book written by planners from the University of Moscow, encapsulated many of the arguments against the suburbs, which it described as “a chaotic and depressing agglomeration of buildings covering enormous stretches of land.” The cost of providing urban services to low-density housing was too high; people living in such housing would drive too much, which could cause congestion (Gutnov *et al.* 1971, pp. 69–70).

The book’s authors proposed to build high-rise, mixed-use developments, allowing people to walk to shops and take transit to work, which (they asserted) would cost less than driving. The planners “scientifically” determined that a family of four needed only 600 square feet of living space, partly because they would share public spaces with other families. Such developments would average about 70,000 people per square mile, slightly denser than Manhattan. People living in thousands of identical apartments would share collective values, something that would not be found in “autonomous” single-family homes (Gutnov, *et al.* 1971, pp. 66, 74, 79–80).

Under soviet domination, eastern European nations built hundreds of such communities. In East Germany alone, just one of several high-density building designs, known as the *Wohnungsbausystem* (“house building system”) or WBS 70, was used to build more than 650,000 virtually identical apartments between 1971 and 1989. This design offered a generous (by *Ideal Communist City* standards) 700 square feet of living area, including a living room, kitchen, windowless bath, and two bedrooms (Hannemann 2004, figure 6).

The United States, Canada, Australia, and New Zealand were slow to follow Europe’s example. When Nikita Khrushchev came to the United States in 1959, President Eisenhower routed his helicopter ride from the airport to show off the middle-class homes and cars on the highways in the suburbs of Washington, DC. Instead of being impressed, says historian Stephen Ambrose, Khrushchev claimed to be shocked by all the waste. In the Soviet Union, Khrushchev told Eisenhower, people lived close together and seldom traveled far, so they did not need cars. And Soviet multi-family housing, he asserted, cost less to build, less to heat, and less to maintain than American single-family homes (Ambrose 1984, pp. 542–543).

Some Americans professed to be shocked by the suburbs as well. John Keats’ 1956 book, *The Crack in the Picture Window*, called the suburbs “conceived in error, nurtured by greed, corroding everything they touch (p. 7).” *Little Boxes*, a popular song in the 1960s, labeled the suburbs “ticky-tacky” – though the term “little boxes” would seem to apply much better to the identical apartments being built for families in Europe.

The evolution of “smart growth”

In 1961, Hawaii became the first U.S. state to pass a law regulating land use with the aim of preventing the spread of the suburbs. Up to this point, U.S. land-use law had aimed at preserving property values by preventing unwanted intrusions, such as apartments or shops in single-family neighborhoods, that would reduce adjacent values. In contrast, Hawaii’s law *downzoned* much of the land in the state by placing it in a zone that prevented subdivisions and other developments. Thus, the role of zoning began changing from preserving property values to reducing them in order to achieve some greater social purpose.

Since 1961, nine other states have passed similar laws, and another half dozen states passed laws originally intended for other purposes but which morphed into growth-management laws.³ Roughly half the population of the United States lives under some form of European-style growth management.

In 1966, a regional government for the greater Vancouver, British Columbia, metropolitan area issued a plan that put most rural land in the region off limits to development (British Columbia Lower Mainland Regional Planning Board 1966). A few other cities in Canada – notably Toronto and Victoria – followed suit, as did most cities or state governments in Australia and New Zealand.

Land-use policies that focus on limiting development of rural lands while increasing the densities of urban areas received a rhetorical boost in 1996 when Maryland Governor Parris Glendening coined the term *smart growth* to describe such policies. The primary advantage of this term was that anyone who was skeptical of stripping away rural people's property rights and forcing urbanites to live in denser neighborhoods could be accused of favoring "dumb growth" (Frece 2004–05).

Smart-growth advocates often point to cities of the streetcar era as models for how modern cities should be built. "Urban planning reached a level of competence in the 1920s that was absolutely mind-boggling," says Andres Duany, a founder of the New Urbanist movement (quoted in Kunstler 1993, p. 255). In fact, the private developers who built the streetcar suburbs were no more competent than developers today; they just based their designs on the transportation technology that then existed, while today's developers base their designs on the technology that exists today.

James Kunstler actually wants to go back before the streetcar era. "Imagine it's 1881," says Kunstler. "You leave the office on Wabash in the heart of vibrant Chicago, hop on a train in a handsome, dignified station full of well-behaved people, and in thirty minutes you're whisked away to a magnificent house surrounded by deep, cool porches, nestled in a lovely, tranquil, rural setting with not a single trace of industrial hubbub." Kunstler calls this "a glorious way to live" (1998).

The problem is that only a tiny fraction of American city dwellers lived this way in 1881. The rest of them lived in high-density housing, better known as tenements or slums. With sweatshop jobs, poor sanitation, and high crime, their lives were far from glorious.

Kunstler probably imagines that everyone could live in his traditional neighborhoods today. Yet, without the mobility provided by the automobile – the same mobility that led the children and grandchildren of the people living in nineteenth-century slums to increase their incomes and escape the tenements – this is unrealistic.

Developing nations are now undergoing many of the same changes that developed nations went through in the late nineteenth and early twentieth centuries: agricultural productivity is increasing, leading to surplus rural workers, many of whom are moving to the urban areas where they can find factory and office jobs.

Many of these urban areas are very dense: While the densest urban area in America (Los Angeles) has about 6,000 people per square mile, and the densest in Europe (London) has about 13,000, India has 17 urban areas with more than 50,000 people per square mile, while

China has 8 with more than 40,000 per square mile (Cox 2008a, p. 76).

Mechanized transport is making urban residents increasingly mobile, and urban areas are becoming polycentric. Starting in 2009 an Indian manufacturer, Tata, expects to sell a 50-mile-per-gallon car to residents of developing nations for just \$2,000 – about the price, after adjusting for inflation, of the least-expensive Model T Fords (O'Connor, January 11, 2008). This mobility is likely to lead to significant reduction in the population density of many developing urban areas as people buy their own homes and marginal farmlands are converted to urban uses.

Flawed assumptions

Some people worry that the addition of hundreds of millions of internal-combustion-powered motor vehicles to the planet will create serious environmental problems, and they argue that developing nations should adopt smart-growth policies so as to avoid wasting land and becoming overly dependent on automobiles. There are several reasons to question the wisdom of this advice.

First, smart-growth advocates underestimate the benefits of personal mobility and homeownership. It is likely that the mass-produced automobile has done more to improve the lives and lifestyles of the average person in developed nations than any other invention.

Since the automobile was invented, American inflation-adjusted incomes per worker have increased by more than seven times. A large share of this increase is due to the mobility provided by the automobile, which gives people access to more jobs and gives employers access to more highly skilled workers. Automobiles also provide many other advantages, including access to low-cost consumer goods and greater social and recreation opportunities. Moreover, by freeing up land dedicated to draft animals, autos and tractors made more U.S. land available for crop production than has been converted to urban uses (O'Toole 2006).

Another benefit of the auto is that it has given far more people access to affordable homeownership. Thanks largely to automobility, U.S. homeownership rates increased by nearly 50 percent after World War II (U.S. Census Bureau 2003). In turn, homeownership also provides numerous benefits. Homeowners take better care of their homes than renters, so people who live in neighborhoods with high homeownership rates tend to have a better quality of life. After adjusting for income and the education of the parents, children in

families that own their own homes do better in school than children in families that rent (Haurin 2003). Most small businesses in the U.S. get at least part of their start-up funding from loans on the equity in the business-owners' homes (de Soto 2000, p. 60).

Second, smart-growth advocates overestimate the beneficial effects of their policy proposals. Smart growth is based on a presumed linkage between land use and transportation. While it is true that new transportation technology, such as streetcars or autos, can have a large influence on land use, the reverse is not so true: changing land uses does not necessarily change transportation choices. In other words, land-use regulation that forces more people to live in higher densities or mixed-use developments will have little effect on the amount of driving they do (Giuliano 1995, p. 8). This can be seen in the many high-density developments built in former soviet nations. For example, Halle-Neustadt, in eastern Germany, was a town of nearly 100,000 people built along "ideal communist city" principles. In 1998, planners from the University of Stockholm praised Halle-Neustadt as one of "the most sustainable" (i.e., least "auto-dependent") cities in the developed world because it was built around mass transit and was designed to discourage auto driving (Book and Eskilsson 1998, pp. 109–110). In fact, as soon as Germany was reunified, most people in Halle-Neustadt bought cars and turned the greenspaces between the apartment buildings into parking lots (*ibid*, p. 111).

Third, smart-growth advocates underestimate (or totally ignore) the effectiveness of technical solutions to energy consumption, pollution, greenhouse gas emissions, and other environmental issues. The installation of catalytic converters and other pollution control devices on automobiles has reduced toxic air emissions from new cars by 90 to 99 percent. This technique has been far more successful, and far less costly, at reducing pollution than all of the efforts to try to get people to drive less (Schwartz 2003, p. 9).

Similarly, technical solutions are likely to be far more effective in reducing energy consumption and greenhouse gas emissions than land-use regulation and construction of rail transit lines. McKinsey and Company estimates that, by 2030, the U.S. can reduce total greenhouse gas emissions by 30 percent if it invests in technologies that cost no more than \$50 per ton of emission abatements. The consulting firm points out that many strategies, such as building cars from lighter-weight materials, would actually save consumers money in the long run (Creyts *et al.* 2007, pp. ix, xiii). By comparison, imposing changes in urban form, if they save any

greenhouse gases at all, are likely to cost thousands of dollars per ton.

Finally, smart-growth advocates ignore or underestimate the costs of their policy proposals. A key part of smart growth is some form of urban-growth boundary aimed at limiting the spread of low-density housing. This effectively creates an artificial land and housing shortage that drives up the cost of housing and land for offices and other businesses.

The costs of smart growth

The effects of smart growth can easily be seen in the U.S., where some states have practiced growth-management planning since the 1960s, others have adopted it more recently, and others still defer largely to private property owners to determine the best land use. In 1969, the median home in urban areas throughout the U.S. cost about twice the median family income. The only major exception was Hawaii, which had passed a growth-management law in 1961 and where housing was three times family incomes.

Today, housing in California and Hawaii is eight times family incomes, while it remains only twice family incomes in states such as Texas that have no growth management. Housing in states that have more recently adopted growth-management laws, such as Florida and Arizona, is four to five times family incomes (O'Toole 2007).

"Government regulation is responsible for high housing costs where they exist," say Harvard economist Edward Glaeser and Wharton economist Joseph Gyourko. In particular, they add, "difficult zoning seems to be ubiquitous in high-cost areas" (2002, p. 3). Other researchers have found that rapid growth in housing prices is strongly "correlated with restrictive growth management policies and limitations on land availability" (Jud and Winkler 2002). Moreover, adds Glaeser, regulation makes prices more volatile, increasing the number of homeowners who face foreclosure because they bought when prices were high and must sell when prices fall (2006, p. 1).

Smart growth thus inevitably reduces homeownership rates and increases the costs of doing business in regions that have adopted it. One result, says Glaeser, is that regions that adopt smart growth tend "to become less diverse and instead evolve into a boutique city catering only to a small, highly educated elite" (2006, p. 2).

Compare, for example, the San Francisco Bay Area with Houston. The eight counties in the San Francisco

Bay Area have strictly regulated land use, putting 20 percent of their land in regional parks and greenbelts and placing 63 percent of the remaining (mostly private) land off limits to development through the use of urban-growth boundaries. The city of Houston has minimal government regulation of land, and the counties surrounding it have virtually none.

Both regions have about the same population, but the 2000 census found that the San Francisco-Oakland urban area is more than twice as dense, with more than 6,100 people per square mile compared with 2,950 in Houston. One of the costs of that density is higher housing prices: the median Bay Area home is more than 10 times median family incomes, while in Houston it is only twice family incomes.

Thanks in part to the higher densities, more Bay Area residents use transit than those in Houston. About 95 percent of Houston commuters drive to work, while only 3 percent take transit. By comparison, 15 percent of San Francisco commuters take transit to work, while 80 percent drive. Density alone isn't the reason, however: at 5,900 people per square mile, the San Jose urban area is almost as dense as San Francisco, yet 93 percent of commuters drive to work and only 4 percent take transit (U.S. Census Bureau 2008). Moreover, given San Francisco's greater density, the Bay Area has 68 percent more cars on the road per square mile of land than Houston. That means San Francisco has more congestion and more delays per commuter than Houston (Schrack and Lomax 2007, p. 32).

Due to the high cost of housing and other costs of doing business, the Bay Area is growing by only about 0.2 percent per year. Houston, in contrast, is growing by more than 2.5 percent per year.⁴ Lower- and middle-income families are departing the San Francisco Bay Area, leaving behind a region that one demographer calls a "Disneyland for yuppies" (Temple, June 22, 2008). Houston, meanwhile, easily absorbed 90,000 permanent new residents who evacuated from New Orleans after Hurricane Katrina and found Houston to have more affordable housing and greater economic opportunities (Goodwyn August 27, 2007).

Smart-growth advocates claim that the costs of sprawl force urban areas to subsidize low-density housing. *The Costs of Sprawl 2000*, a report by urban researchers at Rutgers University, estimated that low-density housing imposed \$11,000 greater costs on municipalities than high-density housing (Burchell *et al.* 2002, p. 13). In response, many cities in San Francisco Bay Area have passed *adequate-public-facilities ordinances*, which allow cities to reject plans for new developments until the city

has the funds to service it. These ordinances have contributed to the artificial shortage and high cost of housing.

In contrast, developers in the Houston area simply pay most or all of the costs of development themselves and pass the costs onto homebuyers. Typically, developers will acquire 5,000 to 10,000 acres of land and subdivide it into home sites, parks, and areas for shops, offices, and schools. They then create a *municipal utility district* that borrows money to build water, sewer, roads, and other utilities. Homeowners and other landowners are assessed an annual amount to repay the costs of the district.

Several counties in the Houston area have county tollroad authorities that build highways connecting these developments to tollroads in the city of Houston. The resulting user-pays system produces more affordable housing and less congested highways that can be found anywhere in the San Francisco Bay Area or other regions in coastal California.

San Francisco and Houston are not isolated examples. Land-use regulation has made housing unaffordable throughout the United Kingdom and much of Australia and New Zealand. Thanks to smart-growth policies, Vancouver and Victoria are the least affordable housing markets in Canada (Cox 2008b, table ES-2). Despite decades of smart-growth-like land-use regulation in Europe, European travel habits are not significantly different from those in the U.S.: where Americans drive for 84 percent of travel, Europeans drive for 79 percent (Eurostat 2003, p. 89; BTS 2008, tables 1-37). Even supposing that it were desirable to reduce auto driving, smart growth has minimal effects on driving at a very high cost to homebuyers, businesses, and others.

Creative class vs. opportunity cities

One branch of smart growth is represented by policy analyst Richard Florida, who argues that, to build wealth, cities should try to attract a "creative class" of people. In his view, this class, including artists, designers, computer programmers, scientists, and engineers, are attracted to dense cities with vibrant, pedestrian-friendly streets (2002). They are, in fact, the elite who make up much of the remaining San Francisco population.

Urban analyst Joel Kotkin challenges this "elite strategy." "A handful of urban regions," he admits, "could conceivably succeed with such a strategy... But it is difficult to see how such areas could accommodate an American population that is expected to rise from 300 million today to at least 400 million in 2050" (Kotkin

2008, p. 7). Instead, Kotkin sees Houston as the model for the future. "One of the primary historic roles of cities has been to nurture and grow a middle class – to be an engine of upward social mobility," says Kotkin (p. 5).

In essence, Florida has a zero-sum view of urban economies. He assumes there are only so many creative people in the world, and cities need to compete with one another to attract them. By contrast, Kotkin has a positive-sum view: "Cities don't lure the middle class," he says. "They create it" (p. 17). Kotkin calls Houston and other cities that embrace this view, *opportunity cities*. Such cities not only have less land-use regulation to assure more affordable housing, they have less economic regulation to minimize the barriers facing small and growing businesses.

Kotkins' opportunity cities should be far more useful to developing economies than Florida's creative class. A major problem urban areas in developing economies may have to deal with is how to accommodate the influx of people from smaller towns and rural areas who are attracted to a thriving economy. A region with minimal land-use and business regulation will create far more economic opportunities for these new residents than one that is focused on trying to attract the cream of the creative elite.

In the long run, the worldwide trend of urban areas containing an increasing share of the population may reverse itself, a process that has already begun in the United States. The mobility provided by the automobile and commercial airliner combined with telephone and Internet communications are reducing the need for many people to locate in urban areas. Some of these telecommuters may decide to stay in urban areas anyway, but others are choosing to become *exurbanites* – people with urban occupations living in rural areas.

Smart-growth advocates have an answer to exurbanization: ban it. Oregon land-use regulators, for example, have imposed a rule forbidding anyone in the rural part of the state from building a house on their own land unless they own at least 80 acres, actually farm it, and actually earn \$40,000 to \$80,000 per year (depending on land productivity) farming it. This rule was needed, said the planners to prevent "lawyers, doctors, and others not really farming [from] building homes in farm zones" (LCDC 1999, p. 2). This attitude is absurd, particularly in a state that is 98 percent rural and where less than 25 percent of agricultural lands are actually used to grow crops (NRCS 2002, tables 1 and 2).

Despite such rules, demographers estimate that exurbanites are the fastest-growing segment of the U.S. population (Nelson and Dueker 1990, p. 93). Even

manufacturing facilities are moving to the countryside in states where both factories and their employees can avoid high taxes, regulation, and congestion (Nelson, Drummond and Sawicki 1995). Developing nations are far from this point, however. Until they reach it, they should do their best to build opportunity cities, ones that rely on user fees to pay for public facilities and minimal regulation to create opportunities for economic growth and wealth production.

Notes

1. See *United Nations Expert Group Meeting on Population Distribution, Urbanization, Internal Migration and Development* 2008, p. iii.
2. *World Urbanization Prospects: The 2007 Revision Population Database*, United Nations, available at esa.un.org/unup.
3. For a complete list of states and how state growth-management laws work, see O'Toole, Randal. 2007. *The Planning Tax: The Case Against Regional Growth-Management Planning*. Washington, DC: Cato Institute, pp. 5–6.
4. Based on Census Bureau population estimates for the counties in each respective metropolitan area.

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BOOK REVIEW

Failed States: A Framework for Rebuilding a Fractured World

By Ashraf Ghani and Clare Lockhart

Oxford University Press, Oxford, UK, 2008

Review by Chris Coyne

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The problems caused by weak and failed states are among the most pressing issues of our time. States in this category suffer from significant governance and economic crises resulting in what the authors term the 'sovereignty gap.' This gap refers to the disconnect between the assumption that all states are sovereign entities and the inability of many of these states to effectively engage in governance. Governments in most weak and failed states provide citizens with few beneficial services and often act in an exploitative manner. This in turn stymies economic development. The international community has a history of intervening in weak and failed states with the aim of remedying these problems. There are few successes to show for these efforts. The central goal of this book is to assess why past interventions have failed and to provide a new framework for the future.

In the Introduction, the authors identify several reasons why efforts to correct the problems that plague weak and failed states have so often failed. For one, policymakers tend to have a poor understanding of the functions of an effective state. Their interventions tend to lack coordination and the means necessary to achieve the desired ends. This problem is magnified by the one-size-fits-all approach typically used by the international community, treating all weak and failed states the same and proposing the same remedies. Also lacking, according to the authors, is a realistic understanding of the time required for the development of the interdependencies necessary for effective state functioning. Finally, interventions tend to neglect shared responsibilities between the international community and indigenous actors. Instead, interventions typically take one of two extremes – the international community imposes a plan on

citizens or the international community takes on the role of an interested observer who is not directly involved.

Following the Introduction, the book is broken into three distinct parts. Part I (chapters 1–5) focuses on the previously mentioned sovereignty gap in weak and failed states. Also discussed is how certain countries have 'reversed history' by making significant changes in policies and governance. Finally, the authors consider how the 'aid complex' exaggerates many of the very problems it is supposed to solve.

The major flaw in this, first part of the book is that many of the examples of reversing history are too shallow to offer significant insight into the process of change. For example, the authors rely on the Marshall Plan and the post-World War II reconstruction of Europe to demonstrate successful coordination on the part of the international community. Numerous historians and economists have called into question the role that the Marshall Plan actually played in the reconstruction of Europe (see Milward 1984, Cowen 1985). Further, even to the extent that the Marshall Plan did play a positive role in generating change, a complex array of factors allowed the aid to be used in an effective manner. The result of such broad brush examples is that the reader is offered few details of how sustainable change emerges. The only conclusion that can be drawn is that some societies have adopted changes for the better.

The second part of the book (chapters 6–7) provides an overview of the ten core functions of the state. The authors place the state budget at the center of state policy. The underlying idea here is that effective budgeting, including the collection and allocation of funds, is the key mechanism through which the state delivers

on its core functions. The authors also propose creating a 'sovereignty index' which attempts to objectively measure the sovereignty gap. If such a metric could be developed, potential interventions could then be evaluated through expected changes in the index.

The final part of the book (chapters 8–9) reviews several mechanisms which can contribute to state building. The authors' strategy is grounded in a 'citizen based approach,' which recognizes the importance of local actors in the state-building process. Central to this approach is a 'double compact' consisting of a compact between country leaders and the international community and a simultaneous compact between country leaders and citizens. In theory, the double compact creates shared responsibilities between the international community and country leaders while also ensuring that citizens are not disenfranchised. In the end, within the authors' framework, successfully fixing failed states entails aligning the efforts of the international community with the local circumstances of country leaders and citizens.

This book has several strengths. The authors are correct to recognize the limits on the use of force by the international community to effectively impose exogenous plans. Afghanistan and Iraq are only the latest in a long line of interventions illustrating the limits of what force can achieve. A related strength is the recognition of the importance of change grounded in indigenous actors as compared to top-down planning and imposition by outsiders, although as I will note below, they do not go far enough in this regard. The chapter on foreign aid (chapter 5) is perhaps the best in the book and provides important insights into the perverse incentives created by aid. Chief among these is the creation of a massive 'aid complex' which sustains itself by undertaking activities which are harmful to the failed states that it is supposed to be assisting.

Despite these strengths, the book suffers from several weaknesses. The first is a lack of consistent focus on the incentives of individual actors. As noted, the authors do recognize the perverse incentives facing individuals within the aid complex, although they do not explicitly use this terminology. However, they fail to extend similar reasoning to their other recommendations and proposed framework. What incentives do members of the broader international community, local political leaders, and citizens face? Under what conditions will those incentives be aligned or misaligned with the interest of promoting the general good? Ultimate success requires not just the desire to do good, but the incentive to carry out the required actions to achieve the desired

end. These questions largely go unanswered. The general examples provided in the first part of the book offer little insight into the incentives facing leaders in countries where change did occur, or the conditions necessary for the emergence of the proper incentives for sustainable state building.

While the authors emphasize the importance of bottom-up state building versus top-down imposition, they are never able to get away from the planning mentality. While noting the limits of exogenous imposition, they still advocate planning at the national level with an emphasis on the relationship between the international community and country leaders. The idea of the double compact recognizes the importance of citizens, but the nation-state is still the central actor in Ghani and Lockhart's framework. The end result is that the authors still advocate top-down planning, although they argue that instead of the international community doing the planning, it should be some combination of the international community and indigenous leaders.

Indeed, emphasis on the collective is prevalent throughout the book as is evident from the concluding chapter on 'collective power.' Even though the authors highlight the importance of individuals and citizens, at the end of the day their framework is one of collective top-down planning. This neglects the important insights of the development economist P.T. Bauer (2004), who emphasized the importance of small-scale trade between private individuals for development. Bauer's view of development is one where the private individual is the key catalyst of change and therefore should be seen as a true citizen based approach to development.

Many of the aforementioned problems emerge from what is perhaps the biggest problem with the book – the assumption that the state is the relevant unit of analysis. The authors establish this assumption early when they note that "Just as the firm is the most effective unit of organization in the economy, the state is the most effective form of organization of the polity. Only the state can organize power so as to harness flows of information, people, money, force, and decisions necessary to regulate human behavior" (4). The entire analysis follows from this initial assumption. The assumption that the state is the best means of political organization presumes that an effective state either exists or can be constructed. It is far from clear that this is true, especially in the case of weak and failed states.

The governments of weak and failed states are the worst of the worst. They impose significant costs on citizens with little to no associated benefits. In these instances, it is far from clear that the state is the best

means of organization. As one example, research on Somalia has indicated that things have improved since the collapse of the central government in the early 1990s (see Coyne 2006, Leeson 2007 and Powell et al. 2008). To be clear, the argument is not that Somalia's current situation is ideal. The country remains mired in a state of underdevelopment and suffers from a host of other problems. The main point is that given the set of feasible institutional arrangements facing Somali citizens, the argument can be made that no central government is preferable to the purely exploitative state which has existed for most of the country's history. Of course, a productive and effective state would be better still, but this is not currently a realistic alternative for Somalia or most other failed states.

An alternative view of how to deal with failed states places the private individual at the center of the process and recognizes the benefits of interaction and trade, even when that trade is small-scale in nature. It recognizes that the same problems that plague the aid complex plague all efforts at central planning by government bureaucracy. Most importantly, it recognizes the real costs associated with propping up the worst governments in the world instead of letting them collapse, to be replaced by emergent institutions, the nature of which cannot possibly be known *ex ante* by central planners at any level.

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BOOK REVIEW

Sex, science & profits

By Terence Kealey

William Heinemann (Random House), London, 2008

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(replace =a= with @)

Clinical biochemist, (privately-funded) university administrator and EJSB editorial board member Terence Kealey¹ first gained some measure of public attention in 1996 with the publication of his book *The Economic Laws of Scientific Research* (henceforth, *The Economic Laws*) in which he argued that governments need not fund science. Kealey's original impetus for venturing outside the confines of his laboratory was the campaign orchestrated in 1984 by Oxford academics to deny an honorary degree to British Prime Minister Margaret Thatcher on the grounds that her budgetary cuts were then destroying British science. Having himself been asked to leave this institution a few years earlier because of a shortage of laboratory space and having later been able to observe abundant resources wherever he took his research, Kealey set out to document how British science was actually thriving under Conservative policy due to increased private funding. What perhaps began as a somewhat modest project eventually turned into an ambitious survey of historical and contemporary economic, science and technology controversies. The biochemist's main conclusion was that public funding always and everywhere crowds out far more important and effective private support of science.

Despite his comment in the preface of *The Economic Laws* that he "hope[d] never to write another book," Kealey found the time and energy to expand significantly on his first foray into science and technology policy. The result is *Sex, Science & Profits* (henceforth, *SSP*), a courageous and witty book that not only restates in a more accessible style the main arguments of his earlier work, but also contains a more ambitious discussion of the intellectual and sociological nature of the scientific enterprise which is rooted in evolutionary psychology thinking.

As in his previous book, Kealey first introduces Sir Francis Bacon's (1561–1626) 'linear' model of technological advance and economic growth, which he summarizes as follows:

Government money → science → technology → wealth

Despite the longstanding academic and political support behind Bacon's notion of science as a public good which can only thrive through government support, Kealey argues that it is not supported by the available evidence. His main objectives in *SSP*, however, are more ambitious than simply documenting this fact, for he not only contends that science is not and cannot be a Baconian public good, but also presents readers with an alternative model of science, technology and economic growth interactions.

As in *The Economic Laws*, the author first supports his argument through a broad and lengthy (almost 260 pages) revisionist historical survey stretching from the Stone Age to recent British government science policy. Kealey's interpretation of the available evidence is rooted in the framework put forward more than two centuries ago by the economist Adam Smith, which he sums up as follows:

Academic science ← new technology → wealth

↑

industrial money + old technology

In short, Smith not only believed that most industrial advances emerge from the creative thinking of people directly involved in production activities rather than from academics ensconced in university laboratories, but also that academic science more often than not feeds off new problems or discoveries made in the technological realm.

Unlike many other broad surveys on the topic written by respected academics,² Kealey pulls no punches for characters he dislikes and often reminds his readers of his good fortune in having been born an Englishman. The result is, to my knowledge, one of the most entertaining serious discussions ever written on the subject. Indeed, I have already recommended it as beach reading to some (obviously academic) acquaintances of mine...

Kealey provides wide ranging evidence in support of the hypothesis that the scientific method is intuitive, citing among others the work of psychologist Jean Piaget, archaeologist Steven Mithen and various dolphin and chimpanzee specialists. He also adds a personal anecdote, observing that upon arriving in his lab, his own PhD students – educated in the British school and University system and lacking in-depth knowledge of any topic other than football – already understood the scientific method.

His observations concerning the inherently competitive nature of science are equally wide ranging. Describing a scientific quarrel between the Greek philosophers Pythagoras and Hippasus in which the former had the latter drowned, he observes that if the story is based on the hearsay of later Greek writers, “the fact of the story, and its credibility to those of us who know scientists (one of my research supervisors hated all his competitors and would have murdered them all), speaks of the perennial nature of the scientific personality” (p. 83). Despite their historically limited contribution in terms of plant domestication, European farmers “did develop poppies and oats. As Dr Johnson noted, the Scots eat oats” (p. 36). [Of course, while Dr. Johnson’s dictionary is said to have defined oats as “food for men in Scotland, horses in England,” Kealey is perhaps unaware of the traditional Scottish rejoinder that, as a result, “England is noted for the excellence of her horses, Scotland for the excellence of her men.” (Smith, 1919, p. 75)]

Readers are also reminded in a discussion of the Second Anglo-American War of 1812 that “the Americans, allied to the tyrannical Napoleon, attacked Britain, the world’s sole defender of freedom. But in 1814 the Americans, from their Blackened House in Washington, D.C., were forced to sue for peace” (p. 347).³ The German-born rocket scientist Wernher von Braun was an “ex-Nazi whose own moral fibre would not withstand much examination” (p. 248). David Lloyd George was “a politician who treated the organs of the state (and the women contained within) as his chattels” (p. 275). The University of Sussex’s prestigious Science Policy Research Unit (SPRU) is a “leading UK lobbyist for government money” (p. 298). The eugenics movement “was

born of snobbery” (p. 264) and a desire “to sterilize... unwanted domestic detritus” (p. 268) and long-term “progress” in marijuana’s cannabinoid content demonstrates that agricultural improvements will occur in the absence of government support (p. 160).

One might quibble with some overgeneralizations (for example, for considering the Bronze Age as (almost) one big waste of time), interpretations (his praise of the 1980 Bayh-Dole Act)⁴ or details of Kealey’s account. For example, his description of Polynesians as “Indonesians” (p. 40); his (admittedly mainstream) use of the words “tragedy of the commons” as opposed to the more accurate “tragedy of open access” (p. 42); and his contention that the Dr Strangelove character was based on John von Neumann as opposed to Edward Teller or a composite of nuclear scientists at the time. The book could also have benefited from better editing, as it contains a number of mistakes in the names of individuals and institutions (Chicago University and Toronto University as opposed to the University of Chicago and the University of Toronto; Nikda as opposed to Nikola Tesla, Puerto Rica as opposed to Puerto Rico, etc.). Yet, Kealey’s main arguments seem to me eminently sensible and sufficiently backed up with evidence. To sum up:

- Human beings are both instinctive traders and predators, but the predominant instinct depends on the institutional environment (presence or absence or property rights, the rule of law and freedom to trade) in which individuals find themselves. As a result, smaller and freer polities (as opposed to large empires or monopoly-granting states) who were less able to curtail individual freedoms have historically contributed disproportionately to economic and technological advances.
- Because intelligence is intuitive and evolved to be adaptive, and because humans are born with a propensity to truck, barter and exchange, the scientific method turns out to be nothing more than the older market method (making an observation; creating a hypothesis; testing the hypothesis; measuring the outcome) applied to different types of problems. As Kealey puts it:

[T]he scientific method emerged when a trader, Thales [of Miletus], first extended his market method into an abstract problem of the type we call scientific. What the directors of a company or the dealers on the exchanges or the entrepreneurs in the market do today is no different, in kind, from what researchers do in their laboratories, but it was the traders

who taught the scientists how to formalize it” (p. 89).

- As demonstrated by neuroeconomists, psychologists and historians of philanthropy, giving money to good causes seems hard-wired in human beings. Rich men and women will therefore always compete to provide “public goods.” Because functioning markets ultimately depend on trust, a successful market society not only fosters trust but also the philanthropic impulse that is an extension of the commercial one. “The quickest way of destroying philanthropy” is therefore “for the state to support public goods” (p. 201).
- Scientists, like all other human beings, tend to look for evidence that reinforces their own preconceptions and are always ignoring inconvenient data. Indeed, “because they are working at the limits of knowledge, they have to” (p. 269). While the postmodernists have a point when they describe science as a political activity, their pessimism about universal truths is unwarranted as long as a multiplicity of funding sources are available, for in that context little boys will eventually “show up the big men of science as having no clothes” (p. 272). But while promoting science in a partisan fashion is the only way to eventually discover scientific truths, government funding – despite its greater prestige in the eyes of most academics – should be avoided as it is essentially “other people’s money” and will therefore be less subjected to the test of credibility (the collective judgement of market, civil society and disinterested parties in the scientific community) than funds provided by most other sources.

While Kealey’s historical survey summarizes and expands on themes often already discussed in *The Economic Laws*, the real value added of *SSP* can be found in the book’s final major section, “What is Science?”

As I see it, the author’s key points are that there is no such thing as ‘science,’ only scientists who need to develop mechanisms to trust each other, and that the private sector will always employ or fund plenty of them. Kealey suggests that corporate managers have no choice in this respect, for they must hire scientists who must be allowed and provided the means to be creative and to publish in order to keep up with other corporate and academic scientists’ relevant research. The real value of company scientists does not therefore mostly derive from their own original work, but from their capacity to understand, import and expand upon the relevant information and know-how (tacit knowledge) developed by

others. Although such ‘copying’ might seem somewhat unethical to outsiders to the scientific enterprise, Kealey argues persuasively that scientific copying is not a form of free-riding, but rather an expensive and time-consuming activity because of the actual costs of discovering relevant know-how produced by others, copying (often through reverse engineering), and retaining competent scientists (p. 306).

In the end, the linear model turns out to be “not linear at all,” but rather in need of a “separate origin, a fork and lots of arrows” (p. 294) along with a reverse arrow to reflect the importance of technology on the generation of new basic science:

Academic science ↔ new technology →
economic growth
↑↑↑↑↑↑↑↑↑↑↑↑
old technology

Kealey further suggests that science publishing must be understood in terms of vanity publishing, which he ultimately traces back to sexual selection. In short, humans advertise their sexual fitness by competing for esteem and are ultimately not interested in absolute, but relative wealth (i.e., how well they fare against others). In the absence of ownership, esteem is the only currency of science and scientists will go to great lengths to ensure that they are not scooped or disproved. Just as sexual selection gave us cleverness and creativity, so did it give us “science, that cleverest and most creative of activities” (p. 311).

Building on the work of MIT researchers Eric von Hippel and Thomas Allen, Kealey further documents that competing companies routinely share information and that a surprising percentage (about a quarter according to some studies) of a company’s most important innovations come from swapping information with rivals. Corporations share knowledge for several reasons, but the most important one is to widen their knowledge base and opportunities. Kealey goes one step further than these researchers, however, and suggests that “government money is not necessary for knowledge to be shared or unduplicated” (p.314). He further argues that academics congregate in conferences for the same reason – “not to *give* information away but to *trade* it” (p. 314). Again, this behaviour is a result of a long evolutionary process through which “humans have acquired instincts for guilt, shame, fairness, honour, generosity and the other emotions that facilitate tit-for-tat and other optimal game theory tactics” (p. 321). The scientific enterprise has therefore always been a collegiate

(i.e., a discrete, mutually-selecting club) as opposed to a public good. It had to be so because members needed to trust one another to report their findings honestly. It is no accident that the Royal Society was founded by Freemasons and modelled on Masonic prescriptions (p. 329).

At the end of the day, science can thus be viewed as “a conversation held between researchers who have learned to trust each other and who share similar tacit experiences” (p. 334). The author labels this process an “invisible college good” (p. 336), which he defines as follows:

Any particular area of science is understood by only a few cognoscenti, who trade knowledge for mutual benefit. And the trade is unusual because it is not a simple barter of A for B between two individuals, but, rather, it is more like the pooling of information between peers. Any particular discovery may benefit others more than the discoverer, yet over a period of time, with enough pieces of information being pooled, chance will ensure that the advantages are distributed between all players (p. 336).

The remainder of the section is best described as an abattoir for the sacred cows of mainstream economics (Stanford University’s Paul Romer, Kealey’s main *bête noire*, chief among them) and policy science research in which he takes no prisoners and shows no mercy, while skewering along the way the need for a patent system (with the exception of the pharmaceutical industries) and the division between pure and applied science which he ultimately traces back to snobbery whereas, in fact, each type of science chisels away “at different faces of the same mountain of ignorance” (p. 397).

Sex, Science and Profits is a courageous, lucid and, in my opinion, persuasive book. Its message deserves to be heard and debated.

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Notes

1. Full disclosure: Dr Kealey is a personal friend and thanks me in the acknowledgements to his book for educating him in scientific co-operations between companies.
2. See, among others, Basalla (1988), Mokyr (1990) and Smil (2005; 2006).
3. Of course, the fact that British North America had in the meantime remained a British colony owed much to the French-Canadian militia.
4. The Bayh-Dole Act transferred the intellectual property rights to technologies created from federal funds to university researchers and their institutions. This Act has been blamed for modifying the behaviour of non-profit institutions in a way that increasingly threatens the norms of open science, mainly by giving non-profit institutions an incentive to sue private companies that allegedly infringe on their intellectual property rights (Nelson, 2001; Feldman et al., forthcoming).

BOOK REVIEW

Greener pastures: decentralizing the regulation of agricultural pollution

By Elizabeth Brubaker

University of Toronto, 2007

Review by Glenn Fox

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This important book builds on earlier work by the same author, *Property Rights in the Defense of Nature* (1995), which made a strong case that customary common law in the United Kingdom, the United States and Canada has been an effective means of pollution control, where and when it has been allowed to work. As that earlier book showed, however, legislative law, often drawn up on the premise that it would promote economic progress or the public good, has often weakened these customary common law remedies to air and water pollution.

This new book applies the same analytical lens to the narrower issue of air and water pollution originating on farms. The focus of the analysis is primarily Canadian policy, although connections to similar policies in the United States are made. Brubaker's thesis is that centralization of authority at the provincial level has eroded rights of property owners in rural communities by undermining the effectiveness of customary common law remedies against trespass and nuisance and also has impaired the ability of local municipal governments to resolve environmental conflicts over farm businesses, especially large livestock farms. The main culprit in this provincial centralization is so called "Right to Farm" legislation. Now in place in all ten provinces, right to farm legislation, among other things, reduces farmers' risk of liability for actions that would likely be found to be trespasses, nuisances or violations of riparian rights under customary common law. Right to farm legislation also typically overrides municipal land use policy, reducing the power of local municipalities to block the construction or expansion of large scale livestock production facilities. Brubaker's approach is pragmatic. She sees local government and customary common law as potential allies in the cause of protection of local air and water

quality from agricultural pollution. Her main focus is on how increased regulatory power at the provincial level has increased the scope for legalized nuisance from livestock agriculture. She pays less attention to tensions between customary common law and government in general, whether at the local, provincial or national level, as alternative means of conflict resolution, compared to her earlier work.

One of the most important contributions of the book is the attention that it gives to odour and to drainage as farm-related environmental problems. Environmental policy development directed at primary agriculture has typically emphasized actions to reduce threats of contamination of ground and surface water by nutrients and bacteria. At a local level, however, most environmental conflicts between farmers and their neighbours originate as a result of odour. Manure stinks. But odour, for various reasons, does not seem to have the same policy traction that ground and surface water quality do. Even the contribution of methane emissions from livestock to global warming has received more research and policy attention than odour. Brubaker makes odour a central issue in this book, both as a property rights issue and as a human health concern. And her analysis of environmental problems, not to mention property rights violations, associated with agricultural drainage, is long overdue.

One of the more problematic elements of right to farm legislation in Canada is the use of standard industry practice as a benchmark for determining if a farm is liable for harms imposed on neighbours. Ms. Brubaker carefully documents how this standard has resulted in numerous cases of agricultural pollution being imposed on neighbours in excess of what would be allowed under a strict liability customary common law regime. Murray

Rothbard (1982) showed that this particular issue is an example of a more general problem related to the substitution of negligence as the basis for liability in pollution cases. Under a negligence rule, the actions of the defendant are deemed permissible – and no liability attaches – if a “reasonable man” would have acted the way that the defendant acted under the circumstances. Under right to farm legislation, the reasonable man is represented by standard industry practice. Rothbard and others have argued that strict liability should be applied to nuisance cases. *Greener Pastures* makes reference to Rothbard’s work, but only in a footnote, and does not develop the idea of strict liability.

In contrast to Rothbard, however, *Greener Pastures* rejects the defense of “coming to the nuisance”: the doctrine that if I have freely moved into the locale of the nuisance I cannot then seek compensation for enduring its impact. In general, right to farm legislation fails to distinguish between two cases: (1) those in which farmers might in principle have legitimately acquired the right to release waste into the local environment by virtue of having arrived there first; and (2) those in which farmers would cause a nuisance to neighbouring landowners as a result of such releases. Rothbard, a strong advocate of the principle of “first in time, first in right”, would clearly distinguish between such cases by permitting the defence of “coming to a nuisance” (that if P has voluntarily exposed themselves to a nuisance caused by D, by purchasing property in the vicinity of that nuisance, then P cannot seek compensation from D for any harm caused by the nuisance). By contrast, *Greener Pastures* rejects the defense of “coming to the nuisance”. This rejection is not complete, however, in that, from time to time, she does support the idea that the character of the neighbourhood is a legitimate guideline for resolving disputes and she even seems to prefer zoning over the first in time, first in right principle. In the present context, the defense of coming to the nuisance would only apply for established farm practices. A new or an expanded or otherwise modified farming operation would not be protected under the first in time rule.

Greener Pastures documents the tension between local municipalities, several of which initiated local measures as a reaction to the development of large scale livestock production facilities within their jurisdictions, on the one hand, and provincial legislatures and farm groups, on the other. The major provincial agricultural associations sought action from provincial legislatures to address what they perceived to be a heterogeneous and inconsistent set of local planning measures aimed at regulating agricultural operations. Larger farms spanning adjacent

townships or counties found themselves needing to comply with multiple sets of regulations and policies. The remedy sought from the provincial legislatures was a level playing field at the local level. Ironically, those farm groups later had cause to regret this request when provincial regulation of farm nutrient use and legislation aimed at protecting groundwater quality were introduced. Ms. Brubaker makes a case for the regulation of agricultural pollution at the municipal level, in effect reversing the national trend toward more centralization at the provincial level. Her argument is based on a claim that municipal government is more accountable to its citizens than are more senior levels of government. She acknowledges, however, the municipal governments are not perfect, and that even they need to operate within the constraints reflected in customary common law property rights. She does not make the case, and this case could certainly be made based on this history of right to farm policy in Canada, that municipalities should be allowed sufficient autonomy to innovate and experiment with alternative approaches to the mediation of conflicts between farmers and their neighbors, an autonomy that has been largely taken away by provincial legislatures. This suppression of experimentation and innovation may well limit the ability to identify new and more cost effective approaches to internalize this important class of externalities.

One objection that is raised to the type of argument that Ms Brubaker is making about property rights approaches to environmental protection is that a private property rights approach will create a bonanza for lawyers. Brubaker raises this issue, but not until p. 96, and then only briefly. This matter deserves more and earlier attention. Many readers will have this objection in mind early in the book and they may not get to p. 96 before they lose interest in the story. There are a number of related issues that can be taken on under this heading. The role of class action suits (which might reduce the cost of weak cases to plaintiffs with ulterior motives), joint and several liability, the role of corporations (especially the limited-liability aspects of this form of business organization) and the role of precedent in customary common-law are all related to this point. Many of these issues are analyzed by Bate and Morris, Yandle, Meiners and Rothbard. Environmental economists have generally rejected customary common law remedies against pollution on the grounds that these remedies involve high transaction costs, and hence are less efficient than regulatory approaches, including emission taxes and tradable permit schemes. Although this argument is made frequently in leading textbooks and

journal articles, I have not been able to find analysis or empirical support for this claim. It seems to be made as an appeal to shared beliefs that does not require substantiation. *Greener Pastures*, and before that *Property Rights in Defense of Nature*, as well related work by Roger Bate, Julian Morris, Bruce Yandle, and Roger Meiners, among others, confront this conventional view with evidence from actual case law. The challenge to textbook writers in the field is substantial and the issue is important. It remains to be seen if this challenge will be acknowledged and addressed.

One insightful observation that is offered repeatedly throughout the book has to do with the apparent irrelevance of the name of the political party that forms the provincial government and the outcome of the legislative process, at least in terms of the treatment of the interests of farmers and also the environmental consequences. Liberals, Conservatives and New Democrats have all facilitated the institutionalization of legalized nuisances in rural communities.

Throughout this review, I have used the phrase “customary common law”, for two reasons. First, Elizabeth Brubaker uses this term in *Greener Pastures* to denote the historical body of theory and practice to which she has appealed in this book and in *Property Rights in Defense of Nature*. In addition, Hayek (1973) and Benson (1990) have explained that contemporary common law is a hybrid in which some principles of customary common law persist, but those principles are mixed with legislative law. It is no longer justifiable to conflate contemporary civil law with customary common law. *Property Rights in the Defense of Nature*, in some respects, was a plea to re-establish customary common law to its rightful place in as a bulwark against the fouling of air and water. But the plea is in support of the pure type of that law, not the current adulterated version.

At the beginning of this review, I described *Greener Pastures* as an important work. This claim might seem exaggerated to urban readers who only rarely find themselves downwind from a major livestock operation. But this book is of general importance beyond the specific context of agricultural pollution. *Greener Pastures* and *Property Rights in the Defense of Nature* ably document the extent of something that Ronald Coase (1960) called “legalized nuisance.” Legalized nuisance arises when actions that would otherwise be considered a tort, either on the grounds of trespass or nuisance, were absolved of liability by a legislature. Coase was offering a broad criticism of economists’ diagnoses of externality problems, which, in his view, often misdiagnosed pollution externalities universally as market failures. Coase identified

a few examples of legalized nuisance in his 1960 essay. Unfortunately, the overwhelming majority of economic commentary on that essay has been distracted by controversies over the so-called “Coase Theorem” and his insight about legalized nuisance and the correct diagnosis of externality problems has gone largely unnoticed in environmental economics and, for that matter, in environmental policy. It is precisely this oversight that makes *Greener Pastures*, and before it *Property Rights in Defense of Nature*, and sympathetic work by Meiners and Yandle (1991), so important. If Brubaker, and for that matter Coase and Meiners and Yandle, are correct, then a great many of economists’ diagnostic and prescriptive analyses of externality problems have missed the mark. Coase’s 1960 observation that it is ironic for economists to call for government intervention to address externality problems when it has often been government intervention that caused the externality problem in the first place has gone unheeded.

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BOOK REVIEW

Blue planet in green shackles

By Vaclav Klaus

Competitive Enterprise Institute, 2007

Review by Peter Gordon

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This book offers a concise and easy to read survey of all the reasons to question the conventional wisdom on global warming. Six of these reasons are about uncertainties (climate change is always occurring; global warming benefits some areas and harms others; the human contribution to current warming is unclear; all of the previous doomsday prophesies have been wrong; long-term forecasts of technological change are impossible; climate forecasts based on complex climate models involve large and persistent uncertainties). Seven others evoke policy problems (favored policy measures [the Kyoto accords] are not cost-effective; in cases of global commons problems, multi-lateral policies that require sacrifice are difficult to monitor and enforce; the Environmental Kuznets Curve [EKC] is real; various "green" policies [e.g. solar energy; windpower, biofuels, etc.] are costly; subsidies invite all of the problems of industrial policy; in a world of scarcity, embracing the precautionary principle is expensive; climate change is not humanity's worst problem). In fact, any interaction effects between any of these positions strengthen them. Consider the interaction between the EKC and the problem of forecasting long-term technological change. It suggests that the best way to proceed is to favor rather than stymie economic growth. From a policy perspective, there is much to be done to incite entrepreneurial and scientific discovery, including tax, regulatory and patent reform.

It is a cliché that technological change is accelerating. Living at the time of the most rapid technological change ever experienced, what are we to do with long range forecasts that are rooted in today's technology? Is there a market for my two- or three-year old camera, cell phone, laptop, or PDA? Can we extrapolate an average annual emission of one metric ton per person per year to all the world's population for each of the next hundred years? Klaus writes, "What will the world be like in

100 years, assuming expected economic growth? We do not know, but surely we will be unimaginably more advanced than we are today. One conclusion resulting from the debate about the likely wealth of future society – which is undoubtedly near unimaginable for us today – seems rather obvious and easy: There are some essential things that we should not try to solve on behalf of future generations." (p. 24). He quotes Schelling (2002) as aptly noting that the developing countries should not be making sacrifices today, because "their best defense against climate change will be their continued development." (p. 27). In my view, and in light of Klaus' analysis, the same sentiment could be extended to all countries.

In terms of cost-benefit analysis, this suggests that a high discount rate is appropriate for any analysis of the policy options. The Copenhagen Consensus (CC) ranked mitigation of global warming last on its list of thirty global priorities. Enhanced research and development on low-carbon energy technology was ranked higher at 14th.¹ But cost-benefit rankings seldom impress true believers and politicians. The Copenhagen Consensus might add further perspective to the climate change discussion if its list of challenges were to include the other timely example of how we might respond to a low-odds-high-cost event that has been labeled as possibly globally cataclysmic: collisions with nearby large extra-terrestrial objects. In both cases, the rest of the world would be free riders on costs borne by the developed countries. But when the amounts spent are comparatively small this is a less serious issue. NASA scientists have argued for \$250-\$450-million per year to be spent to map the trajectories of hazardous asteroids and other near-Earth objects.² Annual U.S. costs of the Kyoto accords have been estimated to be in the range of \$20 billion-\$90 billion (EPRI 1999). Can we make progress in getting catastrophists and others to start thinking

about trade-offs via a detailed head-to-head comparison of these two threats?

To be sure, the points summarized in my opening paragraph have all been discussed in many places. Nevertheless, Klaus' presentation is clear and grounded in his deep appreciation of human liberty and his well founded suspicion of central planning (... "I consider environmentalism to be the most significant illiberal populist ideology of the present era ..." p. 14).

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Notes

1. Copenhagen Consensus 2008. Available at <http://www.copenhagenconsensus.com/Default.aspx?ID=953>.
2. "Near-Earth object", Wikipedia. Available at http://en.wikipedia.org/wiki/Near-Earth_object.

BOOK REVIEW

Fatal misconception: the struggle to control world population

By Matthew Connelly

Harvard University Press, 2008

Review by Heli Kasanen

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Matthew Connelly, associate professor of history at Columbia University, says that *Fatal Misconception* was originally intended as a study of the international security threat caused by rapid population growth in poor countries. His research, however, made him realize that the real issue surrounding population growth is not so much national security, but the division between “us” and “them” or how some people have long tried to re-design world population by reducing the fertility of others.

Connelly examines population control as a global transnational movement because its main advocates and practitioners aimed to reduce *world* population through global governance and often viewed national governments as means to this end. *Fatal Misconception* is therefore an intricate account of networks of influential individuals, international organizations, NGOs, and national governments. Connelly emphasizes that the book is not a conspiracy theory with certain individuals or group leading the efforts for their own benefit. Instead, the reader is introduced to actors with various motives and goals who developed different and more or less successful initiatives. Because of the complexity of the author’s viewpoint and the sometimes chilling examples used, this is a difficult book to read. The story, however, is extremely interesting and important.

Fatal Misconception’s most compelling narrative is its description of how the road to social hell was paved with coercive policies that were promoted as being in the public interest and funded and rewarded by international organizations and developed country governments. For example, in 1983, Xinzhong Qian and Indira Gandhi were awarded the first United Nations Population Award to recognize and reward their accomplishments in limiting the population growth in China and

India in the previous decade. During the 1970s, officials in these countries had launched extremely ambitious population programs that were supposed to improve the quality of the population and halt its growth. The measures used were harsh. For example, slum clearance resulting in the eradication of whole urban neighbourhoods and the widespread sterilization of their inhabitants was an important part of India’s ‘Emergency’ campaign. In Delhi, hundreds of thousands of people were driven from their homes in events that resulted in numerous clashes, arrests, and deaths, while a total of eight million sterilizations were recorded in India in 1976. Sterilization became a condition of access to public services ranging from irrigation water and electricity to medical care, pay raises and promotions in public service. According to Connelly, it is impossible to know how many Indians were sterilized against their will, but the numbers must be staggering.

In China, the target of the one-child policy was to stop population growth by the year 2000. As a result, in 1983 alone, over 14 million abortions, nearly 18 million IUD (intrauterine device) insertions, and over 20 million sterilizations were recorded. Several incentives and disincentives for limiting the number of births were also introduced. For example, parents with only one child were given subsidies for schooling and health care, and priority access to housing. However, these benefits could be revoked if the couple had another child. The threat of pay cuts and the banning of children from the educational system acted as disincentives. Coercion was used when propaganda and persuasion proved insufficient. Individual birth permits were introduced and abortions were performed as late as in the eighth month of pregnancy. According to some reports, mothers were given

injections resulting in stillbirths or early infant death.

Connelly's book has a chronological structure and is divided into nine chapters. It sets out to discover and explain different threads of the population control movement from its roots in Thomas Malthus's 18th century population theory to its culmination in massive fertility reduction campaigns in the latter part of the 20th century. The author begins by connecting the discovery of the idea of people as populations in need of control with the rise of nationalism and the institutionalisation of citizenship in the latter part of the 19th century. The need to reproduce national work force and armies created an interest among elite political classes to improve living conditions. This, in turn, called for monitoring the results of policy interventions and taking a closer look at individuals considered socially non-productive and harmful. Scientific advances also raised hopes that improving the make up of future generations could help solve social problems. Eugenicists and Malthusians worried that immigration of the "inferior races" and medical advances and poor relief without scientific population control would result in the unchecked proliferation of the weakest members of society and the degeneration of the "superior race".

Connelly emphasizes the impact of wars on population control ideology and policies. For example, the mobilization and the casualties of WWI strengthened the concerns about the state of the national populations and provided the impetus to increase efforts to "improve" humankind and increase fertility rates in the following decades. These included everything from relatively benign measures such as improving the health of mothers and infants to more draconian compulsory sterilizations and segregation of "defective" members of society into institutions.

As Connelly remarks, a modern reader might be forgiven for thinking that Nazi "accomplishments" in the field of eugenics would have discredited these ideas in the post WWII period. Instead, however, they started to gain ground globally, albeit with a different focus. The worry over the consequences of explosive population growth in the South became greater than the fear of "race suicide" in the West. Limiting population growth was therefore presented as an essential part of the modernization process of poor countries. In short, improved public health and reduced mortality rates had to be balanced by birth control, otherwise the proliferation of poor people would not only result in local catastrophe, but also drag the rest of the world along.

The rhetoric used also underwent some significant changes. Concerns over declining races were displaced by

"rational family planning" that emphasized the principles of positive eugenics by encouraging the reproduction of "good parents". However, preventing the reproduction of those considered unfit for parenthood by providing contraceptives and other measures was as important, if typically not stated in public. The most influential model of family planning was created by the Swedish social planning experts, Alva and Gunnar Myrdal. According to Connelly: "*The genius of family planning was to imply that parents would do the planning, whereas the Myrdals expected social engineers to create conditions that would shape parents preferences (and in some cases compel more rational choices*" (p. 104). Family planning agendas could include a wide range of measures from free school lunches and subsidized housing for mothers to legalized abortions and eugenic sterilizations. According to Connelly, the idea of family planning could incorporate activists with very different motives and goals, because it simply meant a more scientific and rational attitude towards reproduction.

Environmental concerns in a form that is now familiar to contemporary readers also became part of the population control movement in the post WWII period. One of the leading environmentalists was the American William Vogt who blamed increased population growth for widespread deforestation, desertification, and wildlife extinction. Vogt not only opposed food aid on the grounds that it would only delay starvation and actually ensure a greater catastrophe in the long run, but he also viewed diseases as necessary checks to prevent overgrazing and overpopulation. Like many present day environmentalists, Vogt viewed industrial development as essentially parasitic upon nature and therefore an unacceptable way to address development concerns. Environmentalists also linked environmental concerns with eugenics. Vogt, for example, favoured monetary sterilization bonuses because he considered paying small cash incentives to "permanently indigent individuals" as more cost-effective for society than facing the consequences of the genetic and social degeneration caused by them. (see also the Desrochers and Hoffbauer article in this issue).

As mentioned earlier, one of Connelly's main arguments is that the population control movement was initiated and developed by networks of influential individuals and NGOs rather than being designed by national governments. Indeed, it was not until population control was recognized as a significant issue by the UN in the early 1960s that the question began to attract significant funding. A big breakthrough for the movement came in the latter part of the decade with Paul Erlich's *Population Bomb* (1968) and other similarly

catastrophist titles that gave new urgency to old fears. At this point, demands to move “beyond family planning” to coercion became increasingly common.

Expanding population control programs required increased resources and much of the panic generated at the time grew out of fund-raising concerns. A significant threshold in this respect was crossed following the decision of the US Congress in 1967 to earmark funds in USAID’s budget for family planning. From this point onward, large share of the NGO funding came from foreign aid budgets and agencies with USAID being the most significant one. Actually, international aid played an important role in shaping national family planning programs because it was easier to get (sometimes reluctant) national governments to agree to these goals when the bills were paid by foreign donors.

Connelly describes the population movement at its pinnacle as a huge fund raising machinery that devoted ever increasing amounts of resources to the creation and implementation of ever more ambitious population control crash programs. His story culminates with the founding of the United Nations Fund for Population Activities (UNFPA) and to the large-scale co-operation of USAID, UNFPA, World Bank, and NGOs to halt world population growth country by country. In the beginning of the 1970s, UNFPA was funding nine hundred projects involving nearly one hundred countries. The determination with which these programs were implemented is nothing short of astonishing. For example, in Indonesia’s population program some thirty thousand workers were hired and 115,500 community leaders were trained to support the program. Male heads-of-households were required to report in public meetings whether their families were using contraception. The results were used to re-enforce usage. Some community leaders even beat drums to remind women to take their pills. The UN population program reached its apex 1970s and 1980s when UNFPA awarded its largest grants ever to support programs in India and China. According to Connelly, these funds ultimately contributed to the rejection of the idea of population control and the demise of this movement.

Fatal Misconception is an important contribution to the study of the history of population and social policies. A transnational viewpoint reveals the nature of the population control movement as a network. It shows that historical interpretations that remain confined to national borders are often incomplete, if not misguided, because national policies are often strongly influenced by broader transnational movements. For example, as Connelly remarks, legislation for eugenic sterilization

was passed simultaneously in many countries in the early 20th century, including Nordic countries, with very few political or public protests. One important factor in this respect was that this legislation was promoted mainly by medical and other experts belonging to transnational scientific networks. Eugenics was considered the domain of these experts, and arguments from authority went virtually unchallenged.

Adopting a global approach, however, implies that local contexts and differences are often treated superficially or unsatisfactorily. While Connelly tells his story from the viewpoint of the most important actors in the population movement, the interplay between the powerful and wide-ranging transnational trends and local contexts should not be entirely omitted. For example, although the Finnish eugenics movement was in many respects similar to those in Germany and other Nordic countries, the majority of the sterilizations in Finland were performed as late as in the 1950s and 1960s¹. In other Nordic countries their number went down rapidly in the beginning of the 1950s. One explanation for this is that the construction of the Finnish welfare state truly kicked off only after WWII, considerably later than in neighbouring countries. Hence, the Finnish sterilization policy has to be examined in relation to the development of other welfare institutions, such as the institutional care for the intellectually disabled.

This brings us to the link between population and social policies. It brings out the fact that there are always certain goals and motives behind social policy interventions, such as supporting maternal health care and that social policy has often been a means of striving for certain demographic goals. As Connelly’s analysis shows, the huge death toll of the first World War and the political situation in the interwar period generated a significant interest in “investing” in future generations. When governments began to pay the costs of procreation, the issue became a public matter and people’s reproductive choices came under increased scrutiny.

A central part of Connelly’s argumentation is that population control, as a global movement, does not exist anymore. NGOs and international aid organisations have been forced to change their attitudes and methods as a result of determined opposition, various intellectual critiques, and the rejection of the population control agenda by most governments. However, most of the associated public bureaucracies have not been terminated, but rather moved to a new agenda emphasizing the fight for equal rights, such as right to development and women’s access to education, work and reproductive rights.

In documenting this shift in the nature of the population control movement, Connelly moves from chronicler and critic to cautious advocate of the newly purposed entities. While he worries that the declining birth rates and “aging” populations in advanced economies could result in coercive pro-natalist campaigns, he nevertheless fears the inequality that might result for example from genetic counselling. He argues that, if these services are not universally available, the cumulative effect of individual choices could endow the privileged few with genetic advantages over others. In order to avoid these threats, he suggests that reproductive rights should be secured to everybody. In addition to freedom from coercion and manipulation, people should have equal access to childcare, birth control, infertility treatment, and genetic counselling. As he views it, freedom of choice is not enough because choices can be conditioned by design.

Underlying this dubious public policy proposal is a failure to distinguish between positive and negative rights. Negative rights, i.e. the right to be free from interference, underpin concerns about population control policies. Positive rights, i.e., the right to be provided with something, always pose an obligation on others to do something – and as such inherently conflict with negative rights. Even if we were to accept in principle that some violation of absolute negative rights is desirable on redistributive grounds, it is not clear that the specific form of redistribution proposed by Connelly is desirable. It is precisely with the kind of policies he is suggesting, such as securing infertility treatment or genetic counselling to everybody that manipulation of individual choices is made possible. For example if governments sponsor genetic counselling or birth control, there is a clear presupposition that the increasing usage of these services is desirable. Thus paying for these services is intended to steer people’s behaviour. If people are offered subsidised or “free” services, their choices are unlikely to be the same as they would be if they would be if only their consumption possibilities were increased or in other words, if they received money without strings. As Connelly himself puts it: “*The great tragedy of population control, the fatal misconception, was to think that one could know other people’s interests better than they knew it themselves.*” (p.378).

Worse, there is potential for such policies to become more expressly coercive. There are examples in the

Nordic countries of incidents where health care personnel have failed to inform future mothers of the voluntary character and purpose of prenatal screening, or where people have been persuaded to abort foetuses when there has been a high probability of being born with an intellectual disability – even though such “advice” is contrary to current legislation. In part this is an inevitable consequence of the collectivisation of risk created by the welfare state. Pressure on public finances means that savings in public health care and other services can be perceived as acceptable or legitimate reasons for aborting defective foetuses. It also makes sense that there is a constant discussion in the welfare states about the “quality” of the local population. There is a huge pressure to steer individual choices because of the costs that aging, obesity, smoking, drinking, lack of exercise, and other “bad habits” inflict on public health care and social services.

Fatal Misconception shows that there were people in the population control movement with good intentions, whose aim was to reduce inequality, not to coerce others. However, they compromised and ended up using family planning as a vehicle for population control. In Connelly’s opinion, future systems advocating reproductive rights “*must have a heart and brain and run on more than money*” (p. 383), but his own analysis and the welfare state rationale stated above suggest that we should be more sceptical. There is always a significant risk that even the best intentions will generate bad outcomes when private choices are brought over to the public sphere through policies promoting a certain social agenda. Thus, in the future, instead of promoting certain things as universal positive rights, we should concentrate on preventing outside coercion and manipulation by securing reproductive choices as private matters.

Notes

1. The record year was 1960 with 514 eugenic sterilizations. In total, 7530 eugenic sterilizations were performed in Finland in 1935–1970. Mattila, M. 1999. *Kansamme parhaaksi. Rotuhygienia Suomessa vuoden 1935 sterilointilakiin asti*. Helsinki, Suomen Historiallinen Seura.

BOOK REVIEW

Creating a world without poverty: social business and the future of capitalism

By Muhammad Yunus

Public Affairs, New York, 2007

Review by Per L Bylund and Mario Mondelli

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How do you solve the problem of poverty in this modern day and age? That is the question the 2006 Nobel Peace Prize laureate Muhammad Yunus sets out to answer in *Creating a World without Poverty* (2007). He finds a possible solution in a concept termed “social business,” which is a way of running private businesses not primarily to earn profit, but to provide a social good. The book provides a discussion on this concept based on a number of Yunus’ own experiences in starting businesses with social rather than monetary aims. The book discusses primarily the recently established Grameen-Danone, a Grameen Bank and French dairy giant Danone joint venture, founded with the goal to supply a cheap and highly nutritional yogurt to poor children and families in rural Bangladesh. Partly based on these experiences, the book tries to convey the potential of Yunus’ concept of social business as a viable solution to world poverty.

Yunus, a banker and economics professor, maintains that the free market is an extraordinarily powerful tool to bring about prosperity and provide products to consumers. Market actors, aiming primarily to maximize profits, continuously find ways to do more with less. Still, the economic prosperity brought about by the free market, he claims, “has brought with it a worsening of social problems” (p. 4). The reason for this, he argues, is that it is not the purpose of the capitalist economy to solve social problems and therefore the free market may “exacerbate poverty, disease, pollution, corruption, crime, and inequality” (p. 5).

Yunus further states that the institutions and incentives in the market economy are inherently deficient in that they do not provide a means for solving poverty.

Instead of bringing the benefits of the market to the poor, market actors seem to compete in providing more advanced and expensive products to consumers in already prosperous countries. Even government is dismissed by Yunus due to its inherent inefficiency and a prevalent threat of corruption.

The solution offered by Yunus is not to design a new system, but to utilize the powers of the market in a new way. To make the structure of capitalism complete, Yunus argues, it is necessary to introduce another kind of business. His proposal relies on the recognition of a new type of entrepreneur whose motivation is not profit but to “do good,” a motivation that will lead not to profit-maximization but to “social business.” The social business is not primarily a charitable organization, but a competitive enterprise – restricted from making losses or paying dividends – working to provide charitable rather than business goals. The only real difference between a profit-maximizing business and a social business is their objective and therefore the criteria by which it should be evaluated: it is “operated as a business enterprise, with products, services, customers, markets, expenses, and revenues – but with the profit-maximizing principle replaced by the social-benefit principle” (p. 23). The major contribution and importance of the concept of “social business,” according to Yunus, is that it brings the benefits and advantages of free-market competition to social improvement.

As noted above, Yunus relies heavily on the ability of globalization and the free market to bring more benefits to the poor than any other conceivable alternative. But the concept also relies on a fundamental confidence that

poor people are endowed with a latent ability to get out of poverty; that what is keeping them from doing so is the lack of an enabling environment. The problem is therefore structural in the market economy, but in a way that can easily be corrected by introducing a social aspect of market action that recognizes the “multi-dimensional nature of human beings.” The underlying value of the constitution of a social business is to “unleash [the poor’s] energy and creativity” (p. 247) by providing the market infrastructure needed for poor people to create their own means of wealth creation. This is, roughly, the idea behind Yunus’ successful and world-renowned project of the Grameen Bank. *Creating a World without Poverty* is essentially an attempt to conceptualize experiences from that project.

The concept of social business is interesting, but depends heavily on the entrepreneur taking on a new role or function while playing according to the existing rules in the marketplace. While the objective of the social business is not to make profits, it is necessary that the entrepreneur manages the business in such a way that the social output is maximized while costs are kept well below revenues. The entrepreneur is therefore expected to carefully navigate in such a way that business decisions are optimal from the point of view of economizing, while maximizing output in terms of social good rather than revenue stream. This may be achievable where there is no market competition, but Yunus does not expect the social business to benefit from monopoly status. Contrarily, the social business is to compete with both profit-maximizing firms and other social businesses, a point that we will return to below.

It is not clear what would motivate entrepreneurs to pursue new ways of doing business and achieve a more efficient allocation of resources without profit incentives. Is the “social passion” of the entrepreneur enough of an incentive to allow him or her to compete successfully with profit-maximizing businesses? In the case of the investor-entrepreneur it is possible to argue that the only difference to for-profit enterprises is that the objective is not profit maximization but to maximize a solution to social/environmental problems. However, it is not clear how the performance of a social business can be measured without considering monetary profit. It seems the social business might tend to move from what Ludwig von Mises termed profit management towards “bureaucratic management” (Mises 1983). Is the “want” to maximize social benefits a sufficient driving force to minimize unit cost and keep bureaucratization of management at bay?

Moreover, the entrepreneur in social business needs

a special ability to perceive social *and* business opportunities where profit-maximizing entrepreneurs do not, since social businesses are expected to emerge in niches not currently explored by profit-maximizing business. It is reasonable to assume that such niches may not be profitable or that they may be burdened with high degrees of uncertainty. The question then arises: do social businesses require a special breed of entrepreneurs, or can they be easily implemented by entrepreneurially minded individuals guided by a social passion?

Rather than seeing the poor as consciously and deliberately passive actors, Yunus sees them as very able people, victimized by a market environment stripping them of the means to take advantage of everyday business opportunities. The truth, he claims, is that “[t]he poor can be self-employed entrepreneurs and create jobs for others” (p. 12), and the social business is a way to provide a setting where they can reach their true potential.

Social business is therefore not only a complement to profit-maximizing and not-for-profit business and organizations in the contemporary economy, but an *alternate set* of market actors bound by a distinctly different purpose. It is not simply a version of corporate social responsibility, but an organizational form where social responsibility has taken profit’s place as main goal and incentive. Social businesses will put into practice a new category of business models calling for listing on a separate stock exchange, market and business analysis in social business magazines, demand for “social” educational programs, etc. This system will, just like the contemporary capitalist for-profit market system, include competition between social businesses as well as competition with profit-maximizing businesses.

But the nature of the social business, as defined by Yunus, seems to suggest neither the reason nor the means for competing. Social businesses aim to create social benefits and social improvement rather than profits, so there would be no reason for them to establish in markets where profit-maximizing companies supply the same services. They would also have no reason to continue operations if a market they create attracts profit-maximizing businesses; in fact, they would do better selling their capital assets and establish operations in an area not yet enjoying basic products supplied by for-profit market actors.

Rather than realizing this implication of the definition of social business, Yunus claims they “will compete with [profit-maximizing businesses] *on the same terms* as we see in traditional capitalist competition” (p. 26, emphasis added). But social business does not have the same aim, purpose or incentives as its for-profit

counterpart, and would therefore be hopelessly at a disadvantage trying to supply the same service or product in the same market. Even though Yunus understands that the “social business must be *at least* as well-managed as any [profit-maximizing business]” (p. 137, emphasis in original) to be competitive, he fails to understand that the social business lacks an inherent maximizing incentive comparable to the profit motive.

Social businesses are also said to be able to compete with one another in a non-rivalrous manner, since they have the same non-exclusive goal and act as complements rather than substitutes. Social business competition is therefore to a great extent cooperative rather than rivalrous, which means these firms are thought to spur each other to supply better products and services at lower cost (competition) while rejoicing in *each other's* success in doing so as part fulfillment of the over-arching goal. But this is at the heart of the problem: cooperative group action without individual profit incentive is subject to the free-riding problem; there is weaker incentive to minimize costs and/or maximize output in the absence of real competition and profit.

Perhaps this is part of the reason why social business is not a widely observed phenomenon. Another reason might be the high-risk, no-return nature of social business enterprises. The social business is supposed to find opportunities to do social good through supplying products and services in markets where no profit-maximizing businesses have dared enter. Doing so, the social business is to be primarily financed by investors who do not seek return to their invested capital, and with a business idea to supply services in a market with little purchasing power without making financial losses.

Yunus does not acknowledge these potential problems of social business. Instead, his discussion is imbued with optimism and an unwavering focus on the potential good brought about by successful social business. The social business has the potential to create a world without poverty through utilizing existing market mechanisms but doing so in a new way. The strength of the social-business concept is that it “brings the advantages of free-market competition into the world of social improvement” (p. 27), and as such it does indeed seem to have the potential to be an effective anti-poverty measure. It is in essence an arrangement that brings the supremacy of market organizing of resources to charity, rather than – as Yunus wants us to believe – adding a humane dimension to capitalism.

His optimism and confidence in the power of social business are commendable, but this does not shroud the fact that the potential in the concept seems to be compromised in its very nature. There seem to be very few social businesses in the world, which implies that social business is a very difficult enterprise.

Yet it is difficult to assess the real potential and problems of social business. His treatise is a personal narrative rather than a structured introduction to the conceptualizing of social business and therefore does not offer an in-depth discussion on what social business really is. The book is permeated by contradictory statements on concepts essential to the understanding of social business, leaving the careful reader wondering what Yunus truly believes.

Furthermore, the argument for social business is saturated with politically correct statements, apparently in an attempt to seduce the audience through the use of an emotionally-charged vocabulary. In fact, it is not implausible that a compelling argument for social business can be made without such statements – and that it may even be a *better* and more persuasive argument. More genuine efforts to operationalize the concepts and a more detailed discussion on the role of the entrepreneur motivated by social passion would have given more weight to the argument.

In conclusion, the book presents a number of interesting ideas, but leaves the reader with only limited guidance as to whether these ideas are realizable; after reading the book, the reader is left with more questions than answers.

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BOOK REVIEW

The dominant animal

By Paul Ehrlich and Anne Ehrlich

Island Press, 2008

Review by Matt Ridley

Matt Ridley, author on genetics and human behaviour, has had careers in journalism and as a scientific correspondent.

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‘On what principle is it,’ asked Thomas Babington Macaulay in 1830, ‘that when we see nothing but improvement behind us, we are to expect nothing but deterioration before us?’ He was reacting to a routine jeremiad of romantic pessimism from the reactionary poet laureate, Robert Southey, and he observed something that has been even more true in the two centuries since than it was in his own day: the more things get better, the more sages tell us they are about to get worse. Every sage always seems to live at history’s turning point.

Paul and Anne Ehrlich, authors of *The Dominant Animal*, are modern Southseys. ‘The world in general seems to be gradually awakening to a realization,’ they regret to say, ‘that our long evolutionary story is, through our actions but not our intentions, coming to a turning point.’ For the Ehrlichs, population pressure and ‘global heating’ (the word ‘warming’ is not scary enough for them), not to mention resource exhaustion and toxic poisoning, will ensure that we are the last generation to have a decent standard of living. We are doomed to a terrible future.

The only trouble is, one of the Ehrlichs said this before in the 1960s, only then he was more specific. ‘In the 1970s and 1980s hundreds of millions of people will starve to death in spite of any crash programs embarked upon now,’ wrote Paul: ‘At this late date nothing can prevent a substantial increase in the world death rate.’ This is from the opening paragraph of *The Population Bomb*, first published in 1968, which was the making of Paul Ehrlich’s reputation, turning him from an obscure snake and butterfly ecologist into a guru of the environmental movement complete with MacArthur ‘genius’ award. In that book Ehrlich very explicitly and specifically argued that mass death was inevitable and imminent, that human numbers would fall to 2 billion, that the poor would get poorer, that those who saw that

population growth was already beginning to slow were as foolish as those who greet a slightly less freezing day in December as a sign of approaching spring, and (in later editions) that the Green Revolution then transforming Asian agriculture would ‘at the very best buy us only a decade or two.’

So it was with curiosity that, four decades later, I opened the current volume to see how the Ehrlichs would address the fact that far from mass starvation, the 1980s saw the virtual ending of famine as a cause of death (except where politics created it), the 1990s saw more people removed from poverty than in any previous decade and a halving of the percentage living in poverty even on the World Bank’s conservative figures, that world population growth rates did start falling in the 1960s and by the 1980s even the absolute number of people added each year was dropping, and that the Green Revolution trebled world cereal yields, turning India into a grain exporter even as its population trebled.

Alas, not a word about the previous predictions. Take the Green Revolution. In the new book, there is a glancing admission through gritted teeth that it ‘did increase the food security of millions of poor people’ – but at the expense of disease-susceptible monocultures (no case cited), the disappearance of traditional varieties that make it harder to adapt to changed conditions (yet this morning I listened to a genetic engineer on the radio describe his success with making drought-resistant crops) and ‘nutrient exhaustion’ (even though the whole point of the Green Revolution was to allow the use of fertilisers to refresh tired soils). ‘In the past decade or two,’ the Ehrlichs write, ‘expansion of global food production has failed to match the growing global demand.’ Simply false: per capita food production has grown steadily throughout recent decades.

(Incidentally, even on a much smaller scale, *The*

Population Bomb has proved wonderfully non-prophetic. At one point in that earlier book, Paul Ehrlich wrote about his early research on the water snakes of Lake Erie, concluding sadly: 'You see, Lake Erie has died...the snakes are almost gone.' Yet, the US federal government is considering whether to remove the Lake Erie water snake from the endangered list, not because it is extinct, but because its numbers in Ohio have rocketed from less than 2,000 in 1999 to more than 12,000 today.)

Surely, I thought, as I read on, the Ehrlichs were going to acknowledge that their previous pessimism had been misplaced and their advice to the world to cease economic growth and embrace drastic authoritarianism in the 1960s should be at least revisited. Not a word. The diagnosis – imminent collapse – is the same; and so is the treatment: retreat. The Ehrlichs have plainly learned one lesson. They give fewer hostages to fortune in the new book, which simply wails and carps and moans rather than predicts anything too closely dated. 'An unhappy increase in death rates' is forecast (with what almost seems like relish) as a consequence of the calculation that humanity is now living at 120–140 percent of the biosphere's regenerative capacity. But no date this time.

The Dominant Animal, after a few chapters of earnest but aimless and rather out-of-date discussion of evolution and psychology, is simply another specimen of the 'glass-half-empty' school of environmental writing. Every pessimistic statistic is embraced, however dodgy; every piece of good news ignored or dismissed. And seen from the lofty omniscience of Mount Ehrlich, everybody, even including the reader, is an idiot: 'The penalties for continued ignorance, malfeasance, and folly among opinion makers and the leaders of society – indeed all of us – have escalated enormously.'

It is a pity that the Ehrlichs have so little curiosity about why their previous predictions are wrong for it would enable them to make a fascinating observation. In *The Population Bomb*, they extrapolated population

growth to make the point that things could not continue as they are. Indeed they could not, they did not and they never have, since the very dawn of *Homo sapiens*. That is the whole point of human ecology: it is dynamic, ever changing and ever evolving. The amount of oil left, the food growing capacity of the world's farmland, even the regenerative capacity of the biosphere – these are not fixed numbers; they are dynamic variables produced by a constant negotiation between human ingenuity and natural constraints. Just as economists are learning to ditch the dire concept of 'equilibrium' in favour of constant innovation and change, so academic ecologists are learning to ditch the dire concept of 'climax' vegetation in favour of constant succession and instability. A rain-forest is a highly dynamic system.

Embracing dynamism means opening your mind to the possibility of posterity making a better world rather than preventing a worse one. We now know, as we did not in the 1960s, that more than six billion people can live upon the planet in improving health, food security and life expectancy and that this is compatible with cleaner air, increasing forest cover and booming populations of whales and elephants. The technologies of 1960 could not have supported six billion – Paul Ehrlich was right there. But the technologies changed. Is six billion the turning point? At a time when glass is replacing copper cable, electrons are replacing paper, most employment involves more software than hardware, otters are returning to English rivers, only the most static of imaginations could think so. 'We cannot absolutely prove,' said Macaulay, 'that those are in error who tell us that society has reached a turning point, that we have seen our best days. But so said all who came before us, and with just as much apparent reason.'

BOOK REVIEW

Starved for science: how biotechnology is being kept out of Africa

By Robert Paarlberg

Harvard University Press, 2008

Review by John H. Sanders

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This is a well written book, which raises many issues about African agriculture and the local institutional environment for development. The author has written before about genetically modified organisms (*The Politics of Precaution*). In his latest offering, he develops the thesis that the changes in attitudes towards agricultural sciences in developed countries has led to a resistance towards further scientific advances in agriculture, especially if those advances are seen as benefiting farmers only and not consumers. This resistance and a distrust of regulators have led to strong opposition to GMOs in Europe, but not in the USA. Because of the greater importance of Europe to Africa for both trade and aid, this European rejection of GMOs has effectively been exported to all African countries except South Africa. Consequently, the future growth of agricultural development in Africa is threatened.

There are four central premises in the book, which I will discuss in turn.

- 1) There is underinvestment in agricultural science in Sub Saharan Africa;
- 2) Many African policy makers and NGOs have not supported science based agricultural development;
- 3) There has been an excessive regulation of biotechnology in almost all African countries;
- 4) This overregulation discourages donors from helping scientists obtain drought resistant cultivars for Africa.

Point 1) is not well defined and probably not true except for export crops. Point 2) is very important and will be discussed in detail. Point 3) identifies the culprits blocking additional

biotechnology activities. Not only is Africa systematically discouraged from developing their own GMOs, even imports of GMOs for food aid and trade are now being shut out. But is this a central problem presently for African agricultural development? Point 4) suggests again that a simple scientific solution for African agricultural stagnation is available but just beyond reach.

First, the economic definition of underinvestment is that the returns are very high and probably within reach with additional investment. The returns to agricultural research are measured by how much their product benefits farmers and consumers and then compared with the costs of the supporting agricultural research and extension infrastructure. There is a substantial economic literature on this. Paarlberg cites two studies with average rates of return for agricultural science of 22 and 30% (p. 85). These are very high returns, but largely because of a disproportionate effect from export crops.

Both donors and policy makers have become discouraged with the lack of success of African research establishments in obtaining high returns for staple food crops. Here the performance has been poor despite some recent exceptions for irrigated rice and new corn varieties. In general, the gains from research in root crops, sorghum, millet, cowpea, and peanut performance have been negligible in spite of substantial funding and research efforts since the great drought of 1968–1973. As a result, donors and national policy makers justly consider the returns to investments in agricultural science very low in Sub Saharan Africa. The basic problem, however, is not a lack of performance by researchers. Rather, the researchers' output rarely makes it beyond the research station.

The critical bottlenecks lie in extension, input and

product markets, and the capacity of farmer organizations to move the technologies for staple crops from the research station into farmers' fields.¹ This is where science and practical application need to be concentrated to get the backlog of accumulated technologies out into the fields. Once this is achieved, there will be more domestic support from both farmers and policy makers for increased investment in both basic and applied agricultural science.

The research and educational commitments from donors following the 1968–73 Sahel droughts were never expected to last 50 years, but it was not unreasonable to expect two decades of substantial donor investments to create self-sustaining research establishments comparable to those observed in Asia and Latin America.

This brings us to 2), which can be repackaged into two questions. Why do policy makers feel frustrated by their agricultural research establishments? And, why should we care about the particular perspectives of the numerous NGOs with their countless objectives and *modus operandi*? The answers are related.

The principal institutional development emphasis in Sub Saharan African agriculture has been on short term training (with international agricultural research institutes) and long term education (US and European universities) for the national agricultural research institute personnel. Both short and long term training built up the human capital for staffing these national agricultural research institutions as well as other African or Africa-related agencies.

There was, however, much less donor investment in the human capital of extension services.² When the World Bank focused on investing in the national extension service during the 1980s and into the 1990s there was an increase of highly trained extension personnel and a series of improved institutional performance measures. Unfortunately, an enormous cultural divide in the respective scientific backgrounds of the extension and research personnel remained. In spite of many memoranda of agreement between the two, the extension services often maintained their preferences for indigenous varieties and opposed inorganic fertilizers and other chemicals.³ This stance precluded their collaboration with the national research institutions in order to get new technologies onto the farm. The extension viewpoint was so influential that much agricultural research eventually became directed towards low input solutions. Given the widespread nutrient deficient soils, this was like asking poor people to improve their incomes by eating less.

After a bitter internal fight, the "extension first"

focus of the World Bank was abruptly changed. This left national extension services in Sub Saharan Africa with enlarged staffs and decreased financial support. With national extension services generally unable to fire employees, almost all their funds were needed to support salaries, leaving them dependent upon some type of outside support to implement action programs. Into this vacuum stepped many NGOs, either implementing their own extension, contracting some of the national extension staff to work with them, or subsidizing activities of the extension service. So the NGOs had to be listened to as they became the principal players in the extension activity. Unfortunately, the agricultural experience of many NGO members often consisted of growing tomatoes in their back yards.

This takes us to 3), the importance of over regulating bio-technology. The choice of regulatory regime between the American (Is the risk similar to something already approved?) and the European (Prove that there is no risk) variants will go on for a long time. Both Americans and Europeans, however, distrust their regulators and both sets of regulators responded poorly to the mad cow threat. The lower American standards regarding the acceptable risk of complicated toxins, such as aflatoxin, will probably be raised towards the European standards in the future as medical and food science knowledge increases.

The influence of both NGOs and European donors in pushing against science based agriculture, however, is diminishing as their alternatives are clearly not working. The most important technologies to get onto farmers' fields are already developed and tested. These include the new cultivars, higher inorganic fertilizer levels, improved agronomy and water harvesting techniques for the low rainfall regions. While there remain various problems in getting these technologies in the field, there is nonetheless an increasing number of success stories.⁴

While concerns about hybrids and biotechnology can be delayed for five or ten further years, there is an exception here for the region I work in. The West African cotton producers (especially Mali, Burkina Faso, Chad and Benin) will continue to lose world market share if they do not introduce Bt cotton (Vitale et al 2007). Bt cotton replaces a large number of sprayings of frequently very dangerous and expensive insecticides. Paarlberg summarizes evidence demonstrating reduced insecticide spraying as high as 40 to 60% for the four countries reporting significant use of Bt cotton (p.29). Monsanto has been working in Burkina Faso for the last three years and the Burkinabe are apparently going to release new Bt cultivars to farmers with this gene crossed into local

material in 2009. One would therefore expect even the most rabid environmentalist to support these advances.

Point 4, drought resistance, is the Holy Grail of agricultural research. This search for drought resistance is such a romantic endeavor that we can reasonably expect donors to keep supporting it in the foreseeable future. It was an important priority in the Bean Program at CIAT (International Center for Tropical Agriculture located in Cali, Colombia) when I started working there in 1976. This search has supported generations of breeders and physiologists. Yet researchers can not even give a consistent definition of its objectives. Is their source of drought resistance a response to early, late or mid season drought or is it an attempt to get some of the drought resistant characteristics (Paarlberg, p. 150) of semi arid cultivars such as sorghum and millet into maize or other plants? The private companies are especially secretive on their drought resistance research, giving it a mysterious, elusive quality. "We have it but we are just not going to tell you about it!" seems to be their motto (Paarlberg, pp. 161–163).

The main accomplishment of drought resistant breeding has been shortening the growing season especially with maize.⁵ Unfortunately, when we improve the agronomic environment through water harvesting and inorganic fertilizer, we want plants that stay in the field longer to take advantage of this improved environment (Sanders and Shapiro 2006). We need cultivars bred for this improved environment rather than the elusive super cultivar.

Even with this challenging of some of its basic premises, *Starved for Science* is nonetheless very good, thoughtful and well worth reading.

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Notes

1. In contrast with the food staples, cotton yields more than tripled in the francophone producing areas in the 1970s. For comparison of the cotton successes with other crops, see Sanders et al, 1996.
2. Large scale investment in basic education for the rural areas would also have been expected to facilitate technology transfers from the experiment stations.
3. Paarlberg elaborates on this opposition to new cultivars and inorganic fertilizer from various sources especially NGOs in Chapter 3.
4. For the development recommendations I draw on 26 years of agricultural experience traveling to the Sahelian region, as well as on our present extension program which had over 1,000 ha in new technologies of sorghum and millet in the three Sahelian countries of Mali, Niger and Senegal in 2008. To introduce new technologies for staple food crops it was necessary to confront the seasonal and good season price collapses, obtain price premiums, for a higher quality product, and exert bargaining power through farmers' associations. All of the above marketing strategies help raise profitability sufficiently to pay for higher input levels, i.e. the necessary inorganic fertilizer and the improved cultivars (for a discussion of the interaction of technology introduction and marketing strategies see Tahirou and Sanders, 2006).
5. This earliness search is not really drought resistance. It is drought escape. Drought resistant maize already has a name. It is sorghum.

