

Earth's Biosphere in Peril

John Cairns, Jr.

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On-line book by
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First website posting: March 2011
(Chapters added as completed)

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FOREWORD

When I began to work on water pollution in the late 1940s, chemical tests were the norm for estimating the effects of industrial wastes on aquatic organisms. The laboratory toxicity tests were low in environmental realism and involved only a single species that was exposed for up to 96 hours. Ecotoxicology (formerly called *environmental toxicology*) has taken huge strides between the late 1940s and 2011. The science is robust — the methods and procedures have been validated.

In 1948, I was one of two protozoologists on the river survey team formed by the Academy of Natural Sciences in Philadelphia, PA. The charge to the team was to develop biological pollution assessment methods and procedures for streams and rivers. The initial studies were on the Conestoga Creek and, to a much lesser extent, the Brandywine Creek, both in Eastern Pennsylvania. The methods and procedures were subsequently tested and validated in both the United States and Canada in North America and the Amazon River in South America. Much later, US President Bill Clinton presented Dr. Ruth Patrick, the team leader, with the National Medal of Science for her pioneering research.

However at present, all science, and particularly climate science, is in danger because “. . . a committee of the US Congress was poised to pass legislation that would overturn a scientific finding on the dangers of global warming. The Republican-sponsored bill is intended to prevent the US Environmental Protection Agency (EPA) from regulating greenhouse-gas emissions, which the agency declared a threat to public welfare in 2009” (*Nature* 2011). Another serious long-range problem is sea level rise, which will probably affect at least 20 major US cities in this century (Strauss 2011).

Scientists and their evidence are the essential information flow that may enable civilization and *Homo sapiens* to lessen the risks of these dangerous times, and the EPA is being given a hard time with legislation that restricts its ability to take preventative action. Significant cuts by the US Congress in EPA’s funding are also being considered. As a consequence, this “work in progress” on-line book focuses on both science and intergenerational ethics/morality in the hope that the effects of “business as usual” upon intergenerational ethics/morality may change some minds.

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PREFACE

When I placed the *Future Eaters: Metaphors and Aphorisms as Environmental Teaching Tools* e-book on my website in 2009 as a “work in progress,” I fully expected it to be my last book. However, Dr. Ronald E. LaPorte subsequently invited me to submit a Legacy Lecture for the National Academy of Sciences Members’ Lectures site (<http://www.pitt.edu/~super1/NAS/nas.htm>) for the Supercourse Lectures (my 14 lectures are included in this volume as Chapter 1). Then I received an invitation in spring 2010 from the *Journal of Cosmology* to submit the manuscript titled “Threats to the Biosphere: Eight Interactive Global Crises” (Chapter 2 in this volume). These two events led to a defining moment for me — I decided to spend the rest of my life writing about the Biosphere. In late February 2011, I started another online, free book on my website. So, here Darla Donald (my editorial assistant) and I go again!

ACKNOWLEDGMENTS

I am indebted to Darla Donald for transcribing the handwritten portions of this book and for editorial assistance in preparing it for my website. My daughter Karen Cairns has been extremely helpful in providing a positive incentive for reconsidering the many ethical issues involved. The first draft of every manuscript for this volume was handwritten on recycled paper supplied by Leslie Brooks of the activities center at Showalter Assisted Living Center, Warm Hearth Retirement Village.

Earth's Biosphere in Peril

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CHAPTER 1

Earth's Biosphere

This chapter acquaints readers with Earth's Biosphere since it is rarely mentioned in public discourses.

- (1) The Biosphere is more than a collection of plant and animal species — it is an operating system.
- (2) The present Biosphere is the one in which *Homo sapiens* evolved and flourished.
- (3) If “business as usual” continues, the present Biosphere will collapse (lose a huge number of its component species) and, over evolutionary time, be replaced by a new, quite different Biosphere that is unlikely to be favorable to *H. sapiens* — after a great extinction, the majority of species are different.
- (4) The consumer economy is workable because of a continual flow of renewable resources provided by the Biosphere. So why do polls always show a high priority for the human economy, and the environment (i.e., the Biosphere) is barely listed in the top 20 priorities?
- (5) A present ecological overshoot (i.e., using renewable resources faster than the Biosphere can regenerate them) is at present 154%, which is clearly unsustainable.
- (6) The Biosphere could cross more crucial tipping points in the near future, which would place humankind at serious risk. Extinction cannot be ruled out for both humans and a vast number of other species.

I have 14 Power Point lectures online as of February 2011 (more are being prepared and will be added as they are completed). The presentations are part of the National Academy of Sciences Members' Lectures site (<http://www.pitt.edu/~super1/NAS/nas.htm>) for the Supercourse Lecture series. All are available free.

Biospheric Health and Integrity: The Top Priority for Humankind, November 2009

<http://www.pitt.edu/~super1/lecture/lec36401/index.htm>

Global Climate Pacts: Self Destructive or Successful?, December 2009

<http://www.pitt.edu/~super1/lecture/lec36631/index.htm>

Monitoring Biospheric Health and Integrity, January 2010

<http://www.pitt.edu/~super1/lecture/lec36771/index.htm>

Eco-ethics and Sustainability Ethics to Protect the Biospheric Life Support System, February 2010

<http://www.pitt.edu/~super1/lecture/lec37061/001.htm>

Environmental Refugees: Ethical Issues Involving Overpopulation, February 2010

<http://www.pitt.edu/~super1/lecture/lec37171/001.htm>

Expanding Ecotoxicology to Enhance the Health of the Biosphere, March 2010

<http://www.pitt.edu/~super1/lecture/lec37301/001.htm>

Biospheric Changes are Treat Multipliers, April 2010

<http://www.pitt.edu/~super1/lecture/lec37481/001.htm>

Sustainability and the Biospheric Life Support System, April 2010

<http://www.pitt.edu/~super1/lecture/lec37491/001.htm>

The Effect of Environmental Refugees upon Biospheric Health and Integrity, June 2010

<http://www.pitt.edu/~super1/lecture/lec37961/001.htm>

Biospheric Feedback Loops and Rapid Global Climate Change, June 2010

<http://www.pitt.edu/~super1/lecture/lec38611/001.htm>

Societal Adaptation to a Badly Damaged Biosphere, October 2010

<http://www.pitt.edu/~super1/lecture/lec40121/001.htm>

Slowing Down Biospheric Change, November 2010

<http://www.pitt.edu/~super1/lecture/lec40521/001.htm>

The Sword of Damocles and the Biosphere, January 2011

<http://www.pitt.edu/~super1/lecture/lec41211/001.htm>

Changing Behavior to Nurture the Biosphere is the Right Thing to do, February 2011

<http://www.pitt.edu/~super1/lecture/lec41211/001.htm>

Dumb Growth and the Biosphere, March 2011

<http://www.pitt.edu/~super1/lecture/lec41681/index.htm>

Human Effects upon Evolutionary Processes in the Biosphere, April 2011

<http://www.pitt.edu/~super1/lecture/lec41961/index.htm>

CHAPTER 2

Journal of Cosmology, 2010, Vol 8, 1906-1915.
JournalofCosmology.com, June, 2010

Threats to the Biosphere: Eight Interactive Global Crises

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Abstract

Eight global crises – human economy, climate change, exponential human population growth, ecological overshoot, biotic impoverishment and the reduction of biodiversity, renewable resource depletion, energy allocation, and environmental refugees – affect each other and affect and are affected by the biosphere. Some, perhaps all, are close to tipping points that, if tipped, will result in irreversible change. And yet, no sense of urgency is apparent. If any one of the eight interactive crises passes a tipping point, it will probably act as a threat multiplier for the remaining crises. Both politicians and the average citizen believe that priorities can be established for these interactive crises, but such an option is not viable for a highly interactive system. Polls indicate that most people place economic growth as the highest priority for human society, even though the highest status should be given to the master biospheric life support system to which all other systems are subordinate.

Key Words: Resource depletion, Energy, Environmental refugees

An age is called Dark not because the light fails to shine, but because people refuse to see it. - James Albert Michener

The scientist is not a person who gives the right answers; he's the one who asks the right questions. - Claude Levi-Strauss

1. Tipping Points

Most complex ecological and social systems have one or more tipping points beyond which change is irreversible (e.g., Catton 1982). Passing a tipping point in any one of the eight, complex systems (human economy, climate change, exponential human population growth, ecological overshoot, biotic impoverishment and reduction of biodiversity, renewable resource depletion, energy allocation, environmental refugees) would produce a ripple effect in the other seven and probably throughout the entire biospheric life support system (Solomon et al. 2009).

Reducing risk in the context of the eight interactive global crises would be a difficult undertaking even if the task only involved scientific evidence. Mixed into the responsibility of reduction of risk and avoiding tipping points is the general public's assessment of important issues for the planet. Gertner (2009) quotes a poll, conducted by the Pew Research Center two days after President Obama was sworn in, that ranks "the issues Americans said were the most important priorities for this year [2009]. At the top of the list. . . jobs and the economy. . . Farther down, well after terrorism, deficit reduction and energy . . . was climate change. It was priority No. 20. That was last place."

Economic growth has both provided many benefits to humans and been a major forcing factor in the eight interactive global crises discussed in this manuscript. Perpetual material (i.e., physical) growth is simply not possible on a finite planet, which was recognized over 30 years ago by Economist Kenneth E. Boulding (1972) in his "Ballad of Ecological Awareness." It was published as the conference summary for Farvar and Milton's volume *The Careless Technology*. The conferees were seated in alphabetical order at a huge round table at the 1968 conference, so I had the honor of sitting next to Boulding. I still remember his asking me: "what rhymes with schistosomiasis?" I gave an inadequate reply, but found out later that he was writing a ballad. The ballad is as useful today as the year it was written.

"No growth" (i.e., steady-state) economics has been espoused by Daly (1991, 1994) and Daly and Townsend (1993). The economics of climate change is also discussed in the "Stern Review on the Economics of Climate Change" (Stern 2009). If natural resources were used within the biosphere's regenerative capacity, the probability of crossing tipping points would be significantly reduced.

2. The Human Economy

Hawken et al. (1999) note that "an economy needs four types of capital to function properly:

- human capital, in the form of labor and intelligence, culture, and organization
- financial capital, consisting of cash, investments, and monetary instruments
- manufactured capital, including infrastructure, machines, tools, and factories
- natural capital, made up of resources, living systems, and ecosystem services

The industrial system uses the first three forms of capital to transform natural capital into the stuff of our daily lives: cars, highways, cities, bridges, houses, food, medicine, hospitals, and schools."

Natural systems (fisheries, forests) are usually regarded as subsets of the human economy. However, in fact, the human economy is a subset of the biosphere (aggregate, global, natural systems).

The human economy is substantially different from the economy of natural systems. The genus *Homo* was spread thinly over the planet in small tribal groups for most of 4 million years. Upon the emergence of *H. erectus* and with the transition to *H. sapiens*, when an animal was killed, it was eaten and the hide was used for clothing or other purposes. Hides and human wastes nurtured the biosphere. The rate of growth of the human population was trivial. After the Industrial Revolution, wastes were often harmful to the biosphere because they could not be assimilated into the environment or they exceeded the biosphere's assimilative capacity for them. The human economy is in crisis because it wants "more" of everything for ever more people.

Practices to increase material goods in one area of the world by using natural resources often has effects on other parts of the planet. China's impressive economic growth is fueled by coal: "In Shanxi, filthy coal is a part of daily life, providing a cheap, readily available source of energy that won't be replaced by renewables or reduced via conservation efforts anytime soon" (Minter 2010). "By one estimate, China was responsible for 85 percent of the world-wide growth in coal demand last year, and what it didn't obtain from the world's third-largest known reserves, it imported" (Pearse 2010).

Much of China's coal comes from Australia, which is paying a climate change price: "The driest inhabited continent has just endured its warmest decade on record and its worst drought in history. It's finally started raining again, but not before the 10-year "Big Dry" cost a quarter of all farm jobs" (Pearse 2010). In short, Australia is both feeling and fueling climate change: "Australians unwilling to see the irony of the situation sometimes have it forced on them. In 2007, cyclonic winds washed a coal tanker up on an iconic surf beach in New South Wales. Greenpeace seized the moment, projecting the words COAL CAUSES CLIMATE CHAOS onto the beleaguered ship's hull" (Pearse 2010).

3. Global Climate Change

Humans have evolved and flourished in the present climate – an alternative climate will probably be less favorable. Combustion of fossil fuels during the Industrial Revolution produced more carbon dioxide than the biosphere could assimilate, and anthropogenic greenhouse gas emissions began to change the climate.

Reduction of anthropogenic greenhouse gas emissions is possible by switching to alternative sources of energy (e.g., solar, wind). Although remarkable increases have been made in the development of wind power (Sawin 2010) and solar power (Liu 2010), fossil fuel production is still increasing (Russell 2010) and anthropogenic greenhouse gas emissions are still rising. As a consequence, the atmospheric concentration of carbon dioxide is still growing, as are world carbon dioxide emissions from fossil fuel burning (Mulrow 2010). This situation has already caused glaciers to begin melting and has shifted rainfall patterns that cause both droughts and floods. Obviously, humans have affected the climate and vice versa. If emissions of anthropogenic greenhouse gases, such as carbon dioxide, continue to increase, more climatic tipping points will probably be passed.

The Intergovernmental Panel on Climate Change (IPCC 2007) presents a number of detailed reports that contain scenarios based on the level of greenhouse gases in the atmosphere. The reports summarize a vast body of literature that is analyzed by thousands of climate scientists. The IPCC reports tend to be conservative since many governments influence the executive summary but not the supporting scientific evidence. Also, no body of evidence exists in human history on the rate of climate change being experienced.

Although some evidence on global warming was published in the 1800s, most of the literature is from the last three decades, and the amount is breathtaking. The scientific process is designed to correct errors and generally does so quite well. However, when the number of printed pages is large, the probability is greater that some small errors will be found. In the context of climate change in the news media, these errors are pounced upon and given a great deal of attention. The errors typically have little or no impact on climate science and are usually corrected promptly. However, these small errors have left some doubt in the public mind about scientists and the scientific process, which is regrettable since the preponderance of evidence on climate change becomes more persuasive as the amount of evidence increases.

4. Exponential Human Population Growth

In 1927, the global human population was 2 billion; in 2010, it is nearly 7 billion, which is over a 3-fold increase in a single human lifetime on a finite planet. In 2009, the number of starving people and the number of malnourished people each exceeded 1 billion. In addition, billions of people lack potable water, adequate housing, education, and medical services. If every individual on the planet lived as individuals in the United States live, five planet Earths would be needed. No substantive discussion has been forthcoming on whether humankind's goal is for a populace living at subsistence levels or for a much smaller population leading a quality life. If humankind decided on a smaller population leading a quality life, then how could the population be reduced in a humane way? To achieve any goal, a free and open discussion is essential, but religious beliefs and ideology have blocked even the beginnings of such a discussion on exponential human population growth.

Climate change is already having adverse effects upon agricultural productivity in many parts of the world, which will probably reduce the global carrying capacity for humans. Major adaptation to new conditions will be essential if civilization is to survive. Sustainable use of the planet will be a distant dream as long as humankind thinks that the natural laws of physics, chemistry, and biology can be ignored as applied to exponential human population growth.

The human population is still growing exponentially. How did one species become so dominant that it could compete successfully with all the other animal species for resources and space? This achievement is accompanied by considerable risk because humans are damaging their biospheric life support system by both sheer numbers and environmental destruction (Ehrlich and Ehrlich 2008). Diamond (2005) has analyzed how human societies choose to succeed or fail. Some past societal collapses were not fatal to the human species since isolated events affected only one or a few societies. Globalization may have ended isolation; however, since humankind depends on cheap, abundant resources and regeneration of natural resources, regionalization may soon return.

5. Ecological Overshoot

Ecological overshoot refers to using Earth's resources faster than they can be regenerated, which is due to both exponential population growth and excessive resource consumption. Sustainability requires living within the regenerative capacity of the biosphere (Wackernagel et al. 2002). The last Earth Overshoot Day was 25 September 2009 – the day on which humankind exceeded the regenerative capacity of the biosphere for that year. In economic terms, this circumstance is a huge ecological deficit, which goes beyond unsustainable to madness! Worse yet, ecological overshoot is not a recently discovered crisis – Catton (1982) published on this crisis years ago. By exceeding the biosphere's regenerative capacity for resources, humankind is using natural

capital (and the ecological services it produces) at a rate that probably will result in passing a biospheric tipping point in the near future. A tipping point may already have been passed, but inadequate monitoring systems have not detected it. Other species also depend on the biosphere's regenerative capacity. Ecological overshoot is also an important component of intergenerational equity and violates both eco-ethics and sustainability ethics. Finally, without adequate resources, the human economy will collapse.

6. Biotic Impoverishment

A major study has confirmed that "the world's governments will not meet their internationally-agreed target of curbing the loss of species and nature by 2010" (Black 2010). Since many of the planet's species have not yet been named, calculating the precise extinction rate is difficult; however, the current extinction rate is estimated at 1,000 times the background rate and may climb to 10,000 times the background rate if present trends continue. This loss would easily equal those of past great extinctions. A major report – the Millennium Ecosystem Assessment Report (2005) – summarizes this crisis, and Benn (2010), the UK's environmental secretary, believes "The decline in the world's biodiversity is approaching a point of no return. . . The big challenge will be for the real benefits of biodiversity and the hard costs of its loss to be included in our economic system and markets." Fischetti (2010) notes that "a team of 30 scientists across the globe have determined that the nine environmental processes [biodiversity loss, land use, freshwater use, nitrogen and phosphorus cycles, stratospheric ozone, ocean acidification, climate change, chemical pollution and aerosol loading in the atmosphere]... must remain within specific limits, otherwise the 'safe operating space' within which humankind can exist on Earth will be threatened. . . . the world has already crossed the boundary in three cases: biodiversity loss, the nitrogen cycle and climate change."

Immediate steps must be taken to avoid further reduction of biodiversity (e.g., Myers et al. 2000). The general public and its political representatives might be more concerned with biotic impoverishment if they understood that species are the basic components of the biosphere, which serves as a planetary life support system. Lovelock (2009, p. 33) states that the Earth system, which he calls Gaia, is in trouble, and "the climate war could kill nearly all of us and leave a few survivors living a Stone Age existence. But in several places in the world, including the UK, we have a chance of surviving and even living well." This statement is clearly a worst-case scenario, but does drive home the point that humans are part of Gaia and, when it suffers, humankind suffers as well. The biosphere is clearly a functional system that is more than a collection of millions of species. The charismatic species receive the most attention, but as Louis Pasteur stated: "The role of the infinitely small in nature is infinitely large." The little species ran the planet without humans for billions of years, and humans cannot currently do without them. However, most of humankind lives in cities and has little opportunity to develop a relationship with nature – referred to as biophilia by Wilson (1984).

7. Renewable Resource Depletion

Wastes from *Homo sapiens*, including industrial wastes, are often deleterious to natural systems. Wastes can be a threat to the regeneration of natural resources instead of being nurturing, as is the case for the wastes of the majority of species.

Moreover, in 2009, humankind used natural resources at 140% of Earth's regenerative capacity (<http://www.footprintnetwork.org>). Humankind must redesign its wastes to mimic nature's model (Cairns 2010), cease profligate use of natural resources, and stay within Earth's carrying capacity for its species. Without a steady output of renewable natural resources, the human economy would suffer a serious decline and Earth's carrying capacity for humans would decline precipitously.

8. Energy Allocation

Earth is warming because the emissions of heat-trapping gases (greenhouse gases) exceed the biosphere's assimilative capacity for them. Heat-trapping gases have been present in the atmosphere for millions of years, i.e., Earth's past climate has resulted from natural causes. However, since the Industrial Revolution, anthropogenic greenhouse gas emissions have overwhelmed the biosphere's assimilative capacity. Consequently, the climate is warming at a rate unprecedented in human history. Not only has oceanic water changed from mildly alkaline to mildly acidic (<http://www.ocean-acidification.net/>), but multidimensional climate changes have threatened agricultural productivity, freshwater supplies, and ecologic systems – for example, flowers may bloom before pollinators are present.

The unrestrained burning of fossil fuels produced in an ancient biosphere has been a significant factor in climate warming, but a huge release of stored carbon in positive feedback could cause runaway climate change. Better insulation of buildings could markedly reduce demands for energy and decrease pressure for construction of new fossil fuel and nuclear power plants. However, exponential human population growth could increase use of fossil fuels even if per capita energy consumption remains constant. If increased purchasing power of developing countries continues, coupled with increased per capita consumption of resources, energy demands will increase even more.

The goal should be to keep anthropogenic emissions of greenhouse gases within or below the biosphere's assimilative capacity for them. An equitable way to achieve this goal would be to establish a per capita anthropogenic greenhouse gas emission level (WBGU Presse 2009) that would not exceed the biosphere's assimilative capacity. The total emissions would be assigned to the nation states of the world with heavy fines and/or sanctions if emissions levels were exceeded.

A major problem, especially in the 21st century, has been a carefully crafted, well financed campaign to cast doubt on global climate science. The product – doubt – has been established in the minds of the general public (Hoggan 2009), and little or no public support is observable for remedial action such as reducing anthropogenic greenhouse gas emissions or rapid development of alternative forms of energy (e.g., solar, wind).

9. Environmental Refugees

The issue of environmental refugees has not yet reached a global crisis level, but could do so because of food shortages, coastal flooding, and loss of low-lying islands (e.g., The Maldives). If "business as usual" continues and anthropogenic greenhouse gas emissions are not reduced to match the biospheric assimilative capacity for them, the present numbers of environmental refugees will almost certainly increase. Sea level rise will increase the vulnerability of low lying islands and estuaries to storm surges. More ecological and societal tipping points will be crossed, and agricultural productivity and freshwater supplies will decrease markedly. The numbers of environmental refugees will increase markedly, and the nations to which they migrate with hopes for a better life may not be prepared to provide food, housing, medical care, education, and employment, to mention a few necessities.

If oceanic water warms more, methane will be released. Some methane is already bubbling to the surface, and no robust evidence is available on how long this release has been going on or how much is reaching the atmosphere. Carbon is also stored in permafrost, wetlands, soils, and timber. Climate change could release much of this as carbon dioxide. In a worst case scenario, this could cause runaway climate change, and many millions of environmental refugees. Many regions will already have exceeded the carrying capacity for humans, and the refugees will further destabilize an already hazardous situation.

Unsanitary refugee campgrounds are breeding grounds for a pandemic disease to start, and further migration would help spread the disease. In addition, environmental refugees would make conditions much worse in nations that run an ecological deficit, much like their getting into an overcrowded lifeboat. Nations are not prepared to receive the world's refugees.

10. Biospheric Context

The eight interactive global crises must be addressed collectively in a biospheric context. Some illustrative examples are presented in Power Point lectures in the Legacy Lectures/Supercourse at <http://www.bibalex.org/supercourse/nas/nas.htm> — John Cairns, Jr. This biospheric series is a work in progress, and more illustrative examples of relevant issues in a biospheric context will be added. The biosphere is central to resolving the global crises and also serves as the planet's life support system.

11. Decision Science

The developing field of decision science may be critical in coping with the crises that humankind faces. It is an "intersection of psychology and economics, . . . focuses on the mental processes that shape our choices, behaviors, and attitudes. . . . people can behave unexpectedly when confronted with simple choices. We have many automatic biases – we're more adverse to losses than we are interested in gains, for instance – and we make repeated errors in judgment based on our tendency to use shorthand rules to solve problems" (Gertner 2009).

Researchers in the Center for Research on Environmental Decisions (CRED) "consider global warming a singular opportunity to study how we react to long-term trade-offs, in the form of sacrifices we might make now in exchange for uncertain climate benefits far in the future" (Gertner 2009). Research of Elke Weber (as quoted in Gertner 2009) indicates "that we have a 'finite pool of worry,' which means we're unable to maintain our fear of climate change when a different problem – a plunging stock market, a personal emergency – comes along. We simply move one fear into the worry bin and move one fear out." Weber (as quoted in Gertner 2009) also describes a "single-action bias": "Prompted by a distressing emotional signal, we buy a more efficient furnace or insulate the attic or vote for a green candidate – a single action that effectively diminishes global warming as a motivating factor."

Although scientific studies of the eight interactive global crises is dauntingly complex, the global climate crisis has shown that, despite a huge, still increasing mountain of evidence, public concern about climate change diminished as the evidence increased. Doubts sown by climate change "skeptics" was undoubtedly a significant factor, but the human decision making process is probably the decisive factor. If so, then more research into the area of decision science would be prudent.

12. Conclusions

A tyranny surfaces when decisions are based primarily on components of any highly interactive system – decisions should be based on the whole rather than the parts. This situation is exacerbated when political concessions are made on individual components that are the focus of special interests groups and that are deleterious to the entire system (e.g., fossil fuel subsidies).

Most politicians and the general public favor **economic growth**, so discussion of climate change is likely to be regarded as subversive. At present, the most discussed interactive global crisis is **climate change**, but a well financed organization of "deniers" has blocked any effective remedial action. An unwritten, very effective taboo is active in discussions of **exponential human population growth**. **Ecological overshoot** is not regarded as a crisis because the consequences are not yet visible to many people in developed countries. Of course, most people in developing countries are well aware of the ecological overshoot crisis, although they would use different words to describe it. The **biodiversity crisis** has received much attention in the news media, but little effective corrective action has been attempted (e.g., polar bears). A huge number of people live in cities and have little or no connection to natural systems; however, this situation cannot be the main explanation for the lack of empathy for natural systems. **Renewable resource depletion** is a major problem (e.g., Amazon forests). Although a few sanctuaries have been established and portions of old growth forests have been temporarily preserved, depletion of natural resources is, in general, much more rapid than their regeneration. **Energy allocation** is mostly based on ability to pay, although some countries have subsidies for the poor. Combustion of fossil fuels, especially coal, has exacerbated global warming and other types of climate change. Better insulation of buildings would save much energy, but the incentives to do so on a massive scale are lacking. Development of non-carbon alternative energy sources (e.g., solar, wind) is beginning to pick up speed, but the need is greater than the action. Nuclear energy is non-carbon, but problems remain, such as terrorism; storage of long-term, high-level wastes; and the availability of huge amounts of cooling water. A massive wave of environmental refugees has not yet appeared, but flooding of low lying islands, estuaries, and heavily populated coastal areas is in the near future if present trends continue. Such incidents as a major decrease in agricultural productivity, greatly reduced freshwater supplies, continued exponential human population growth, further increases in environmental endocrine disruptors, or pandemic diseases could initiate massive migrations.

One hopes none of these crises will ever worsen, but robust information indicates they will. Regrettably, most people and most politicians are either unaware or in denial about the existence of these crises.

A full and open discussion of these interactive crises and the consequences of their continuing are badly needed now. Some of the crises are already political dynamite (i.e., global climate change, exponential human population growth, the human economy, sources of energy); others will become controversial as soon as the effects on people's lives become evident (i.e., biotic impoverishment, renewable resource depletion, and ecological overshoot). In addition, the news media will need investigative reporters with high scientific literacy to cover the unfolding of the events. Finally, humankind will need leaders with the courage to give Winston Churchill-type speeches ("Blood, sweat, toil, and tears") to convey the urgency needed to avoid making the crises worse.

Acknowledgments: I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication. Paula Kullberg and Karen Cairns also brought many important articles to my attention.

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CHAPTER 3

Global Discourse on Interactive Crises

As I say, I'm a discourse advocate. What form it comes is less important to me than the fact that there is discourse.

Jim Lehrer
US National Public Radio

We are not made wise by the recollection of our past; but by the responsibility for our future.

George Bernard Shaw

The lack of civil discourse on the eight interactive global crises (i.e., human economy, climate change, exponential human population growth, ecological overshoot, biotic impoverishment and reduction of biodiversity, renewable resource depletion, energy allocation, and environmental refugees) is frightening, since they could, individually or collectively, destroy civilization as presently known. Some crises elicit hostile exchanges (e.g., climate change). For others, discussion is essentially taboo (e.g., exponential human population growth). For still others, rhetoric is plentiful but has little substantive remedial action (human economy). For far too many, public and political literacy is too low (e.g., ecological overshoot, renewable resource depletion, environmental refugees). Discussion on the climate crisis is blocked by advocates of old sources of energy (e.g., fossil fuel) who fear loss of revenue resulting from competition from new sources of energy. A common factor in all eight crises is either ignorance about or deliberate disregard of the universal laws of physics, chemistry, and biology. Another important factor in the lack of discourse is an unwillingness to consider remedial measures if they might threaten human economic growth. All the crises are threats to the present Biosphere, which is the life support system for *Homo sapiens* and all other life forms, and is also the source of renewable resources that make the human economy possible.

Literacy always improves discourse; therefore, increased environmental literacy should be a high priority in any discussion on environmental topics — for example, a member of the US Congress believed that an unseasonable snowfall in Washington, DC proved that global warming was a hoax. An environmentally literate person would know that global warming is assessed by a long-term increase in global mean surface temperature. In addition, science confirms that episodic displays of variability are the norm for all attributes that affect life on the planet.

The eight interactive global crises (i.e., human economy, climate change, exponential human population growth, ecological overshoot, biotic impoverishment and reduction of biodiversity, renewable resource depletion, energy allocation, and environmental refugees) are generally considered individually, and, yet, they must be considered collectively since they are interactive. No synthesis exists for collective consideration either in science (although science is involved in each crisis in some way) or in policy matters, although effective policy cannot be developed on each of the items separately. The resulting discourse may seem disconnected because the crises are disconnected now in both science and policy making. However, an effective discourse will not be possible until a synthesis is reached in both science and policymaking.

Climate Change

Climate change is the crisis that has been the most prominent subject of any existing environmental discourse. Much attention has been given in the United States in the 21st century to the uncertainties in the global warming science, as if all life were certain and predictable. This importance is proposed by the same people who believed in and acted upon the conviction that the unregulated market would always return to equilibrium (Say's Law). In the 21st century, humankind learned the hard way that such an economic principle is not accurate. Uncertainty is the norm, and, when initiating any discourse, this reality should never be forgotten.

Even though believers and deniers have been outspoken in the press, some important factors still need to enter the discourse, such as the reality that comparatively small temperature changes can affect the structure of algal communities. For example, Cairns (1956a) found that comparatively modest increases in temperature can shift dominance from diatoms, to green algae, to bluegreen algae. The area known as Death Valley in western United States has one of the highest daytime temperatures in the world; it sometimes reaches 130°F,

but it has a diverse group of scorpion species. However, a small, further increase in temperature will probably drive many of the resident species to extinction. Even though this example is quite specific, increased discourse on climate change will include many such interactions.

The United Nations Climate Change Conferences in Copenhagen, Denmark (2009) and Cancun, Mexico (2010) did not result in substantive agreement on quantitative goals for reducing anthropogenic greenhouse gas emissions or a date for achieving any major global goals. In fact, the means of transportation (such as airplanes) used by delegates attending these conferences increased the global carbon footprint.

Biotic Impoverishment and Reduction of Biodiversity

Biotic impoverishment and a reduction in biodiversity reach a crisis level when species become endangered or even become extinct. Discourse on this crisis must include how to develop appropriate monitoring and examination techniques for as many species as possible. For example, a species can be quite near a lethal threshold and still appear normal, a common rather than an exceptional situation. Often, no easily observable deleterious effects can be detected at stress levels (e.g., toxicants, temperature) very near the response threshold (Cairns, 1956b). Even at the response threshold, not all individuals respond identically. Most single species thresholds are determined in the laboratory. In addition, the number of variables tested in the laboratory is far short of the variables in natural ecosystems (Cairns, 1983; Cairns et al., 1981). Nevertheless, many toxic chemical substances are being discharged into the Biosphere without adequate scientific information on their effects. However, if interactions between and among species, different levels of biological organization, and different chemical and physical interactions are added to the circumstances, then species loss could be reduced. Policy decisions must be based on the predominant scientific information available at the time, coupled with monitoring of the system at risk to furnish a feedback loop to provide an early warning if conditions change or worsen.

E. O. Wilson stated: “The one process ongoing in the 1980s that will take millions of years to correct is the loss of genetic and species diversity by the destruction of natural habitats” (Kolbert, 2011). During the three decades since Wilson made that statement, no global discourse has emerged on this topic and humankind is already paying dearly for this omission. The political and civic discourses that are dominant at present primarily concern the economy (e.g., jobs, taxes, financial security, funds for retirement) — all important issues, but less important than the survival of civilization and *Homo sapiens*, which are worth a global discourse! If not, Mother Nature (i.e., the universal laws of physics, chemistry, and biology) will solve the question of survival in ways that will impoverish humankind.

Exponential Human Population Growth

Civilization is in trouble! “Over the last few decades we have created a food production bubble — one based on environmental trends that cannot be sustained, including overpumping aquifers, overplowing land, and overloading the atmosphere with carbon dioxide” (Brown, 2011). Considerable uncertainty exists about when this bubble will burst. However, 1 billion people going to bed hungry each night indicates for them that the bubble has already burst. The discourse on exponential human population growth must include discussions on food security as well as other resource crises.

“Climate change has likely intensified the monsoon rains that have triggered record floods in Australia’s Queensland state, . . . with several months of heavy rain and storms still to come” (Fogarty 2011). In contrast, other parts of Australia have a decade long drought (the Big Dry), which has affected both agricultural productivity and wildlife. Bush fires are common. Many parts of the planet have reached a point where water is a matter of life or death. Black (2011) describes such a situation in Peru, which once had an ample supply of water. The drinking water supply should be part of any discourse. The issues of food and water supply are scary, but humankind should have an open discourse about them.

The Human Economy

The human economy is invariably the highest priority of nation states. A 60% increase in restaurant prices has been predicted due to rapidly increasing food prices (Bloomberg, 2011, 13 Jan), which will not likely be markedly decreased unless events dramatically reduce the human population (such as a “Black Death” pandemic disease). Increased resource prices, especially food, will reduce consumer spending and cause a decline in economic growth. Increased taxes to maintain schools, roads, bridges, and other components of society’s infrastructure will have adverse effects on the perpetual growth of the human economy. In short, by giving the human economy the highest priority, humankind is neglecting global crises that adversely affect the human economy. From a systems perspective, such actions do not make sense.

Is Global Discourse Possible?

Addressing any global problem requires a global discourse on the issues involved. In addition, time may be very short to discuss some of the interactive global crises (e.g., global warming) if the positive feedback loops for such conditions as the release of frozen hydrated methane on the floor of the oceans speed up and discharge millions of additional tons of carbon dioxide in addition to the anthropogenic greenhouse gas emissions that are still increasing. No sense of urgency exists on the part of the general public or their political representatives to address these global crises. Scientists, of course, are often disturbed that they and their evidence are under attack from deniers of some of the crises. Conditions are not favorable for fostering a global discourse on them. An action-oriented response may only occur when multiple, climate-caused catastrophes occur in many parts of the planet.

Henry A. Kissinger (2011), US Secretary of State from 1973-1977, provides some intriguing suggestions on how sovereign nations might structure a discourse to avoid a cold war between the United States and China. His comments apply well to a discourse on the interactive global crises that might save the present Biosphere. Maintaining a good relationship between two powerful nations is extraordinarily difficult, but all nations on the planet will have to collaborate to save the present Biosphere.

(1) Care must be taken lest both sides analyze themselves into self-fulfilling prophecies.

(2) Conflict is not inherent in a nation's rise.

(3) . . . national aspirations [must be subordinated] to a vision of a global order.

(4) Each [nation] assumes its national values to be both unique and of a kind to which other peoples naturally aspire.

(5) America's exceptionalism finds it natural to condition its conduct toward other societies on their acceptance of American values.

To be considered here also is the ability to accept the evidence published in peer-reviewed scientific journals, even if the "news is bad."

(6) [A sovereign nation cannot act] as if it can participate in or withdraw from international affairs at will.

These actions have been the problem with climate change treaties.

(7) America has found most problems it recognized as soluble. China, in its history of millennia, came to believe that few problems have ultimate solutions.

In terms of the eight interactive crises, people deny that seven of the crises even exist or believe that they have occurred in the past. In the United States, the conviction is that the financial crisis can be solved, but no robust evidence indicates that this belief is justified since economic recovery requires more resources than are available.

(8) American diplomacy pursues specific outcomes with single-minded determination. Chinese negotiators are more likely to view the process as combining political, economic and strategic elements and to seek outcomes via an extended process.

(9) The aim should be to create a tradition of respect and cooperation so that the successors of leaders meeting now continue to see it in their interest to build an emerging world order as a joint enterprise.

What is more important than solving the eight interactive global crises that threaten the present biospheric life support system (Cairns 2010)?

A framework for a global discourse integrating all eight global crises is difficult to outline because the need for one is not yet apparent to most humankind and its political representatives.

Conclusions

All eight interactive global crises worsened in 2010. Individual contributions to these crises (e.g., ecological footprint size) vary dramatically. If global cooperation is to be achieved, most nations and many individuals must take immediate action to reduce ecological footprint sizes, which will probably be strongly resisted by the huge footprint individuals and nations.

The discourse on interactive global crises should initially focus on global warming because that has been much in the news, but primarily because a huge quantity of recent scientific evidence has been published in peer-reviewed journals. In addition, a strong scientific consensus and endorsement has been offered by the US National Academy of Sciences, the UK Royal Society, and their counterparts throughout the world. If the science is ignored or rejected again, as it was in the Copenhagen and Cancun climate conventions, humankind will be too late to avoid the consequences of these interactive global crises.

A discourse on the eight global interactive crises should appropriately focus on the Biosphere since all the crises are occurring in some component of the Biosphere. The fact that all eight global crises are interactive

should be easily demonstrated, and the relationship of each of the global crises to the Biosphere should then become apparent.

The Intergovernmental Panel on Climate Change is a good model for structuring a discourse on the eight interactive global crises. Any panel or steering committee initiating a discourse on the eight interactive global crises should have had experience working with individuals from other disciplines and some members should be transdisciplinary individuals. Any task force charged with the policy portion of the discourse should have members who are literate on how science works. Some individuals will also be needed to integrate the products of both committees.

Synthesis is hard and funding is essential for a global discourse. A long-range global perspective is also essential.

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CHAPTER 4

The Triumph of Ideology in an Increasingly Fact Free World

In a time of universal deceit, telling the truth is a revolutionary act.

George Orwell

The American lifestyle is not up for negotiation.

Attributed to former US President George H. W. Bush at the Rio Earth Summit in 1992
(As quoted in Bell and Golden, 2008)

The saddest aspect of life right now is that science gathers knowledge faster than society gathers wisdom.

Isaac Asimov

The best index to a person's character is how he treats people who can't do him any good, and how he treats people who can't fight back.

Abigail Van Buren

Most scientists prefer to use the words “theory” and “hypothesis” instead of the word “fact.” But the merchants of doubt (Oreskes and Conway 2010) have portrayed the word “theory” as merely a guess and use “hypothesis” as a pejorative term. In addition, science on global warming is designated a hoax and, in the 2008 US presidential elections, a huge number of candidates stated that they do not believe in evolution. Attacks on scientists by politicians and radio talk shows typically involve inflammatory language. Special interest groups (e.g., in defense of fossil fuel) have spent huge sums of money to cast doubt on scientific evidence perceived to be a threat to their profits. Of course, more scientific evidence exists in the 21st century than at any other time in history. However, this evidence does not become policy until the general public accepts it as fact.

Global discourse is essentially nonexistent on the effect that the destruction of the present Biosphere will have on humankind's children, grandchildren, and their descendants. At best, they will live in a world more unstable, hostile, and resource depleted than the one that exists at the outset of the 21st century. The present Biosphere, like everything else on Earth, is the product of the universal laws of biology, chemistry, and physics, and the people who spend their lives studying these universal laws are called scientists. Scientists gather evidence and other scientists decide how valid that evidence is. However, to the general public, this evidence is usually described as good (e.g., a cure for a life-threatening disease) or bad news (e.g., global warming caused by anthropogenic greenhouse gas emissions). “The future of mankind hangs in the balance of 21st century predicaments, including climate change, resource allocation, food shortages, water scarcity and overall sustainability” (Ehrlich and Orstein 2011). This declaration is “bad news” indeed, but instead of society's addressing these problems, the bearers of the bad news, the scientists who produce the evidence, are attacked.

The assault on science in the United States is facilitated by well financed doubters (Oreskes and Conway 2010), many without adequate (or even any) scientific credentials. Some of the same individuals have made a profession of obscuring the truth from tobacco smoke to global warming. The doubt casters need not have published in peer-reviewed journals. They can merely cherry pick three or four e-mails from thousands to succeed in their denial mission, even when the e-mails have no effect upon the preponderance of scientific evidence.

The process of scientific research is extensive and complex. Securing funding for a research project can take hundreds of hours of staff time. In addition, competition for funding is daunting, with no assurance of receiving the grant. Funding is typically not for any part of the principal investigator's salary, but is often used to pay graduate student stipends, post docs, young faculty, and technician's salaries and to purchase specialized equipment.

When data gathered is adequate to test the researcher's hypothesis, the results are often prepared for publication, which usually requires two to three drafts before the manuscript is submitted to a scientific journal.

Usually three reviewers are asked by the journal to evaluate the manuscript. Such reviewers are the backbone of scientific quality control, although they receive less recognition for their services and time than they deserve. Inadequate manuscripts are rejected, often with suggestions for improvement in the research itself or in the interpretation of the results. Even though this explanation is a condensed version of the scientific quality control process, the process never stops. When a manuscript is published in a scientific journal, it is never immune from evaluation. Some journals designate an open period (e.g., six months) in which legitimate evaluations are accepted. Of course, “off the wall” comments that attack the scientists rather than the science are not permitted — neither are “it might be bad for the economy” comments accepted. Finally, every qualified scientist is responsible for correcting any errors.

New information generated from research is not always perceived as “good news.” No doubt, some people were disturbed when they were told that Earth is not flat. The news that Earth is not the center of the universe and the sun does not revolve around Earth also probably disturbed some people. Even in the 20th century, Rachel Carson’s *Silent Spring* (1962) caused much hostility toward her because she wrote that pesticides did more than kill pests — they harmed other forms of life, such as wildlife and humans. Carson criticized the chemical industry for being irresponsible, but the chemical industry continued to claim that pesticides were safe, which was accepted without question by many public officials. My career was just beginning in 1962 when I was 39. I decided that, if the science were sound, I need not try to respond to anti-science rhetoric. Fortunately, I had not published a popular book (as Carson had) and had published only in professional journals, so I was “safe” from unsubstantiated criticism.

The disinformation campaign against scientists and their science, which began with Rachel Carson, had two major effects.

(1) Corporations producing hazardous chemicals found that they could hire a few highly vocal individuals to cast doubt on scientific evidence. These people need not be credentialed, research scientists to achieve the desired results if the news media insisted on a “balanced view” and presented “both sides” regardless of the preponderance of scientific evidence.

(2) Some scientists, but fortunately by no means all scientists, did not wish to fight back because the argument took time from their research.

One of the major differences between detractors of science and scientists is that, when proven wrong, detractors quickly state: “Let’s not engage in the blame game.” However, scientists, not always cheerfully, admit they are wrong because the evidence leaves them no other choice. The doubters of science take no responsibility for the lives lost to cigarette smoke, hazardous chemicals, and the like. In short, a vast gulf exists between the ethics of scientists and the ethics of detractors.

However, science will prevail since it is based on a preponderance of evidence. But what can be done until the unsubstantiated arguments fail? “Evolutionary adaptation can be rapid and potentially help species counter stressful conditions or realize ecological opportunities arising from climate change. The challenges are to understand when evolution will occur and to identify potential evolutionary winners as well as losers . . . Extinction can be avoided if populations move to favorable habitats, organisms successfully overcome stressful conditions via plastic changes, or populations undergo evolutionary adaptation” (Hoffmann and Sgrò 2011). The tide is still turning against science in the United States and some other parts of the world. However, the detrimental effects of climate change and other global interactive crises must be addressed collectively rather than individually (Cairns 2010).

One viewpoint that is an obstacle to nurturing the Biosphere is that “unused space” should contain shopping malls or housing developments. Proponents of such a view must realize that life forms fully occupy such spaces. Every part of the Biosphere is important, especially when large portions are damaged, such as the Gulf of Mexico in the 21st century due to the massive British Petroleum leak. Attempts are often made to calculate the monetary loss when parts of the Biosphere are damaged; however, when very complex systems are damaged, the “compensation” is likely to be inadequate. Prudence should dictate that all possible efforts be made to avoid damage to the biospheric life support system.

Continued global climate change, oil spills, and ubiquitous toxic chemical substances mean more ecosystems will go into disequilibrium, more species will become extinct, and more species will suffer population reductions that result in that species losing ecological significance (biotic impoverishment). These changes make ecological restoration more difficult and push the Biosphere closer to a tipping point (irreversible change). However, some biospheric stability probably can be achieved with assisted recolonization of ecologically damaged areas. Ordinary citizens can make amazing strides in ecological restoration with some professional guidance. A group of high school students in California restored a stream (John Berger, personal communication) when they, their teachers, and their parents became the stream’s guardians and removed many tons of trash from the stream and campaigned to reduce waste discharges into the stream.

Switchgrass (*Panicum virgatum*) is a summer perennial grass that is native to North America (<http://bioenergy.ornl.gov/switchgrass-profile.html>). It sequesters carbon below ground, holds soil together, and plays an important role in the Biosphere. Switchgrass was described as useless (i.e., little or no commercial value) until it was discovered to be a source of bioenergy for automotive fuel. In the same vein, solar panels can be used to acquire energy for electric cars, which are presently being fueled by fossil carbon that, when released, damages native species. Humankind's attitude toward the Biosphere must change. Risking a huge portion of the Biosphere, such as the Gulf of Mexico, to obtain a finite supply of petroleum is amoral.

In March 2007, then US Senator Barack Obama stated that the United States is not suffering from a budget deficit but an "empathy" deficit (<http://www.npr.org/templates/story>). However, the concept of empathy is usually used in the context of humans. E. O. Wilson believes that humans also have an innate and genetically determined affinity with the natural world, which he terms *biophilia* (<http://oxforddictionaries.com/definition/biophilia>). At present, biophilia has been replaced by technophilia, which is the strong enthusiasm for technology (<http://www.websters-dictionary-online.net/technophilia?cx=partner-pub-093945075>). Some individuals even believe that all global crises can all be eliminated by future technologies. In truth, technology has caused more problems than it has solved, the worst being the damage to the present Biosphere. The worst crisis caused by technology is likely to come soon if "business as usual" continues, i.e., combustion of fossil fuels that result in anthropogenic emissions of greenhouse gases could cause as much as two-thirds of the world's gigantic storehouse of frozen carbon to be released (Leahy 2011). This tipping point may be less than 20 years away. How can technology solve this problem?

"Even the most optimistic business as usual emissions [greenhouse gases] is projected to result in some dramatic, and potentially dangerous, climate impacts. Therefore, despite uncertainty over the future of climate change, we have to improve on the status quo" (Mastrandrea and Schneider 2010, p. 61). However, no sense of urgency has been displayed for beginning robust efforts toward either mitigation (reduce humankind's impact on the Biosphere) or adaptation (e.g., prepare for rising sea levels). Humankind must face and eliminate or reduce many global crises, but no significant progress has been made on any of them. What is missing is a universal concern for the ethic/moral obligation humankind has to posterity, to other life forms, and to the billions of individual humans who are living in poverty and are lacking housing, medical care, education, and even potable water.

However, humankind is not trying to improve the status quo. Enormous support continues for the use of fossil fuels despite ever increasing scientific information about their harm. Plastics are still popular despite strong evidence that more than 70% of them release chemicals that act like the sex hormone estrogen (Hamilton 2011). Can a culture that continues to expose babies to harmful chemicals in plastic bottles have any sense of ethics or morality? Even when in doubt about the evidence, compassion requires that babies and young children be protected until they are old enough to judge acceptable risk for themselves.

Sovereign nations exist to protect their citizens, but the justification for much legislation is that environmental laws might hurt the economy. United States Senator John Barrasso (Wyoming) is campaigning "to stop the [US President] Obama administration from incorporating climate change into federal plans and policies, taking aim at an interagency report released in October that proposed ways for the federal government to respond to increased frequency of severe weather events and other effects of global warming" (Chemnick 2011). How else can a sovereign nation protect its citizens if it ignores highly probable future problems?

The US Congress turned to the US Environmental Protection Agency (EPA) for advice on handling wastes from oil and gas drilling. The EPA scientists "concluded that some of the drillers' waste was hazardous and should be tightly controlled. . . . But that is not what Congress heard. Some of the recommendations concerning oil and gas waste were eliminated in the final report handed to the lawmakers in 1987" (Urbina 2011).

The most stunning rejection of science is covered in a *New York Times* editorial (Editorial 2011): "Regrettably, politics trumps science among House Republicans, who recently voted to zero out this country's extremely modest \$2.3 million annual commitment to the IPCC [Intergovernmental Panel on Climate Change]. The bill also slashes spending on a half-dozen domestic programs that study the causes and effects of climate change." However, even if the production of evidence was eliminated in this country, the intergenerational ethical issues remain. Suppressing scientific evidence about global climate change is shameful and demonstrates an absence of intergenerational ethics/morality.

One reason humankind may show little concern for posterity is the constant assertions of technophiles and most economists that future generations will lead better lives than the current generation is leading — so why help them? Until recently in evolutionary time, errors have caused tribes or nations to disappear, but globalization has markedly increased the risks to civilization and its future. "It does not take a political scientist . . . to point out how problematic our discourse has become: Much of talk radio and television punditry is highly partisan and hysterical" (Herbst 2011).

Conclusions

As the complexity of any system increases, it inevitably becomes more vulnerable. “Bad news” results whenever the universal laws of nature are violated. Ancient civilizations (e.g., the Assyrians) destroyed natural capital (i.e., natural resources) in their doomed effort to maintain the status quo. Their descendants perished or fled. However, when the crises are global, no backup planet is available for fleeing populations. Listening to people who only state what the individual wants to hear and wants the population to hear is a dangerous tactic.

Acknowledgments. I am indebted to Karen Cairns, Paul Ehrlich, and Paula Kullberg for calling useful references to my attention.

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CHAPTER 5

Biospheric Intergenerational Ethics

“...if we don't act quickly and determinedly to address climate change the world will face billions of climate refugees and extended world wars in a near future.” Lord Nicholas Stern

“The first lesson of economics is scarcity. There is never enough of anything to satisfy all those who want it. The first lesson of politics is to disregard the first lesson of economics.” Thomas Sowell

Intergenerational ethics must be based on the integrity and health of the biospheric life support system because humankind will almost certainly not survive if the present Biosphere is destroyed. Since the present Biosphere is indispensable to human life, a sovereign nation should protect vigorously the components under its control; however, this scenario is not the case. A subcomponent of the Biosphere, the human economy, is receiving a high priority and the environment a low one. The concepts of *food security*, *water stress* (quantity and potability), *spread of diseases*, and *environmental refugees* are becoming increasingly common. As resources rapidly decline, the gap between the wealthy and the poor increases, which produces social unrest at best and riots and anarchy at worst. Assaults on scientists and their evidence will not eliminate the global crises and will not divert attention from them except briefly.

Dangerous Complacency

Birol and Stern (2011) have sounded a warning: “There were worrying signs at the World Economic Forum in January that policymakers are becoming dangerously complacent about the scale of our climate change challenge. Now with political unrest, economic uncertainty and soaring oil prices understandably dominating the headlines, there is a risk of further distraction from the action required to meet our current climate change goals.” Why is humankind waiting for policy to decide whether to save the present Biosphere and by doing so save future generations? Where are the ethical/moral values that should transcend economic values? If reducing consumerism would reduce stress on the Biosphere, should the financial system be guiding civilization? If eliminating the subsidy on ethanol derived from foodstuffs (e.g., corn) would enable the poor to eat, should people be pumping corn into their automobile gas tanks?

Humankind is delusional if it actually believes in the comfortable future predicted by the technophiles. In addition, discussion about exponential human population growth is a taboo topic. If major lifestyle/behavioral changes are not made NOW, the next generations will face huge waves of environmental refugees who are driven by hunger, disease, and wretched living conditions. They will head to those countries they perceive as wealthy enough to provide a utopian lifestyle. Food shortages are already a major problem, especially in countries where the poor may spend up to 90% of their income on food.

Warning — Danger Ahead

Climate change is a major danger now. Most present warnings about climate change from climate scientists and those in related fields, plus warnings from some economists, have had little impact on the thinking of the general public and policy makers. The preponderance of scientific evidence indicates both danger now and extreme danger ahead if “business as usual” continues. However, attempts to suppress scientific evidence viewed as a threat to corporations and/or political ideologies are dangerous forms of censorship that will result in much human misery. The attempt to demonize scientists as conspirators who are perpetuating a hoax will not solve any of the global crises.

“The way humanity manages or mismanages its nature-based assets, including pollinators, will in part define our collective future in the 21st century” (UN Under-Secretary-General and UNEP Executive Director

Achim Steiner, as quoted in McCarthy 2011). Although the word *Biosphere* is not used specifically in this quote, the concept of “nature-based assets” is synonymous. Humankind is now experiencing a food crisis — “. . . of the 100 crop species that provide 90 per cent of the world’s food, more than 70 are pollinated by bees” (McCarthy 2011). Bees are declining in many areas of the planet, which has already had a negative impact on agriculture productivity through decreased plant pollination. The Biosphere must be nurtured — habitat degradation, excessive use of pesticides, air pollution, and the transformation of the countryside into a humanized environment has deprived humankind of nature’s (biospheric) services. Future generations will be incredulous at the mistakes made in the name of economic growth. Intergenerational ethics/morality should have prevented such mistakes. Some religions in the United States have embraced the task of saving the Biosphere (life on Earth) as a duty. However, their work has not substantively reduced the rate of biodiversity loss or biotic impoverishment because species numbers are still low.

Is Intergenerational Ethics a Hoax?

And so, once the EPA has cleaned up the country’s most glaring messes, once sea otters and peregrine falcons had rebounded from near extinction, once Americans had had a disagreeable taste of European-style regulation, the environmental movement began to look like just another special interest hiding in the skirts of the Democratic Party. It consisted of well-heeled nature enthusiasts, tree-spiking misanthropes, nerdy defenders of unfashionable values (thrift, foresight), invokers of politically unfungible abstractions (the welfare of our great-grandchildren), issuers of shrill warnings about invisible risks (global warming) and exaggerated hazards (asbestos in public buildings), tiresome scolds about consumerism, relies on facts and policies in an age of image, a constituency loudly proud of its refusal to compromise with others. Bill Clinton, the first boomer President, knew a stinker when he saw one. Unlike Richard Nixon, who had created the EPA, and unlike Jimmy Carter, who had set aside twenty-five million acres of Alaska as permanent wilderness, Clinton needed the Sierra Club a lot less than it needed him. In the Pacific Northwest, on lands belonging to the American people, the U.S. Forest Service was spending millions of tax dollars to build roads for multinational timber companies that were clear-cutting gorgeous primeval forest and taking handsome profits for themselves . . . (Franzen 2006, p. 174).

The above quote is Franzen’s humorous analysis of the state of the environmental movement at a particular point in time. His statement seems to be a superb expression of what appears to be a dominant, but less well stated, view in the United States. This situation continues, unfortunately, with little action to strongly protect the environment. A species (*Homo sapiens*) that has acquired the power to alter Earth’s climate and significantly damage the Biosphere would become a terrible threat to all life forms if that power were not accompanied by an ethical responsibility for the Biosphere. The complex, global society that humankind has created and the huge number (nearly 7 billion) of humans whose existence technology has made temporarily possible require a long training period (20-30 years) to even have a chance at a quality life. When children are brought into a complex, global society, their parents have an ethical/moral responsibility to prepare them for such a setting and an ethical/moral responsibility to nurture the environment that will sustain their lives.

The Ethical/Moral Responsibility to Avoid Tipping Points

Every time a global tipping point is passed, irreversible changes occur that affect the Biosphere. In short, every time a global tipping point is passed, Earth becomes more different, less habitable for present life forms, i.e., more alien. For example, the Greenland and Antarctic ice sheets are losing mass (melting) at an accelerating pace (ScienceDaily 2011). The shift from mildly alkaline to mildly acidic water in the world’s oceans is another example of a tipping point.

However, to understand, make policy about, and effectively avoid passing biospheric tipping points, human society and its political representatives must be scientifically literate, including an understanding of the scientific process. This requirement is far from true in the United States at present since recommendations in the US Congress to restrict anthropogenic greenhouse gas emissions by federal regulatory agencies have been proposed and voted down, even though the restrictions are based on scientific evidence published in peer-reviewed journals. How can the Biosphere be protected and, at best, nurtured without scientific evidence? Scientists, like most people, cannot function at their best when their research is constantly being denigrated by people lacking robust scientific credentials (e.g., some politicians, some news media).

Another major issue is that global crises and problems require global solutions, as well as support of the nearly 7 billion humans on the planet. Political, ethnic, and religious polarizations are major obstacles to establishing the necessary consensus on actions, values, and accepting the predominant scientific evidence.

During major catastrophes (such as the earthquake in Haiti in 2010 and the tsunami/earthquake in Japan in 2011), many, but far from all, humans feel they are apart from humankind, not a part of it. Equally important, the events in Japan are a dramatic illustration that humans cannot avoid the universal laws of biology, chemistry, and physics. The news media tends to describe these catastrophes as unforeseen events. Some risks are unavoidable or can be remarkably reduced (e.g., windmills vs nuclear plants for electric power). Risks can also be reduced by using less energy per capita, better insulation of dwellings, reduced travel, and efficient appliances. Some spokespersons say “Let the people speak,” but who speaks for future generations? Democratic votes must involve intergenerational ethics/morality. If the present generation shows a lack of concern for its descendants, what does this deficiency say about it? What does this lack show about placing economic growth as the highest priority?

Not Willing to Make Sacrifices?

Humans do not appear to be willing to make sacrifices for their descendants. Major lifestyle changes are necessary to avoid a collapse of the present Biosphere. Germans use half the energy per capita as their counterparts in the United States. Other cultures use far less energy per capita than the Germans. If energy per capita was markedly reduced, humankind could avoid building new nuclear power plants and phase out all of the old, coal-fired power plants.

Industrial energy consumption could be dramatically reduced if consumption of material goods was reduced. Many cultures (e.g., Europe, Asia) have superb public transportation systems, and food, packages, etc. can be transported on the same system with less consumption of energy.

In addition, travel — especially air travel — adds to each individual’s carbon footprint. Is any trip worth jeopardizing the future? Was that overseas trip to a conference necessary?

Houses, especially ones with poor insulation, consume a great deal of energy. In some cases, only two people may occupy a 5,000 square foot house. Suburbs that serve as “bedroom communities” often require long-distance commuting on weekdays, and much space that was previously farmland surrounds a single dwelling. Is such affluence a disregard for intergenerational ethics?

Conclusions

The global range of energy use is enormous — in Kerala State in India, the per capita consumption of petroleum has been one-sixteenth of the consumption of petroleum in the United States. The vast gap in material possessions is visually displayed in *Material World* (Menzel and Mann 1994). The American Plains Indians had few possessions since they were semi-nomadic. Prestige and status were not correlated with material possessions but to deeds that benefited the tribe. Such distinctions cannot be achieved with a global population of nearly 7 billion. Intergenerational ethics must be based on nurturing and protecting the present biospheric life support system, without which *Homo sapiens* probably could not survive. Biospheric renewable resources are the raw materials of the human economic system. Humankind has a long way to go with probably not much time before runaway climate change occurs.

Acknowledgments. I am indebted to Paul Ehrlich, Karen Cairns, and Shireen Parsons for calling useful references to my attention and to Karen Cairns for valuable comments on the first draft of this manuscript.

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CHAPTER 6

A Worst Case Scenario for Continuing Business as Usual

Know what's weird? Day by day, nothing seems to change. But pretty soon, everything's different.

Bill Watterson
Calvin and Hobbes

Humankind's insatiable appetite for cheap, abundant, convenient energy in developed countries, such as the United States, is one of humanity's major risk factors. Even countries such as China, which use far less energy per capita energy than the United States, are moving rapidly into development of high energy lifestyles. Despite a present and increasing ecological overshoot, 2 billion additional people are expected to be added to the human population in the 21st century, and the high energy per capita consuming United States expects another 100 million, who presumably will anticipate being part of the high energy lifestyle. The biospheric life support system is threatened because words such as *safe* and *sustainable* are used without robust scientific evidence to support their use. Nuclear power is declared "safe" until a disaster like the one in Fukushima, Japan, occurred in March 2011. The concept of *sustainable growth* on a finite planet is an oxymoron. *Clean coal* is not available at present and is unlikely to be available at an affordable cost in the future. *Clean water* legislation and *clean air* legislation produce neither of their intended goals, and scientific evidence that is contrary to such claims is denigrated. Worse yet, these delusional words suggest a more suitable environment for humans than future generations probably will inherit if "business as usual" (i.e., not living sustainably) continues.

Collapse of the Present Biosphere

The first five, major, biotic extinctions were not caused by human activities, but humans are a significant factor in the sixth, great, biotic extinction now in progress. Each of the previous five extinctions resulted in a new Biosphere consisting of mostly different species that appeared over evolutionary time. Each resulted in quite different environmental conditions from its predecessor. *Homo sapiens* evolved and flourished following the fifth great extinction. A new Biosphere will not likely be favorable to *H. sapiens* since its component species will almost certainly be different from the present Biosphere. Since *H. sapiens* is part of the present Biosphere, its continuance cannot be assured. Human laws, human denials, and human delusions will have no affect on the changes, which are determined by the universal laws of biology, chemistry, and physics. These laws also cannot be avoided with human technology.

Humankind is part of the Biosphere and is dependent upon the biospheric life support system. Political entities from town to nation do not exist in an isolated bubble. The atmosphere is global — climate change is global. The global community is obvious in instances where pesticides and plastics used in a particular locale end up in distant parts of the planet. For approximately 200,000 years, *Homo sapiens* has been a small tribal species spread thinly over the planet. Humans had to be knowledgeable about their habitat or die. Consequently, humankind should become accomplished at nurturing the portion of the Biosphere in which it lives. If every individual would nurture the Biosphere, the terrestrial part of the planet would be less threatened. However, land is only about 29% of Earth's surface. The 71% covered by oceans must also be nurtured. To avoid the entire Biosphere collapsing and being replaced over evolutionary time by a new Biosphere, a global effort will be required. The lack of global action on all eight interactive global crises (Chapter 2 in this volume) indicates a lack of ethical/moral behavior.

A Worst Case Scenario

Humanity is in multiple, intellectual boxes about energy, population, climate change, and other global crises. Any global discourse that has occurred has not resulted in a sense of urgency about addressing the crises. Americans demand an endless supply of cheap, readily available energy. Sadly, assurances are given that these unreasonable demands will be met, even if this generation's children and grandchildren have to suffer

later. The spent fuel pools at earthquake damaged Fukushima Dai-ichi are a major, long-term concern (<http://www.scientificamerican.com/article.cfm?id=nuclear-fuel-fukushima>) that posterity will have to cope with for longer than *Homo sapiens* has existed on Earth. Intergenerational ethics would not permit humankind's unborn descendants being given such a responsibility.

How many Chernobyls and Fukushimas will be needed before humankind begins acting on its responsibility to posterity? How long before humankind realizes that the production of nuclear energy is hazardous to children for many generations? How long before humankind abandons release of carbon dioxide, mercury, and other hazardous substances from coal-fired power plants? How long before humankind realizes that neither absolute confidence nor absolute certainty exist in any part of life, but, rather, only different levels of risk exist. If the answer to any of these questions is "more than a decade," humans should prepare to experience the worst case scenario.

A Less Dismal¹ Worst Case Scenario

"Nature favors those organisms which leave the environment in better shape for their progeny to survive" (Lovelock 1979). How can humankind leave the environment in better shape? One way is to lessen or eliminate all eight interactive global crises.

Regulation of anthropogenic greenhouse gas emissions is very controversial and likely to become more intense when policy decisions are made on whether to limit them by nation or per individual. A report by the Potsdam Institute for Climate Impact Research (PIK Report No. 166) proposes per capita emissions rights. China is now the leading anthropogenic greenhouse gas emitter, with the United States a close second; however, on an individual basis, the United States has far more per capita emissions than China (http://www.nationmaster.com/graph/env_co2_emi_percap-environment-co2-emissions-per). Developing an emissions policy that suits all will be difficult, but living without anthropogenic greenhouse gas emissions control is suicidal.

The PIK report espouses "a global limit on emissions that is consistent with a two degrees Celsius climate target" (which has now been categorized as "dangerous" and going beyond that as "extremely dangerous" [Anderson and Bows 2011]). The rationale is that countries "like the USA and China that do not want to accept national emissions limits" (PIK Report No. 166) might agree to this policy. The basic issue of individual vs national emissions is caused by increased prosperity in developing nations, which makes a high energy lifestyle possible for many millions of additional people. The question must now shift from "what can I afford?" to "what can Earth afford?"

This issue was identified years ago: "We conclude that the concentration of wealth is natural and inevitable, and is periodically alleviated by violent or peaceable partial redistribution. In this view all economic history is the slow heartbeat of the social organism, a vast systole and diastole of concentrating wealth and compulsive recirculation" (Durant and Durant 1968, p. 57). Just because more individuals can afford automobiles does not mean Earth can afford more automobiles, and, therefore, more carbon dioxide emissions. More important, the huge wealth disparity will almost certainly produce massive societal unrest and anarchy, which is not conducive to the goal of sustainable use of the planet. However, now the distribution of financial wealth is extraordinarily wide, with a few percent of the global human population at the top and a huge percent at the bottom.

"For example, Egypt, with 80 million people today, is projected to grow to some 138 million by 2050. Per capita income in Egypt is now about \$5,500, compared with about \$47,000 in the United States and \$30,000 in the European Union. The aspiration gap is even more stunning for sub-Saharan Africa, which is expected to explode from 870 million people to 1.8 billion in the next 40 years. Per capita income there is now \$2,000 and less than a third of the population has access to a toilet" (Ehrlich and Ehrlich 2011). Humans must exhibit intelligence and compassion to a much greater extent if they wish to avoid mass misery.

Pandemic

An *epidemic* is a sudden outbreak that becomes widespread and affects a whole region, a continent, or the world (<http://www.medterms.com>). A *pandemic* affects a substantial portion of the human population. A major consideration at present is a new pattern of antibiotic resistance that is spreading around the globe: "With no new medications in the pipeline capable of dispatching these latest superbugs, we may have to live with the risk of untreatable infections for an uncomfortably long time . . . Looking ahead, researchers envision the emergence of completely resistant strains of gram-negative bacteria, arriving long before the drugs that could treat them" (McKenna 2011). These health concerns may become pandemic since global warming increases the range of both diseases and disease carrying organisms.

¹Inspired by economist Kenneth Boulding's dismal theories.

Poor quality of life and resultant environmental refugees are also major considerations for the global community. Already much of humankind is starving or malnourished, lacks potable water, and lacks the scientific literacy to understand these complex risks. Couple this situation with social unrest and increasing numbers of environmental refugees and the circumstances for a pandemic are ideal. The conflicting social values of the culture that environmental refugees invade plus a paralyzed bureaucracy may be prophetic for the 21st century.

Conclusions

Trends in all eight interactive global crises must be reversed markedly and soon in order to preserve the present Biosphere. However, preservation of the present Biosphere is not enough — it must be nurtured as well. Astonishingly, many people have only a vague idea of the nature of the Biosphere, especially that it is the life support system of all life forms.

The record of inadequate attempts to regulate anthropogenic greenhouse gas emissions by the world's nations shows that they cannot be trusted to protect or nurture the Biosphere. Grassroots-level protection may be superb in some areas and resisted in others, but is probably the most promising approach. Until anthropogenic greenhouse gas emissions are significantly reduced, runaway climate change will not only be possible but probable.

Every time the Biosphere passes a tipping point, irreversible change occurs. Each irreversible change means leaving a different planet for posterity than the planet that the present generation enjoys. Since the changes can only be recognized and evaluated in retrospect, determining their favorable or unfavorable effects upon humankind is not possible; however, some predictive models may be available at sometime in the future. Until then, all biospheric changes should be viewed as involving considerable risk. In the meantime, humankind must be prepared for unexpected disasters. Early warning signals might be provided if sophisticated monitoring systems were put in place and continually funded and staffed. In a complex, interactive system such as the Biosphere, all actions affect other actions, and cause-effect pathways must be included in any monitoring system.

Humans, including me, are in some degree of denial. Perhaps rejection of the worst case scenario for Earth's future is an essential state of mind for today's civilization. However, such denial does not remove its possibility, even probability.

Acknowledgments. I am indebted to Richard Rusk for calling my attention to the *Scientific American* article and to Paula Kullberg for calling the Anderson and Bows article to my attention.

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CHAPTER 7

A Covenant for the Biosphere

Rational treatment of Earth's life support system is long overdue. Achieving sustainability is discussed, but little change has been made in lifestyles. In a senseless quest for ever more energy, humankind is changing the climate, risking nuclear disaster, and engaging in mountaintop removal. Mindless use of renewable resources damages the Biosphere and has led to a 150% ecological overshoot. Economic growth is always a top priority — nurturing and protecting the Biosphere (the environment) rate barely in the top 20 priorities. Meanwhile, the illusion of societal stability is beginning to fade. The transformation from an unsustainable global society to a sustainable one must begin with a pact to nurture the Biosphere, which must be based on an economy that does not damage humanity's life support system. Now is a good time to begin!

Ignoring Humankind's Life Support System

The Biosphere is still being seriously degraded (e.g., the change from alkaline to acidic pH in the oceans), with no substantive effort to stop dangerous trends. A covenant, a solemn and binding agreement for all of humankind, is essential if the present Biosphere is expected to endure.

In 1777, Captain James Cook introduced the word **taboo** to his countrymen in England. Cook maintained that the word had “very comprehensive meaning, uniting around things that were forbidden — because they were either polluting or sacred [(or both)]” (Hardin 1996, p. x). “A taboo on words that is held inviolate for a long time becomes a taboo on thinking itself. (How can we think of things for which we hear no names?)” (Hardin 1996, p. xiii). Taboos obstruct the development of a covenant for the Biosphere. “Science, to be successful, must be open. As soon as a barrier to discussion becomes evident, we know that scientific investigation has been stopped in that direction” (Hardin 1996 p. xiii).

The taboo on discussing carrying capacity for humans has blocked achieving sustainable use of the planet (Cairns 2004). Sustainable use of the planet will not be achieved until population size can be kept within Earth's carrying capacity for humans. Inhabitants of Tikopia Island used some effective measures to stabilize their population between 1000 and 1800 AD — infanticide, abortion, and decreeing that only first-born sons could have children (Firth 1936, Kirsch 2000). Even with far more humane methods of birth control that the Tikopians used, discussions of population control are still taboo in many cultures.

Of course, if discussions are taboo, the default position is that Mother Nature (i.e., the universal laws of biology, chemistry, and physics, which have been described by Flenley and Bahn [2003], Diamond [1994], and others) steps in, and the results are not pleasant. Population collapse, resource wars, famine, disease, and even cannibalism are more repugnant to most people than presently available means of population control. However, until humankind transcends existing taboos that block sustainable use of the planet, the default position of Mother Nature will occur. Taboos that are federally sanctioned do not always work as the attempt to prohibit liquor in the United States proved.

Denial

When the preponderance of evidence points in one direction, one should not despair — denial still exists! In the United States, denial of global warming has worked well by casting doubt on both scientists and their evidence. When the news media intend to publish or air information on global warming, deniers insist that the time allotted be “balanced” with viewpoints from both “sides.” The deniers emphasize that uncertainty exists in scientific evidence as if uncertainty were not the norm in politics, sports, the stock market, and fishing. Denial results in delay on remedial action while the crisis worsens. Bill Watterson states in his *Calvin and Hobbes* comic: “It's not denial. I'm just selective about the reality I accept.” Humankind cannot accept only the scientific evidence it regards as good news and reject evidence regarded as bad news. Scientific evidence should neither be ignored nor suppressed because of emotional reactions by a society unwilling to accept reality.

Sustainability vs Collapse

The Tikopian culture achieved sustainability for many hundreds of years because it accepted the reality that difficult choices must be faced and acted upon. They lost sustainable use of their island when outsiders insisted that the difficult choices they were making were not compassionate and need not be made. Tikopians

lost the intergenerational equity they had by ceasing to make the difficult choices. The inhabitants of Easter Island chose to live unsustainably and lost huge numbers of lives and finally reverted to cannibalism — showing that living unsustainably and avoiding the difficult choices is not compassionate either! Other examples are available of cultures that lived unsustainably and collapsed (Diamond 1994), such as the fall of the powerful, rich, opulent Assyrian Empire and its capital city of Nineveh: “Desolation meets desolation, a feeling of awe succeeds to wonder, for there is nothing to relieve the mind, to lead to hope, or to tell of what has gone by” (British archaeologist Austen Henry Layard as quoted in Ehrlich and Ehrlich 2004).

Not too many years ago, if a society/culture failed and others did not, the event did not endanger civilization; however, with current globalization, all civilizations might fail as a reaction to the failure of one society/culture. No nation or society can ignore the universal laws of nature. Mother Nature can tolerate massive losses of species and even the Biosphere of that time can change, and, as long as some species survive, a new and different array of species will be produced in evolutionary time. No one can predict what the surviving and new species will resemble, but, if past extinctions are a useful guide, a different Biosphere will appear. Only time will tell if the human species will survive under the new conditions. One factor is very clear — when natural resources are exploited rather than nurtured, Mother Nature does not nurture the reckless species that brought about the destruction.

Were Assyrians as obsessed with economic growth and consumerism as humankind is today? The Assyrian army provided a flow of resources “to keep the party going.” Did the inhabitants fear making fundamental changes in their lifestyles? Did they realize that the changes they were causing in the environment were irreversible and would have major deleterious effects? Were they as adept at denial as the current civilization? Did they believe that technology would prevent catastrophes? What kind of world did they want to leave to their children?

Ecological Restoration Gulf Coast Style

Those individuals who think humankind does not need a covenant to nurture the Biosphere should take a look at how money from British Petroleum was used for the cleanup of oil from the huge leak in the Gulf of Mexico (2010). In Florida, a county “spent \$560,000 on rock concerts to promote its oil-free beaches” (Deslatte et al. 2011). Ocean Springs, Mississippi, reserve police officers equipped themselves with tasers (to help clean up oil?). In nearby Gulfport, the sewer department “bought a \$300,000 vacuum truck that never sucked up a drop of oil. . . . Florida’s tourism agency sent chunks of a \$32 million BP grant as far away as Miami-Dade and Broward counties on the state’s east coast, which never saw oil from the disaster. . . . Some of the money BP doled out to states and municipalities hasn’t been spent yet,” even though \$550 million has been accounted for (Deslatte et al. 2011). “More than \$400 million went toward clear needs like corralling the oil, propping up tourism and covering overtime. Much of the remaining chunk consists of equally justifiable expenses, but the total is also riddled with millions of dollars’ worth of contracts and purchases with no clear connection to the spill” (Deslatte et al. 2011). How the money was spent had incredibly lax oversight, even though some of the money was spent wisely. However, much more could have been done if all the money had been spent wisely.

Societal pressure is building to permit more drilling for oil in the Gulf of Mexico even though its ecological integrity has been seriously damaged and much oil remains in the Gulf’s substrate. This important part of the Biosphere at least should be substantively restored before more oil drilling is permitted. The covenant to protect the Biosphere requires that individuals be dedicated to its integrity in order to be successful.

Population Crisis

With energy and food prices rising, water stress in some areas of the planet, and water scarcity in many others, approximately 1.2 billion people go to bed hungry each night and at least another billion are malnourished. The population crisis is already a reality for many of the world’s people. What about the future?

When it comes to population growth the United Nations has three primary projections. The median projection, the one most commonly used, has world population reaching 9.2 billion by 2050. The high one reaches 10.5 billion. The low projection, which assumes that the world will quickly move below replacement-level fertility, has population peaking at 8 billion in 2042 and then declining. If the goal is to eradicate poverty, hunger, and illiteracy, then we have little choice but to strive for the lower projection (Brown 2011).

The Comfort Zone

A **comfort zone** (psychology) is defined as a situation or position in which a person feels secure, comfortable or in control (<http://www.thefreedictionary.com>). A comfort zone for an individual usually includes

familiar work, family, living quarters, social groups, religion, and even food. Humankind lives within globalized trade and financial systems as it encounters global crises (e.g., climate change), all of which are outside the comfort zone for a small group species like *Homo sapiens*.

Some regions adapt to global issues more rapidly than others — for example, “almost nine out of 10 EU citizens believe that climate change is a serious problem, with 63% convinced it is a ‘very serious’ issue and 24% deeming it a ‘fairly serious’ matter” (EurActiv 2009). In contrast, “US citizens tend to have a less drastic view on climate change: 65% still consider it a problem, but a growing number disagree with this idea” (EurActiv 2009).

Three factors may account for the difference in perception of global issues.

(1) Science, both global warming and evolution, are under assault in the United States by well funded opposition campaigns.

(2) Voter turnout in federal elections is often 50% or less in the United States

(<http://www.infoplease.com/ipa/A0781453.html>), which indicates a lower than desirable citizen involvement, even in national affairs.

(3) The European Union nations have good public transportation systems and are less dependent upon fossil fuel than the United States, which has many long distance automobile commuters.

A Lack of Candor

People do not want to be reassured about risks, they just want candor. They have been told that nuclear power plants are “safe.” Then came Fukushima: “With all the euphemistic language on display from officials handling Japan’s nuclear crisis, one commodity has been in short supply: information. . . . The less-than-straight talk is rooted in a conflict-adverse culture that avoids direct references to unpleasantness” (Tabuchi et al. 2011). However, science is the ultimate source of candor since it is based on verified evidence and published in peer-reviewed journals. However, in the United States and elsewhere in the world, science is often ignored or rejected because it is a source of bad news (e.g., climate change). The bad news will continue until humankind reduces emissions of anthropogenic greenhouse gases. If drastic reductions are made in the next decade, the news may be good. However, attempts to reassure people by using the word “safe” instead of providing information on risk lacks the necessary candor. Lack of candor is a poor form of political damage control.

Conclusions

A covenant with the Biosphere must be based on robust scientific evidence about the universal laws of biology, chemistry, and physics. Living as part of the Biosphere and not apart from it is the *sine qua non* of the covenant. Sustainability ethics (avoiding unsustainable living) and wise limits to the use without abuse of natural resources must also be a foundation of the covenant. Eliminating exceeding Earth’s carrying capacity for humans and eliminating ecological overshoot are also essential to nurturing the present Biosphere.

Acknowledgments. I am indebted to Paula Kullberg, Paul Ehrlich, Shireen Parsons, and Ralph Disney for calling useful references to my attention.

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CHAPTER 8

Existential Risks Involving Earth's Biosphere

"Existential risks . . . are threats that could cause our [*Homo sapiens*] extinction or destroy the potential of Earth-originating intelligent life. . . . Existential risks have a cluster of features that make ordinary risk management ineffective" (Bostrom 2002). In the 160,000-200,000 years that *Homo sapiens* has been on Earth, the species has been exposed to a variety of risks, such as disease, starvation, and hostile tribes or armies. If individuals or a culture/nation take foolish risks, death may be the result. However, if the risk is at the global level and is unsuccessful, extinction may be the result.

Test fast, fail fast, adjust fast.

Tom Peters

Living at risk is jumping off a cliff and building your wings on the way down.

Ray Bradbury

Existentialism is a philosophical movement embracing diverse doctrines but centering on analysis of individual existence in an unfathomable universe and the plight of the individual (who must assume ultimate responsibility for acts of free will without any certain knowledge of what is right or wrong or good or bad) (<http://www.merriam-webster.com/dictionary/existentialsim>). In some cases, the universe is depicted as hostile or indifferent — for example, Earth can indeed become a hostile environment when the conditions change markedly for existing life forms. However, in the past, an adequate number of species survived unsuitable conditions to produce a diverse array of species suited to the new conditions. Five major periods of biological extinction have occurred on this planet. Each was caused by physical events outside the normal climatic and other physical disturbances that species, and entire ecosystems, experience and survive. The first, second, and third extinctions have been attributed to climate change with 25%, 19%, and 54% taxonomic families lost, respectively. The fourth extinction involved 23% taxonomic families lost with no exact cause known. The fifth extinction was possibly caused by Earth's collision with another celestial body or a volcanic event, with 17% taxonomic families lost (Eldredge 2001). The sixth great biological extinction appears to be underway (Larsen 2004).

The universe is indeed indifferent to humankind's fate, both as individuals and as a species. The universal laws of biology, chemistry, and physics must be obeyed — for example, an individual should not expect special treatment from the law of gravity. Science has provided humans with much information about these laws, but, even when scientists provide the information, it is often ignored. At present, a well financed effort is under way to discredit scientific evidence (Orekes and Conway 2011). Consequently, of what value is the scientific information when a major, organized effort is attempting to cast doubt on it?

Existential Risk #1

An individual can file for bankruptcy after making serious financial mistakes, a nation can bail out a "too big to fail" bank, the European Union might bail out a nation, but no entity can bail out a planet following a major, global, financial meltdown. Economic convergence is the theory that the economic factor, especially productivity, applying in a group of countries that should move them closer together (<http://www.economics-dictionary.com/definiton/convergence>). However, when resources, especially food and water, are scarce and expensive, divergence in the form of resource wars seems probable.

Most, probably all, complex systems have tipping points that, if passed, result in irreversible change (Gladwell 2000). At present, no early warning signal can show that complex systems are nearing a tipping point, so prudence demands the avoidance of actions that might initiate irreversible change. However, since even numerous failed states (<http://www.foreignpolicy.com/articles/2011/06/17/2011>) appear to represent, collectively, an intractable problem, existential global financial crises should be avoided.

Existential Risk #2

Many, interactive, global, existential risks exist in Earth's biosphere (Cairns 2010). Oceans cover 71% of Earth's surface, so they constitute an extremely important component of the Biosphere. "Life in the oceans is at imminent risk of the worst spate of extinctions in millions of years due to threats such as climate change and over-fishing, . . . Time was running short to counter hazards such as a collapse of coral reefs or a spread of low-oxygen 'dead zones,' . . ." (Reuters 2011). Climate change is indeed a global, existential risk that must be addressed globally, especially since the Biosphere is Earth's life support system. In addition to adverse effects on marine life, sea level rise will have a major impact on coastal cities and affect many people (Kenward 2011).

Existential Risk #3

Biodiversity loss on a large scale is obviously important because species are the basic operational units of the Biosphere. Biotic impoverishment – reduction in the number of individuals in a species so that it is of little or no ecological significance – is also a major factor. Even dominant species can become extinct during a mass extinction. "The fossil record shows, however, that the major extinction events of the geologic past have played a larger and more complex role, by removing not just marginal players but also dominant incumbents, owing at least in part to extinction selectivities that are partly independent of those seen under 'normal' extinction regimes" (Jablonski 2001). The dominant species may also be most favored by conditions produced by the environment they inhabit, and they lose their competitive advantage when the biosphere goes into disequilibrium. *Homo sapiens* has only experienced the present Biosphere; therefore, its replacement poses an existential risk.

Existential Risk #4

For nearly the entire 200,000 years that *Homo sapiens* has existed, humanity has been able to live off nature's interest – consuming resources at or below regeneration levels and producing carbon dioxide at a rate within Earth's assimilative capacity. "Sustainability requires living within the regenerative capacity of the Biosphere. . . . Our accounts indicate that human demand may well have exceeded the biosphere's regenerative capacity since the 1980s. According to this preliminary and exploratory assessment, humanity's load corresponded to 70% of the global capacity of the global biosphere in 1961, and grew to 120% in 1999" (Wackernagel et al. 2002). The situation is worsening rapidly since Earth Overshoot Day was reached on August 21 in 2010 with an overshoot of 150% (Global Footprint Network 2011). Such percentages are clearly unsustainable and a very serious existential risk! If such numbers arose for the conventional economy, dire warnings would be issued. But, since it's only the biosphere, why worry?

Existential Risk #5

In 1798, Thomas Robert Malthus, a graduate of Cambridge University, wrote "The Principles of Population" in which he noted that population growth would always outrun food supply. The late 1700s and 1800s provided evidence for both hunger and poverty in England, which were eloquently described by Charles Dickens. Ironically, Malthus was condemned for reporting what he observed despite the fact that hunger still exists in the 21st century, even in wealthy countries. "To secure a quality life for current and future generations, sufficient land, water, and energy must be available. Worldwide today there is evidence that food production and distribution processes are problematic; more than 3.7 billion humans are now malnourished. With the imbalance growing between population numbers and vital life maintaining resources, humans must actively conserve cropland, freshwater, energy, and biological resources" (Pimentel and Pimentel 2006).

Projections of future population growth indicate another 3 billion humans will be added in the 21st century, bringing the human population total to approximately 10 billion. Food security means having a reliable supply of food in order to lead a quality life (Martin 2011). However, Malthus showed many years ago that, unless something other than starvation and misery limit exponential population growth, increasing the supply of food while ignoring population growth just increases the number of people living in misery. "This fall [2011] the Earth's human population will exceed 7 billion. It took modern humans about 200,000 years to reach 1 billion in 1800. Since 1960, humanity has grown by one billion about every 12 years. . . . Some suggest that the Earth has plenty of room for more people, since a geographic area such as the state of Texas could hold the entire current world population at the density of the state of New York" (Faller 2011). *Homo sapiens* has had hundreds of years to solve this problem and has failed. The result is billions of people living in misery.

Existential Risk #6

"Climate change is the ultimate collective-action problem. . . . Its only solution lies in a level of global cooperation that humanity has never seen before. . . . Purely technological fixes . . . will not be sufficient to mitigate or successfully adapt to climate change" (Smith 2009). The way humankind views technology in the 21st century appears to be a way to avoid personal and social change by making it possible to continue business as usual.

Existential Risk #7

In the United States, the discord about climate change has evolved into an assault on science (Hulme 2009). Climate change and its consequences are due to the universal laws of nature, and *Homo sapiens* can neither alter them nor ignore them. Humankind has been accustomed to believing that these laws operate for humankind's pleasure instead of using the information gained from these laws to decrease risk of extinction for the human species. In other words, *Homo sapiens* is only one species out of a huge interacting web of species and interspecies relationships within the Biosphere that are important to human survival as a species. Discord has worsened since 2009 to the extent that only the implacable universal laws can serve as a unifying theme.

At a global warming denier conference at the Heartland Institute, President Joe Bast stated that fossil fuel dependency is not a problem. A sign in the lobby of the meeting facility read (Lacey 2011):

| GLOBAL WARMING? | |
|--|--|
| NOT MAN MADE | NOT HARMFUL |
| <ul style="list-style-type: none">• <i>It's natural variation</i>• <i>Human impact is very small</i>• <i>Computer models are flawed</i>• <i>There is no "consensus"</i> | <ul style="list-style-type: none">• <i>Past warmings were beneficial</i>• <i>No current harms</i>• <i>Future warmings will be modest</i>• <i>Warmer is better</i> |

These assertions are not evidence. Climate scientists who publish in peer-reviewed scientific journals have evidence. No middle ground exists in such situations. "There didn't seem to be much agreement from the attendees about why – or if – climate was changing. But there was unanimous agreement that the IPCC, the Obama Administration, James Hansen and the environmentalists are part of a plot to grow government and take over people's lives. The conference is a political one, not a scientific one" (Lacey 2011). However, this discord involves more than science – controlling anthropogenic greenhouse gas emissions means regulating them; to many people, regulation means BIG GOVERNMENT. However, climate change has adverse effects upon the Biosphere, which is the source of renewable resources that are essential to the economy. Society's enlightened self interest requires protection of the Biosphere that also serves as the planet's life support system.

Conclusions

Science has served humankind well for many years. It has increased the human life span dramatically. Scientific research has been the foundation of the technologies that are an integral part of humankind's daily lives, even of those people who attempt to discredit science. It has provided much knowledge about the universal laws of nature, which have produced Earth and the Biosphere that envelopes it. Scientific research will be essential to identify and cope with existential risks that *Homo sapiens* has never encountered in its 200,000-year history. Policy should be based on the preponderance of scientific evidence produced by credentialed scientists and published in peer-reviewed journals. If dissenters have some scientific credentials and if they have strong counter evidence, they should be able to prevail because dissimilar, verifiable stances are also an integral part of the scientific process.

Scientists will always be identifying risks that will be labeled "bad news" by special interest groups that perceive the evidence as a threat to their profits or ideology. Disinformation will always be a tool of the "spin doctors," but the scientific process has always triumphed because it produces validated evidence as a result of peer review, both before and after publication. In the absence of scientific evidence, *Homo sapiens* will be unaware of risks – particularly those caused by new, untested technologies or failure of existing technologies (e.g., Fukushima nuclear catastrophe) once thought to be "safe."

The universal laws of nature are neither hostile nor indifferent to human fate unless they are ignored or violated. In addition, species whose lifestyle is not compatible with nature's laws must suffer consequences. Existential risks are ones that neither *Homo sapiens* nor individuals of the species have encountered – global financial meltdown, oceanic change, biotic impoverishment, ecological overshoot, human overpopulation at 7 billion, and climate change. Humankind should pay more attention to what is happening to the environment now and avoid new risks, even if the risks provide temporary economic benefits, because no economic benefit is worth extinction.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and Paul Ehrlich, Paula Kullberg, and John James for calling useful references to my attention.

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CHAPTER 9

Petition of the Candlemakers Against the Sun

We are capable of shutting off the sun and stars because they do not pay a dividend.

Economist John Maynard Keynes, 1933*

“Frederic Bastiat’s classic satire, “Petition of the Candlemakers Against the Sun (<http://bastiat.org/en/petition.html>)”, has been given new relevance. Written in 1845 in defense of free trade and against national protectionism in France, it can now be applied quite literally to the cosmic protectionists who want to protect the global fossil fuel-based growth economy against ‘unfair’ competition from sunlight – a free good” (Daly 2011). Professor Daly makes a point crucial to the survival of civilization and possibly the human species. Technology that uses fossil fuel in a Biosphere “pre-adapted by millions of years of evolution to the existing flow of solar energy” (Daly 2011) is no longer sustainable. Fossil fuel changes the climate, so why not cease use of fossil fuel? Instead, humankind is contemplating using geo-engineering to permit more use of fossil fuel. Humans cannot alter the universal laws of biology, chemistry, and physics. Why postpone changing lifestyles to be congruent with these universal laws? Why cling to and protect practices that are destroying the Biosphere that has served *Homo sapiens* and the millions of other life forms so well?

The Biosphere is primarily a “free good” because, except for domesticated animals and plants, no individual or nation owns Earth’s biota. Except for coastal areas, the oceans that cover about 71% of Earth’s surface area are a free good. Most marine biota, except for a few species such as whales, have no global regulations on harvesting. Some regulations do exist for fisheries, but they have not been effective in maintaining “brood stocks.”

The global atmosphere is a free good, and it transcends political boundaries. Neither effective global nor national regulations exist on anthropogenic greenhouse gas emissions. Attempts to regulate them have been nearly a total failure despite many international conferences that aim to establish limits.

Terrestrial components of the Biosphere, such as the Amazon rainforests, belong to one or more nations and individuals but have not been protected effectively as components of the biospheric life support system. Even when property ownership is clear, anyone with sufficient money can usually gain access to harvest them. Most nations strongly resist any attempts to diminish their sovereign rights to establish control over their portion of the biospheric life support system. However, in order to be effectively managed as a system, a global policy is essential.

The same protectionism of practices that harm the Biosphere was evident when corn was used to produce ethanol for automobile fuel. Corn is planted by using energy produced from petroleum, often brought across an ocean to be refined, transported to distributors, and, when used, produces the greenhouse gas carbon dioxide. Growing corn requires vast amounts of water — usually 1,000 tons per ton of grain.

Why does humankind have an obsession for persisting in the use of fossil fuels? They badly damage the biospheric life support system and will need to be replaced in the 21st century with alternative sources of energy (solar, wind, geothermal) that are carbon free and do not produce hazardous wastes. Continued use of fossil fuels will make a few people wealthier and endanger the lives of many people.

Persuasive evidence indicates that nurturing regional or local ecosystems can have cumulative, global, beneficial effects (Rudel 2011). Humankind has and is witnessing how individual and local practices can damage the Biosphere — for example, anthropogenic emissions of carbon dioxide cumulatively cause global climate change and alter oceanic pH from mildly alkaline to mildly acidic. “An increase in the frequency and intensity of environmental crises associated with accelerating human-induced global change is of substantial concern to policy makers. The potential impacts, especially on the poor, are exacerbated in an increasingly connected world that enables the emergence of crises that are coupled in time and space” (Biggs et al. 2011). Regulations on smog, mercury, carbon dioxide, mining wastes, and vehicle emissions may be established (Broder 2011), but what will happen to human health and the environment if these regulations are repealed or funding is inadequate for enforcing them? Proponents of these regulations are “working under intense pressure from opponents in Congress [in the United States], from

* Both the Keynes quote and the idea of the candlemaker petition come from Daly (2011).

powerful industries, from impatient environmentalists and from the Supreme Court, which just affirmed the . . . duty to address global warming emissions, a project that carries profound economic implications” (Broder 2011).

Since global climate change is a planetary problem, the anthropogenic carbon dioxide greenhouse emissions from coal and petroleum could, by continuing business as usual, destroy the Biosphere by pushing atmospheric greenhouse gas levels beyond one or more as yet unknown tipping points, which could cause runaway climate change and other irreversible effects. This problem involving human health and well being, as well as biospheric health and integrity, needs urgent attention because a number of societal and ecological tipping points, which result in irreversible change, may be closer than thought. A few illustrative examples follow.

(1) Water Wars

Water is the most abundant resource on the planet, but contaminated water is neither suitable for drinking nor agriculture. “Almost half of humanity will face water scarcity by 2030 and strategists from Israel to central Asia prepare for strife. . . . As global warming alters weather patterns, and the number of people lacking access to water rises, millions, if not billions, of others are expected to face a similar fate as water shortages become more frequent” (Arsenault 2011). The words “similar fate” refer to the heartbreaking suffering already experienced by many people for whom the crisis is here now. A huge global inequality in wealth already exists, so a comparable inequality in resources per capita, such as water, is not surprising.

(2) Biodiversity, Species Extinction, and Biotic Impoverishment

“For most organisms, the number of described species considerably underestimates how many exist. This is itself a problem and causes secondary complications given present high rates of species extinction. . . . Most species are not known to science; . . . these ‘missing species’” (Joppa et al. 2011) are ecologically important. Some “hotspots” exist that contain a disproportionate number of species per unit area and much of the rest of the planet may contain fewer species to very few species. Species are the basic components of the Biosphere and interactions of biospheric components are poorly understood. Ecosystem “boundaries” rarely, if ever, correspond with political boundaries; therefore, political policies should recognize this characteristic in both wording and implementation of policies, although they rarely do. Stated bluntly, the Biosphere is a complicated system upon which *Homo sapiens* depends but rarely acknowledges this dependence.

(3) Global Food Scarcity

Heat waves clearly can destroy crop harvests. The world saw high heat decimate Russian wheat in 2010. Crop ecologists have found that each 1-degree-Celsius rise in temperature above the optimum can reduce grain harvest by 10 percent. But the indirect effects of higher temperatures on our food supply are no less serious. . . . even a 3-foot rise in sea level [from melting glaciers and warming the oceans] would sharply reduce the rice harvest in Asia, a region home to over half the world’s people that grows 90 percent of the world’s rice. . . . For the 53 million people living in Peru, Bolivia, and Ecuador, the loss of their mountain glaciers and dry-season river flow threatens food security and political stability” (Brown 2011).

Elsewhere in the world, changing rainfall patterns, depletion of aquifers used for irrigation, expansion of the range of agricultural pests, droughts, and floods do much damage to crops and rangeland.

(4) Ocean Stresses

“The ocean is the largest ecosystem on Earth, supports us and maintains our world in a habitable condition. To maintain the goods and services it has provided to humankind for millennia demands change in how we view, manage, govern and use marine ecosystems. The scale of the stresses on the ocean means that deferring action will increase costs in the future leading to even greater losses of benefits” (Rogers and Laffoley 2011). Key points to consider in this change follow.

- *Human actions have resulted in warming and acidification of the oceans and are now causing increased hypoxia.*
- *The speeds of many negative changes to the ocean are near to or are tracking the worst-case scenarios from IPCC and other predictions. Some are as predicted, but many are faster than anticipated, and many are still accelerating.*
- *The magnitude of the cumulative impacts on the ocean is greater than previously understood.*
- *Timelines for action are shrinking.*

- *Resilience of the ocean to climate change impacts is severely compromised by the other stressors from human activities, including fisheries, pollution and habitat destruction.*
- *Ecosystem collapse is occurring as a result of both current and emerging stressors.*
- *The extinction threat to marine species is rapidly increasing.*

(Rogers and Laffoley 2011)

(5) Adapting to Global Climate Change

A direct connection exists between present biospheric health and integrity and the well being of *Homo sapiens*, which is only one of the millions of species that have evolved and flourished under present conditions. Humankind should not tolerate biospheric damage because it is a threat to humankind's own well being. The US Chamber of Commerce "views air conditioning as a viable human 'adaptation' to global warming" (Kohut 2011). What about the rest of the species in the Biosphere that lack air conditioning? Should humans use fossil fuel power for air conditioning? McKibben (2011) notes: ". . . arguing that . . . 'populations can acclimatize to warmer climates via a range of behavioral, physiological, and technological adaptations'" is absurd. In addition, many humans cannot adapt — the 2003 heat wave in Western and Central Europe has been blamed for 70,000 deaths, and, from late July until the second week of August 2010, the estimated Russian death toll was 55,000 people (Parry 2011).

(6) Climate Change is a Probable Cause of Mass Extinction

"The fate of humanity and nature may depend upon early recognition and understanding of human-made effects on Earth's climate" (Hansen 2009). During the first five mass extinctions, many species were lost from the Biosphere, and, in the present great extinction (the sixth), many have already been lost. Clearly, many species could not adapt to rapidly changing, new conditions. Humans facing a major climatic change may not be able to adapt, even with technology. Technology generally requires energy (e.g., air conditioning), and, if the technology uses fossil fuels that emit greenhouse gases, it may exacerbate an already risky situation. ". . . the climate models currently in wide use (by, e.g., the IPCC) probably won't be able to predict abrupt climate changes" (Roberts 2011). "According to the evidence from the past, the Earth's climate is sensitive to small changes, whereas the climate models seem to require a much bigger disturbance to produce abrupt change. Simulations of the coming century with the current generation of complex models may be giving us a false sense of security" (Valdes 2011). Rapid adaptation may be essential for survival, and, if humans cannot prevent rapid change by marked reduction of anthropogenic greenhouse gas emissions, which are under their control, how will they be able to adapt to situations beyond their control? "Fact is, radical uncertainty and volatility are the new normal. We have very little real grasp of the risks we face, we just know that some of them carry consequences so huge — potentially limitless — that they completely short-circuit our models" (Roberts 2011). Darwin's dice will roll continually, and humankind has no comprehension of the final outcome.

Conclusions

Humankind and millions of other species are about to face risks never before experienced in the approximately 200,000 years that *Homo sapiens* has inhabited Earth. As climate change worsens, it will almost certainly be the predominant moral/ethical issue of present day society. The fate of human civilization is closely linked to the fate of the present Biosphere. Economic growth for economic dividends is based on renewable resources from the Biosphere. The ecological overshoot for 2010 was 150%, meaning that the human economy is using resources faster than the Biosphere can regenerate them — brood stock is being used in oceanic fisheries, old-growth forests are being clear cut and are being replaced with seedlings, fossil water from aquifers is being pumped in orders of magnitude faster than it is being replaced, and many other ecological atrocities are occurring. Above all, natural capital is being depleted, which is the source of ecosystem services that constitute Earth's life support system. These practices result in the assault on science when evidence produced from scientific studies demonstrates that humankind's present life style is unsustainable and harmful to the Biosphere.

Humankind is obsessed with fiscal debt and barely aware of ecological debt as measured by ecological overshoot and ecological footprint data. Humankind began experiencing ecological overshoot in 1986, and the first ecological debt day was 19 December 1987. In 2010, ecological debt day was 21 August, which is dramatically unsustainable and is closely coupled with humankind's fixation on economic growth.

All eight global crises (Chapter 2 in this volume) that threaten the Biosphere must be addressed simultaneously now because passing tipping points results in irreversible change. If humankind fails to live sustainably, the severe consequences will be the end of civilization and/or extinction. Existential risks (Chapter 8 in this volume) have a cluster of features that make ordinary risk management ineffective. An attitude change is essential if the present Biosphere, which does not pay dividends but is humanity's life support system, is going to survive the effects of economic growth.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg, Paul Ehrlich, Karen Cairns, and Peter Leigh for calling useful references to my attention.

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CHAPTER 10

Redistribution of Earth's Resources by Global Policy or Laws of Nature?

Forced to choose, the poor like the rich love money more than political liberty, and the only political freedom capable of enduring is one that is so pruned as to keep the rich from denuding the poor by ability or subtlety and the poor from robbing the rich by violence or votes.

Will Durant

The things that will destroy us are: politics without principle, pleasure without conscience, wealth without work, knowledge without character, business without morality, science without humanity, and worship without sacrifice.

Mahatma Mohandas K. Gandhi

For most Americans, economic growth is a spectator sport.

Paul Krugman

All life on Earth is governed by resource availability. All eight interactive global crises (Chapter 2 in this volume) affect and are affected by resource availability, or lack thereof, on a finite planet. In the human economy, money is used to acquire resources either in raw form (e.g., grain) or in processed form (e.g., bread). Money can also be used to acquire land and water resources originally used by other species. Economic growth would be impossible without resources. Consequently, on a finite planet with finite resources, limits exist to all kinds of growth except in knowledge and wisdom.

Resource wars (e.g., World War II) are based on attempts to acquire more resources that exist within a nation's political boundaries — for example, in World War II, Germany wanted more *lebensraum* – the territory believed needed for a nation's natural development (*Merriam-Webster Dictionary*). Japan, with practically no resources (e.g., oil, minerals, wood, etc.), wanted the resources of nations in or bordering the Pacific Ocean. Resource wars will almost certainly intensify as Earth's human population increases from 7 to 10 billion in the 21st century. Ironically, all wars are profligate wasters of resources. However, the ultimate irony is that, in the quest for perpetual economic growth, *Homo sapiens* is taking resources from other species that collectively constitute Earth's biospheric life support system upon which both human life and the human economy depend. Even more ironically, the intensity of focus on economic growth is so great that the biospheric life support system gets little or no attention.

Biospheric Collapse

Throughout this volume, numerous references have been made to the collapse (great extinction number six) of the present biosphere. The world's oceans represent approximately 71% of Earth's surface, and they are already in great peril. The terrestrial portion, at about 29% of Earth's surface, is also being seriously degraded. Predicting when a tipping point will be reached is not possible, but passing one probably results in irreversible changes. Biotic impoverishment is a sound indication of irreversible effects, but will not indicate precisely when a tipping point is reached.

Climate change has already had serious deleterious effects upon the Biosphere, including reduced agricultural productivity that diminishes food security and increases food prices. Hazardous chemicals produce a variety of stresses on the Biosphere: "Trees and plants are extremely susceptible to damage by chemical pollutants, yet the kind of damage that occurs is not easily predictable. Air, water and soil interact in complex ways, depending upon the chemical – or chemicals – involved, the kind of vegetative cover, atmospheric conditions and soil types. The control of chemical pollutants and their effects requires not only more knowledge but more extensive international planning and cooperation" (Kabata-Pendias 2011).

A sustainable economy is one in which:

a. the total throughput of renewable resources is no greater than the net primary production of the ecosystem, and

b. *the total extraction of non-renewable resources is no faster than the rate at which alternative resources can be discovered* (Porter 2011).

What is termed *sustainable use of the planet* does not even come near meeting these conditions. Humankind produces wastes that do not even serve as resources for the natural systems of the Biosphere.

Ecosystem Simplification

The previous five mass extinctions have demonstrated that nature always tends toward a rich biodiversity, which may originate from a very few species. The Agricultural Revolution was the result of simplifying an ecosystem by replacing it with domesticated plants and animals that provided an abundance of food with less ecosystem literacy than hunting and gathering, which was the method that *Homo sapiens* used to acquire food for most its time on Earth. Diamond (1987) believes that agricultural abundance was not the blessing it was once thought to be: "Now archaeology is demolishing another sacred belief: that human history over the past million years has been a long tale of progress. In particular, recent discoveries suggest that the adoption of agriculture, supposedly our most decisive step toward a better life, was in many ways a catastrophe from which we have never recovered. With agriculture came the gross social and sexual inequality, the disease and despotism, that curse our existence."

Many people believe Thomas Hobbes' description of life before the Agricultural Revolution as "solitary, poor, nasty, brutish, and short" (<http://www.phrases.org.uk/meanings/254050.html>). But Diamond (1987) describes modern hunters and gatherers: "It turns out that these people have plenty of leisure time, sleep a good deal, and work less hard than their farming neighbors. For instance, the average time devoted each week to obtaining food is only 12 to 19 hours for one group of Bushmen, 14 hours or less for the Hadza nomads of Tanzania. One Bushman, when asked why he hadn't emulated neighboring tribes by adopting agriculture, replied, 'Why should we, when there are so many mongongo nuts in the world?'" Milton (2000) notes: "Finally, all the hunter-gatherers that were included in the Atlas were modern-day humans with a rich variety of social and economic patterns and were not 'survivors from the primitive condition of all mankind.'"

Human Modified Ecosystems

Human modification of ecosystems is an existential risk that humans have not previously experienced because approximately 10,000 years is not long in evolutionary time. "Human-modified ecosystems are shaped by our activities and their side effects. They share a common set of traits including simplified food webs, landscape homogenization, and high nutrient and energy inputs. Ecosystem simplification is the ecological landmark of humanity and the reason for our evolutionary success. However, the side effects of our profligacy and our poor resource practices are now so pervasive as to threaten our future no less than that of biodiversity itself" (Western 2011). Clearly, the Biosphere is being altered and the consequences will be catastrophic for humankind, which flourished and evolved in the present Biosphere.

Domestication of Species

"Artificial selection is the selection of advantageous natural variation for human ends and is the mechanism by which most domestic species evolved. Most domesticates have their origin in one of a few historic centers of domestication" (Driscoll et al. 2009). Artificial selection for human goals obviously differs from natural selection. Domesticated species represent only a tiny fraction of the total species in natural ecosystems, and the performance of either group is difficult to predict if climate change proceeds at its present rate. In the 21st century, food riots have occurred in some parts of the world, and, since domesticated animals do not forage for their own food, they are, in a sense, competing with humans for grain and water. When domesticated animals are concentrated in feed lots, waste disposal becomes a problem. Hunters/gatherers were intimately associated with natural systems and required an encyclopedic knowledge of natural ecosystems to survive. Working with domesticated species does not require this knowledge. The Agricultural Revolution diminished the association of humans with natural systems and, therefore, the ability to survive in them if the agricultural system declines. Natural systems, collectively, are the Biosphere.

Water

Of the total water on Earth, oceans comprise 96.5% and freshwater only 2.5%. Of the 2.5%, groundwater is 30.1%; glaciers and icecaps are 68.6%; surface water and other freshwater are 1.3%. Of the 1.3% surface and freshwater, lakes comprise 20.1% and ice and snow comprise 73.1% (<http://ga.water.usgs.gov/edu/earthwherewater.html>).

Humans only drink a few liters of water per day, but large amounts are essential for the production of food. The "most agriculturally productive regions of the world are all regions where natural rainfall is sufficient to allow rain-fed agriculture to flourish; . . . For example, in the United States, corn is a productive grain that typically yields over 100

bushes per acre, but requires a climate where rainfall is at least 76 centimeters (30 inches) per year” (Water Encyclopedia 2011). A useful approximation is that 1 ton of grain requires 1,000 tons of water to produce.

Much of the world’s grain and other crops is produced by irrigation. “In the twentieth century, the practice of irrigation was greatly increased to provide food for the world’s growing population. Globally, irrigation now accounts for 69 percent of the 3,240 cubic kilometers (772 cubic miles) of water withdrawn for human use, and 87 percent of all water consumed” (Water Encyclopedia 2011). In this context, the term *consumed* means not usable for other purposes.

“Many countries are facing dangerous water shortages. As world demand for food has soared, millions of farmers have drilled too many irrigation wells in efforts to expand their harvests. As a result, water tables are falling and wells are going dry in some 20 countries containing half the world’s people. The overpumping of aquifers for irrigation temporarily inflates food production, creating a food production bubble that bursts when the aquifer is depleted” (Brown 2011).

“ . . . in the Middle East, where populations are growing fast, the world is seeing the first collision between population growth and water supply at the regional level. . . . In Mexico, home to 111 million people, the demand for water is outstripping supply. In the agricultural state of Guanajuato, the water table is falling by 6 feet or more a year” (Brown 2011). In the United States, “The average natural flow of the Colorado River as measured at Lees Ferry will decrease by approximately 9 percent over the next 50 years, . . . In addition, the average yield of the river could be reduced by 10 to 20 percent due to climate change” (Gallup Independent 2011).

“For 10,000 years, the Nisqually Indians have relied on Chinook salmon for their very existence, but soon those roles are expected to reverse. Based on current warming trends, climate scientists anticipate that in the next 100 years the Nisqually River will become shallower and much warmer. Annual snowpack will decline on average by half. The glacier that feeds the river, already shrunken considerably, will continue to recede” (Kaufman 2011). The universal laws of biology, chemistry, and physics will prevail. The risks are at the biospheric level, and no ecosystem component will survive in a hostile biosphere. When complex ecosystems, such as the biosphere or its component ecosystems, pass a tipping point, change is swift and irreversible — not ideal for adaptation.

Power Plants

“Cooling power plants requires the single largest share of U.S. freshwater withdrawals: 41 percent. . . . As for water quality, coal and nuclear plants discharge water in the summer at an average temperature of 17°F warmer than when it entered the plant. . . . When adequate cooling water is not available to fossil fuel, nuclear, and other steam-generating plants due, for example, to prolonged drought or high water temperatures caused by a heat wave, the plants have to cut back power production or even shut down. . . . Hydropower facilities face the same fate when water levels drop too low for power production” (Union of Concerned Scientists 2011a).

Although massive earthquakes and tsunamis may not threaten most nuclear power plants, the Fukushima catastrophe in Japan did cause questions to be raised about nuclear plant safety. “. . . the result at the Fukushima Daiichi plant — a ‘station blackout,’ or loss of power from both the electrical grid and backup diesel generators — could similarly occur at U.S. plants in areas subject to earthquakes, hurricanes, tornados, ice storms, or even falling trees. . . . If the flow of cooling water into the pools is interrupted for a prolonged period of time, as it was at the Fukushima plant, the fuel will begin to overheat and melt, just as in a reactor core meltdown” (Union of Concerned Scientists 2011b). Under such circumstances, radioactive material can intrude into the environment (Union of Concerned Scientists 2011b).

Enter the Next Biosphere

“We tend to believe that all human beings use the same modes of thinking. We assume that the natural world is ultimately knowable, that by rational thought human beings can ferret out the underlying structure of the universe. This impulse governed the thinking of the ancient Greeks and it certainly affects all of us living in an increasingly scientific and technological world. Many cultures outside the west put greater emphasis upon the particular and the aesthetic, rather than on the abstract and the logical. Some scholars who work in comparative cultures have said that our belief in the universality of rational thought is perniciously provincial. One has even gone so far as to say that we in the modern west are among the most dogmatically ethnocentric people on earth!” (Mohrman 1999). In the 21st century, humankind is faced with at least eight interactive global crises and is beginning, reluctantly, to realize that nature’s laws can neither be ignored nor circumvented by technology.

The Ultimate Irony

Nature, once perceived as an assortment of species without structure, is, in fact, a very orderly system governed by a universal set of laws. Because nature is dynamic, the order is not apparent unless one has what Aristotle termed *an instructed mind*. The order that humans have attempted to create is also subject to nature’s laws, which are not influenced by human constructs — for example, the “free market” was once assumed to be self

regulating, but it was not, and the belief that available resources did not limit growth (e.g., Simon 1998) has been falsified by water, food, and other resource scarcities in the 21st century.

Profligate use of fossil fuels to spur economic growth is changing Earth's climate and many, probably most, changes will be irreversible. The Biosphere has already suffered major biotic damage, and most changes are not favorable to *Homo sapiens*. Biospheric collapse will make survival difficult for many species, including humans. Most complex systems collapse swiftly after passing a tipping point, and little or no time will be available for extended conferences that produce little action on crises such as climate change.

Conclusions

Kurt Vonnegut's (2005) poem "Requiem" has these closing lines:

*When the last living thing
has died on account of us,
how poetical it would be
if Earth could say,
in a voice floating up
perhaps
from the floor
of the Grand Canyon,
"It is done."
People did not like it here.*

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Karen Cairns, Paula Kullberg, Paul Ehrlich, and Peter Leigh for calling useful references to my attention.

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CHAPTER 11

The Biosphere: Humanity's Common Wealth

If all mankind were to disappear, the world would regenerate back to the rich state of equilibrium that existed ten thousand years ago. If insects were to vanish, the environment would collapse into chaos. E. O. Wilson

*O, that a man might know
The end of this day's business ere it come!* Julius Caesar

A human being is part of the whole, called by us 'Universe'; a part limited in time and space. He experiences himself, his thoughts and feelings as something separated from the rest — a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest us. Our task must be to free ourselves from this prison by widening our circle of compassion to embrace all living creatures and the whole of nature in its beauty. Nobody is able to achieve this completely but the striving for such achievement is, in itself, a part of the liberation and a foundation for inner security.

Albert Einstein
Letter of 1950, as quoted in *The New York Times* (29 March 1972)

Dr. Ruth Patrick, my mentor, often used the phrase “Use without abuse of natural systems.” At the outset of economist Herman Daly’s (2010) thought provoking article he states: “Let’s start with this phrase ‘sustaining our commonwealth.’ By sustaining, I don’t mean preserving inviolate: I mean using without using up. Using with maintenance and replenishment is an important idea in economics. It’s the very basis of the concept of income, because income is the maximum that you can consume while maintaining capital intact.” Biologist Garrett Hardin (1968) has addressed the same concept in his frequently cited article “The Tragedy of the Commons.” However, the realization that the Biosphere is not only the planet’s life support system but is also the source of renewable resources upon which the human economy is based has yet to be acknowledged by the general public or its political representatives. The human economy is a subset of the Biosphere; consequently, stating: “Environmental protection, i.e., the Biosphere, is acceptable as long as it doesn’t hurt the economy” makes no sense. *Homo sapiens* is a component of the Biosphere, and its fate is entwined with the fate of Biosphere.

Co-evolving with the Biosphere

Since *Homo sapiens* is just one of the 30+ million species that comprise the Biosphere, assuming that one species could co-evolve with 30+ million other species might be considered arrogant. However, the present Biosphere was a self-regulating system for all but about 10,000 years of the 200,000 years that *Homo sapiens* has existed. In the 20th and 21st centuries, *Homo sapiens* has badly damaged the Biosphere and continues to do so. Even though humans are dependent upon the Biosphere, they are causing the most stress to it: “Humankind is dependent upon Earth’s ecological life support system, whose well-being, in turn, depends upon the practices of human society. The health of both systems requires harmonious, mutualistic interactions between them” (Cairns 2007). The eight interactive global threats to the Biosphere (Cairns 2010) that involve and affect humans have all worsened in a very short time.

Co-evolution can be defined as “the simultaneous development of adaptations in two or more populations, species or *other categories* [italics mine] that interact so closely that each is a strong selective force on the other” (Raven and Johnson 1986). However, formidable obstacles exist to developing this relationship. In the United States and many other countries, economic growth is pitted against environmental protection, and growth usually wins. “I know of no country [the United States], indeed, where the love of money has taken stronger hold on the affections of

men, . . .” (de Tocqueville 1835). The Biosphere is in extreme stress, and financial concerns, a major topic of discussion for years, are still the primary, perhaps only, point of focus.

Another obstacle to co-evolution is the major assault from a variety of sources on scientists and their evidence (Oreskes and Conway 2011). In addition, funding for scientific information distribution and attendance at conferences is being reduced: “The House [US Congress] moved yesterday to extract the United States from climate change negotiations and to eliminate nearly all U.S. funding to help poor countries deal with global warming” (Friedman 2011). Global crises require global action, and isolation is not a viable strategy. Failure to help poor states is equivalent to stating “Your portion of Spaceship Earth is in trouble, but it is far way and has nothing to do with us.” A distinction should be made, however, between poor states and failed states (<http://foreignpolicy.com/failedstates>) because conditions under which financial aid is given should certainly be different.

Plastic Bags

The “poster child” for humankind’s failed relationship with the Biosphere (i.e., the environment) could be the plastic bag, which is used by nearly everyone on the planet and then thrown away. “Away,” of course, means disposal as waste, even though the Biosphere cannot use plastic bags as input (i.e., a resource), unlike the wastes of other species. In fact, disposal of plastic is a hazard and is one of humankind’s least compassionate and thoughtless practices as far as the health and integrity of the Biosphere are concerned. Nothing should be manufactured that the Biosphere cannot beneficially assimilate.

“The world consumes 1 million plastic shopping bags every minute – and the industry is fighting hard to keep it that way. . . . American shoppers use an estimated 102 billion plastic shopping bags each year – more than 500 per consumer. Named by Guinness World Records as the ‘most ubiquitous consumer item in the world,’ the ultrathin bags have become a leading source of pollution worldwide. They litter the world’s beaches, clog city sewers, contribute to floods in developing countries and fuel a massive flow of plastic waste that is killing wildlife from sea turtles to camels” (Doucette 2011). “The plastic bag has come to represent the collective sins of the age of plastic” (Freinkel 2011). The basic problem is that humankind is throwing waste into the Biosphere that is not useful to any species and harmful to many species. Humans are killing species, the basic operating units of Earth’s biospheric life support system, which is also the source of renewable resources for the human economy.

Human Redirection of Evolutionary Processes

Humans have caused many changes in the Biosphere and are continuing to do so – for example, “The acidification of the world’s oceans could have major consequences for the marine environment. New research shows that coccoliths, which are an important part of the marine environment, dissolve when seawater acidifies. . . . Coccoliths are very small shells of calcium carbonate that encapsulate a number of species of algae. Algae plays an important role in the global carbon-oxygen cycle” (ScienceDaily 2011). If algae cannot survive the present pH or the worsening pH and if anthropogenic carbon dioxide emissions are not markedly decreased, it is unlikely that there will be an immediate replacement for the algae, which form the base of the food chain. Perhaps a replacement will evolve in evolutionary time. Acidification is a serious problem for many other marine organisms as well.

“The end-Triassic mass extinction (~201.4 million years ago), marked by terrestrial ecosystem turnover and up to ~50% loss in marine biodiversity, has been attributed to intensified volcanic activity” but is now “robustly linked to methane-derived massive carbon release and associated climate change” (Ruhl et al. 2011). “Volcanic activity occurred over a period of 600,000 years at the end of the Triassic, while the extinction took place over a period of just 10,000 to 20,000 years, . . .” (Bhanoo 2011).

The importance of this finding is that massive amounts of carbon are stored in frozen hydrated methane on the floor of the oceans, and vast reserves of carbon are in terrestrial permafrost. Some is already being released, but, further increases in global temperatures may well result in release of this stored carbon into the atmosphere if anthropogenic emissions of greenhouse gases continue to increase. Climate change would then almost certainly destroy even more of humankind’s common wealth.

Biospheric Resilience

Most, probably all, organisms have some resilience (the ability to recover to the original form) as do ecosystems and the Biosphere. For ecological systems, resilience may be a function of the recolonization potential — for example, many years ago when a fly ash pond break badly damaged approximately 100 miles of the Clinch River in Virginia, recolonization from 17 tributaries and the headwaters returned the aquatic community to nearly its predisturbance condition (Cairns et al. 1972). The mollusks did not recolonize as rapidly as other organisms. This situation was unusual in two aspects: (1) practically all the fly ash was swept downstream so that residual toxic effects were minimal as were the effects of suspended solids, and (2) at that time, the river was receiving very few other waste discharges. Major industrial spills in other rivers did not result in the degree of biological recovery observed in the Clinch River (Cairns et al. 1973).

“Once discovered, it seemed obvious that conditions for multi-stable states were inevitable. And that, being inevitable, there were huge consequences for theory and practice. . . . The multi-stable reality, in contrast, opened an entirely different direction that focused on behavior far from equilibrium and on stability boundaries. High variability, not low variability, became an attribute necessary to maintain existence and learning. Surprise and inherent unpredictability was the inevitable consequence for ecological systems” (Holling 2007).

Tipping Points

Passing an ecological tipping point (Cairns 2005) means that the resilience of the ecosystem has been exceeded. Unfortunately, no robust warnings are available, at present, that such a critical threshold is about to be passed; consequently, the location of the tipping point is only known in retrospect. This information means that nurturing the Biosphere reduces the risk more substantively than seeing how closely a critical threshold can be approached without serious consequences — for example, a 2°C increase in global mean surface temperature was once thought acceptable. Now evidence indicates that a 2°C increase is the threshold between “dangerous” and “extremely dangerous” (Anderson and Bows 2011). Even if the Biosphere has multiple steady states, they may not be as favorable to *Homo sapiens* as the present state.

Funding for Biospheric Research

Funding for education, scientific research, and regulatory agencies has been reduced and further reductions are highly probable. The complex problems at the global level require an environmentally and scientifically literate public to understand the necessary actions and who can take a constructive role in reducing the causes of the crises. Scientists must generate evidence about biospheric trends and educators must communicate the information to the general public and the leaders it elects. Global crises are beginning to intensify – cutting funding for education and scientific research is not an option.

Some recently published information demonstrates how crucial scientific information is to the survival of civilization.

(1) “The forest sink [for carbon] is equivalent in magnitude to the terrestrial sink deduced from fossil fuel emissions and constraints of ocean and atmospheric sinks” (Pan et al. 2011).

(2) “. . . 4.1 to 5.8 m of sea level rise during the Last Interglacial period was derived from the Antarctic Ice Sheet. The results reemphasize the concern that both the Antarctic and Greenland Ice Sheet may be more sensitive to temperature than widely thought” (McKay et al. 2011).

(3) “. . . there are very few places left with fertile soil to feed large populations, and . . . we . . . are slowly removing our planet’s life-giving skin” (University of Washington 2007).

(4) “Increasing concentrations of atmospheric carbon dioxide (CO₂) can affect biotic and abiotic conditions in soil, such as microbial activity and water content. In turn, these changes might be expected to alter the production and consumption of the important greenhouse gases nitrous oxide (N₂O) and methane (CH₄). . . . therefore . . . the capacity of land ecosystems to slow climate warming has probably been overestimated” (van Groenigen et al. 2011).

(5) “Reservoirs could contribute significantly to anthropogenic CO₂ emissions” (Kemenes et al. 2011).

Global warming could change sub-tropical and even present temperate reservoirs from sinks to sources.

Conclusions

The examples of threats to humankind’s common wealth mentioned here provide evidence that business as usual will continue to damage the Biosphere and that some systems assumed to be carbon dioxide sinks that slow down the rate of climate change are becoming sources that will almost certainly increase the rate of change. Increasing evidence indicates that protecting, especially subsidizing, fossil fuel extraction and burning is not a sustainable energy strategy. Humankind must take immediate measures to both protect and nurture the Biosphere, which is a planetary life support system and the source of renewable resources that are the basis of the human economy.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg and Paul Ehrlich for calling useful references to my attention.

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CHAPTER 12

A Social Contract for Preserving and Nurturing the Present Biosphere

When sorrows come, they come not single spies, but in battalions.

William Shakespeare, *Hamlet*

The good we secure for ourselves is precarious and uncertain until it is secured for all of us and incorporated into our common life.

Jan Addams

Men exist for the sake of one another. Teach them then or bear with them.

Marcus Aurelius Antoninus

The natural world is the larger sacred community to which we belong. To be alienated from this community is to become destitute in all that makes us human. To damage this community is to diminish our own existence.

Thomas Berry

The German Advisory Council on Global Change [WBGU] (2011) has proposed “A Social Contract for Sustainability.” The key elements follow.

- *The aim of the new social contract is to preserve natural life-support systems for present and future generations.*
- *The social contract combines the ‘proactive state’ with more participation by civil society in a framework of local, national and global cooperation. Science has an important role to play in this contract.*
- *The social contract should have a global reach. It should not be purely national in focus, as the major impacts of environmental change are transboundary in nature.*
- *In light of the inequalities in resource consumption, levels of development and development capacities within world society, the social contract must show due consideration for fairness, justice and equity.*

Sustainability becomes unsustainability when humanity uses natural capital to maintain economic growth instead of living on renewable resources at a level the Biosphere can replace. Reason, scientific evidence, and ethical values should eventually prevail, and ecological overshoot/debt clearly should not.

Default Position

All plans have a default position, even if nothing is done. If, for example, a social contract for preserving and nurturing the present Biosphere is developed and the contract never progresses beyond the conference stage, the default position is that the universal laws of biology, chemistry, and physics will produce severe penalties since living unsustainably violates these laws. Even though these laws will never be fully understood, many are now identified but lack the attention they deserve because they are viewed as threats to some corporate profits and some individual lifestyles. For this reason, science is under assault, as it has been for hundreds of years. Ultimately, science prevails as it *almost* has with smoking tobacco, ozone depletion, and Earth as a sphere. Some indications exist that various present risk management methodologies may not be suitable at the biospheric level of organization (e.g., Cairns 2011). Caution is advisable until the issue of appropriate risk management is resolved.

Elements of the Social Contract of *Homo sapiens* and the Biosphere

- (1) *Homo sapiens* is one of the 30+ million species that collectively comprise the present Biosphere and is a part of, not apart from, the Biosphere, although this relationship is not often evident in humanity's actions.
- (2) Protecting and, more important, nurturing the Biosphere will require continually operating feedback loops that provide information on biospheric health and integrity.
- (3) The Biosphere must be regarded as a single system with continually interacting components. A global perspective is mandatory.
- (4) The Biosphere constitutes Earth's life support system and must be treated accordingly.
- (5) The oceans comprise about 71% of the Biosphere and, except for coastal areas, are not under the control of any nation or individual. Treaties to protect oceanic fisheries have not yet been successful. As a consequence, brood stocks of most commercially valuable species are not thriving. In addition, excessive atmospheric carbon dioxide is absorbed by the ocean water, which has changed from mildly alkaline to mildly acidic. If present trends continue, especially in cooler water that absorbs more carbon dioxide, the acidity will reach corrosive levels.
- (6) Earth's atmosphere transcends political boundaries, and hazardous materials (e.g., radioactive substances) may be transported by air currents for substantial distances as they also are by ocean currents.
- (7) Terrestrial biospheric components are under the control of both nations and individuals, and efforts to protect them have not been successful. The right of sovereign nations and individual property rights will be thorny issues in developing a social contract for a global life support system, although a global social contract is the only way to protect a global life support system.
- (8) Economic growth is a major goal for most nations, although such growth on a finite planet with finite renewable resources is unsustainable. Economic growth requires natural capital, which produces renewable resources and ecosystem services. On a finite planet, resources are inevitably finite, placing limits to growth. Another 3 billion people are expected on Earth in the 21st century. With a total population of 7 billion in 2011, where will the resources come from for another 3 billion?

Humanity has been warned! In 1798, Thomas Malthus published his "Essay on the Principle of Population," in which he concluded that, unless family size was regulated, man's misery of famine would become globally epidemic. In 1968, Paul Ehrlich published the *Population Bomb*, and in 1972 the first edition of *Limits to Growth* put resources and population into a global context. Population growth/resource availability remains a matter of deep concern. For years, the United States, with 4% of the global human population, has consumed approximately 25% of the planet's resources. This statistic is certain to change because of increased affluence in developing countries and because of reduced productivity of the Biosphere. Even in the wealthier countries, this change will result in less resources per capita, which will worsen due to exponential population growth. Strong opposition to the concept that resources limit either population or economic growth has been the hallmark of economist Julian Simon, who published *The Ultimate Resource* (Simon 1981) and *The Ultimate Resource 2* (Simon 1996).

Reduction of Biospheric Resources

Biospheric health and ecological integrity have been badly damaged by human activities so that continued production of renewable resources and ecosystem services at their present level would be astonishing.

As societies become more complex they become inevitably more precarious. They become increasingly vulnerable. And as they begin to break down there is a strange retreat by a terrified and confused population from reality, an inability to acknowledge the self-evident fragility and impending collapse. The elites at the end speak in phrases and jargon that do not correlate to reality. They retreat into isolated compounds, whether at the court of Versailles, the Forbidden City or modern palatial estates. The elites indulge in unchecked hedonism, the accumulation of vaster wealth and extravagant consumption. They are deaf to the suffering of the masses who are repressed with greater and greater ferocity. Resources are more ruthlessly depleted until they are exhausted. And then the hollowed-out edifice collapses (Hedges 2011).

The ecological overshoot/debt alone, at 150% in 2010, is enough to cause a biospheric collapse even in the unlikely event that the overshoot/debt remains at this level.

"The World Bank forecasts slowdown in global [economic] growth as rising commodity prices hit the poorest nations" (Elliott 2011). In addition, serious ecological problems exist in many parts of the planet. Three illustrative examples follow.

- (1) "The current Southwest drought [United States] is exceptional for its high temperatures and arguably the most severe in history" (MacDonald 2010).

(2) “Long after the political uprisings in the Middle East have subsided, many underlying challenges that are not now in the news will remain. Prominent among these are rapid population growth, spreading water shortages, and ever growing food insecurity” (Brown 2011a).

(3) “A new scramble for Africa is under way. As global food prices rise and exporters reduce shipments of commodities, countries that rely on imported grain are panicking. Affluent countries such as Saudi Arabia, South Korea, China and India have descended on fertile plains across the African continent, acquiring huge tracts of land to produce wheat, rice and corn for consumption back home” (Brown 2011b).

Environmental Refugees

The global problems in all parts of the planet are destined to produce large numbers of environmental refugees in the 21st century. In fact, the numbers are likely to worsen dramatically if humanity continues to burn coal and replace petroleum with tar sands and tar shale. Worse yet, humans cannot even discuss with civility these and other issues essential to a sound social contract. “The century has constantly reminded us that civilization is a thin veneer of civility, stretched across the passions of the human heart” (Moyers 2009, p. 25). “These virtues [compassion, empathy, and reason] are not yet impossible to find, but the stitches in our social fabric are showing. In order to strengthen our social bonds, we must come to a definition of what is acceptable behavior” (Connelly 2011).

Conclusions

In order to establish a social contract for preserving and nurturing the present Biosphere, humankind must value it more than economic growth and regard the Biosphere as a functioning system rather than an assortment of commodities. The present assault on science and scientific evidence must cease because only science can provide knowledge about the universal laws of biology, chemistry, and physics. However, scientific knowledge must be used with compassion, empathy, reason, wisdom, and civility. Above all, other life forms with which humans share the planet must be regarded as far more than commodities. If humans assign a low priority to the biospheric life support system, no social contract to protect and nurture the Biosphere will work!

Acknowledgment. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg, Paul Ehrlich, Karen Cairns, and Peter Leigh for calling useful references to my attention.

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CHAPTER 13

Biospheric Refugees

*It is not necessary to change,
Survival is not mandatory.*

W. Edwards Derrington

The sad truth is that most evil is done by people who never make up their minds to be either good or evil.

Hannah Arendt

*Try not to become a man of success,
But rather try to become a man of value.*

Albert Einstein

Environmental degradation, overpopulation, refugees, narcotics, terrorism, world crime movements, and organized crime are worldwide problems that don't stop at a nation's borders.

Warren Christopher

. . . nature does not bestow them [natural resources] on us; we seize on them in her despite.

Jean-Jacques Rousseau
Book IV, Confessions, 1770, published 1782

Defining a Biospheric Refugee

A "biospheric refugee" is an individual member of a species (e.g., *Homo sapiens*) that is forced to leave a formerly habitable area of the Biosphere because the area has become less hospitable or inhospitable. For example, humans living in the Maldives Island group and the Bermuda Islands will be displaced by rising sea levels (e.g., ScienceDaily 2011a). I have previously used the term "environmental refugees," but am now replacing it with "biospheric refugees" to designate humans who are relocating on a finite planet to a new ecosystem that is perceived to have better resources or other benefits.

Another example of increased risk that is bacteria that are spreading in warming oceans and "causing a proliferation of the *Vibrio* genus of bacteria, which can cause food poisoning, serious gastroenteritis, septicemia and cholera" (Melvin 2011). Both sea level rise and contamination of seafood would almost certainly displace inhabitants of coastal areas.

Outbreaks of old diseases are another risk because unvaccinated individuals can carry diseases to other areas when they become biospheric refugees. With both smallpox and polio, a global effort was required to control these diseases, and the effort was effective. However, "In early 2007, . . . violent opposition to vaccinations arose in Pakistan's Northwest Frontier Province. In 2009, the Taliban refused to let health officials administer polio vaccinations in Pakistan's Swat Valley. . . . devastating floods in 2010 displaced millions, hindering vaccination initiatives and allowing the disease to spread. . . . At the end of August 2011, there have been 77 cases of polio in Pakistan, compared to the 43 cases for the same period in 2010" (Earth Policy Institute 2011). "Smallpox plagued humanity for thousands of years. In the 18th century, smallpox killed one out of every ten children in France and Sweden. Over the 20th century, the virus caused between 300 and 500 million deaths worldwide. No effective treatment was ever developed. . . . The eradication of this devastating disease is one of the public health's greatest achievements. It involved mass vaccinations and surveillance to track and contain outbreaks. In 1977, ten years after the World Health Organization (WHO) began an intensive eradication program, the last naturally occurring case of smallpox was identified in Somalia. And on May 8, 1980, the World Health Assembly declared smallpox eradicated" (Earth Policy Institute 2011).

Globalization of Resources

The only way to protect and nurture the Biosphere is to use a quality control system to monitor and assess that quality control conditions are being met to ensure the health and integrity of the Biosphere. The severe, existing damage is persuasive evidence that sovereign nations are either incapable or unwilling to develop such systems. A global issue could be addressed by convening a global conference; however, since the series of conferences on global warming, from Kyoto, Japan to Cancun, Mexico, has failed to significantly reduce the risk of global warming, a successful regional conference might be the best starting point. One such conference, "Transitions to a Low Carbon Energy System in Europe," is proposed in October 2011 by the EEAC Working Group Energy (program co-ordination: christain.hey@umweltrat.de [EEAC WG Energy chair; German Advisory Council on the Environment SRU] EEAC-European Environment and Sustainable Development Advisory Councils, www.eeac-net.org) and deserves serious attention since carbon free energy sources will reduce atmospheric greenhouse gas emissions.

Meanwhile, the damage to the Biosphere continues. Recent examples follow.

(1) "A leak from a shallow water crude oil pipeline in the Main Pass Area of the Gulf of Mexico has led Chevron to shut down its Louisiana Main Pass pipeline network, . . . Both the U.S. Coast Guard and the Louisiana Oil Spill Coordinator's Office said they had not been informed of a leak off the coast" (McGurty and Sheppard 2011).

(2) "Europeans face greater risk of illness, property damage and job losses because of the impacts of climate change on the seas around them . . . (ScienceDaily 2011b). Unlike citizens of the United States, where denial of the scientific evidence of climate change is still very strong, in Europe "Worried citizens, whose biggest top-of-mind concerns are sea level rise and coastal erosion, are taking personal actions to reduce carbon emissions" (ScienceDaily 2011b). At least Europeans will be better prepared for the inevitable consequences of climate change when they occur, but a global preparedness is mandatory if civilization is to survive.

(3) Coral reefs "will be the first entire ecosystem to be destroyed by human activity" according to Professor Peter Sale who has "studied the Great Barrier Reef for 20 years" and "currently leads a team at the United Nations University Institute for Water, Environment and Health" (Marszal 2011). Coral reefs are a keystone ecosystem in the world's oceans and an important source of both food and recreational dollars. The people who depend on them will almost certainly become biospheric refugees.

(4) "The extent the Arctic sea ice has reached on Sep. 8 [2011] with a 4.240 million km² [is] a new historic minimum. . . . the ice melt in the Arctic would further proceed and even exceed the previous historic minimum of 2007. It seems to be clear that this is a further consequence of the man-made global warming with global consequences. Directly, the livelihood of small animals, algae, fishes and mammals like polar bears and seals is more and more reduced" (Heygster 2011).

(5) "The conversion of Earth's land surface to urban uses is one of the most irreversible human impacts on the global biosphere. It drives the loss of farmland, affects local climate, fragments habitats, and threatens biodiversity. . . . a worldwide observed increase in urban land area of 58,000 km² from 1970 to 2000. . . . Across all regions and for all three decades, urban land expansion rates are higher than or equal to urban population growth rates, suggesting that urban growth is becoming more expansive than compact." (Seto et al. 2011).

Why is humanity behaving in such suicidal manners? Destroying the biospheric life support system in which *Homo sapiens* evolved and often flourished is not a rational act. Neither is destroying the natural capital that produces the renewable resources upon which the human economy depends. The best explanation of this behavior is that the Biosphere is perceived as a miscellaneous collection of plants and animals that should be protected only if no adverse effects occur in the human economy. The present Biosphere is an interacting, living system upon which humans depend and without which civilization could not survive. The first five biospheres did not produce conditions so essential to human survival, and *Homo sapiens* could probably have not survived in any of them. Humanity must develop a more accurate vision of the present Biosphere and act accordingly.

Three Billion More

Frequent statements indicate that the global human population is expected to add 3 billion additional people on or before the end of the 21st century. Some assertions have been made that the population will then stabilize, but no persuasive information indicates how this stabilization will or will not happen sooner. Of course, a pandemic disease comparable to the "Black Death" might well reduce the human population to match or go below Earth's carrying capacity for humans, but one hopes for a more compassionate solution to the problem of overpopulation.

" . . . a taboo is 'a prohibition excluding something from use, approach or mention because of its sacred and inviolable nature'" (Hardin 1996, p. vii). "If we refuse to discuss a subject, how can we inform the unknowing what it is that is sacred? . . . A word-taboo held inviolate for a long time becomes a taboo on thinking itself (for how can we think of things we hear no words for?)" (Hardin 1996, p. viii). "Science, to be successful, must be open. As soon as a barrier to discussion becomes evident, we know that scientific investigation has been stopped in that direction" (Hardin 1996, p. x). If even discussing overpopulation is taboo, one cannot be surprised that society has no plans to feed and

house or provide education and health care for the projected 3 billion additional people nor how to cope with the biospheric refugees who will result if these basics are not available or provided.

Hardin (1998) discusses the ostrich factor – “the stupid ostrich thrusts its head and neck into a bush, ‘imagining that the whole of the body is concealed’” (Hardin 1998, p. 1) – in society, i.e., society is observing a taboo and closes off the search for causes of crises. Lack of discussion on biospheric refugees ignores the causes of such crises as sea level rise, food scarcity, and agricultural water supply. As early as 1965 (Cairns 1965), trends in population growth were showing that the global human population would reach 6 billion in 2000 if continued. Why has the discussion of this crisis (any others) been taboo?

Misery as a Means of Population Control

Approximately 1.1 billion people are currently starving and approximately 2 billion are malnourished, which confirms that the human population grows faster than the food supply (Malthus 1798). Economist Kenneth E. Boulding’s (1971, p. 137) “Dismal Theorems” are a relatively recent evaluation of overpopulation, including technology’s enhancement.

First Theorem: “The Dismal Theorem”

If the only ultimate check on the growth of population is misery, then the population will grow until it is miserable enough to stop its growth.

Second Theorem: “The Utterly Dismal Theorem”

This theorem states that any technical improvement can only relieve misery for a while, for so long as misery is the only check on population, the [technical] improvement will enable population to grow, and will soon enable more people to live in misery than before. The final result of [technical] improvements, therefore, is to increase the equilibrium population which is to increase the total sum of human misery.

Third Theorem: “The moderately cheerful form of the Dismal Theorem”

Fortunately, it is not too difficult to restate the Dismal Theorem in a moderately cheerful form, which states that if something else, other than misery and starvation, can be found which will keep a prosperous population in check, the population does not have to grow until it is miserable and starves, and it can be stably prosperous (Boulding 1971).

Severe food shortages already exist in 2011 in various parts of the world. The situation in Somalia, both food and potable water, is appalling, especially since much of the relief food has been stolen and is being sold in villages where children are starving. The situation can only deteriorate further since climate change is adversely affecting both food and water supplies and the human population is still growing exponentially. This crisis should be enough to initiate a free and open discourse on bringing Earth’s population within Earth’s carry capacity and preventing more humans from living in misery.

An Alternative Vision of the Future

My own vision “in progress” follows.

- (1) Biospheric refugees have disappeared because humans are living within Earth’s carrying capacity.
- (2) Humans nurture the Biosphere and live in harmony with the universal laws of physics, chemistry, and biology.
- (3) Social evolution replaces technology as the primary means of solving problems.
- (4) Free and open discussions have replaced taboos on discussion of human population size, ecological overshoot, economic growth, carrying capacity, and evolution.
- (5) Denigration of scientists and scientific evidence is not used to avoid making tough choices about global warming and other global problems.
- (6) Political leaders have the courage to inform citizens that their lifestyle is unsustainable (i.e., a 21st century counterpart of Winston Churchill’s “blood, toil, sweat, and tears” speech at the outset of World War II).
- (7) Corporations are regarded as legal entities and are not given some of the same rights as humans.
- (8) Beyond the basic necessities of food, shelter, and clothing, a “social contract” is in place to restrain greedy individuals from consuming a disproportionate share of Earth’s finite resources (i.e., orders of magnitude more than the average citizen).
- (9) Since many decisions must be based on scientific information, all citizens understand the scientific process and how it works.
- (10) Above all, humankind must pledge to leave a habitable planet for posterity and must back up the pledge with continuous action to protect the biospheric life support system, including both natural capital and ecosystem services.


Acknowledgment. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg, Karen Cairns, Peter Leigh, and Shireen Parsons for calling useful references to my attention.





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CHAPTER 14

Chaos Theory And Biospheric “Surprises”




 **CHAOS THEORY POSITS THAT COMPLEX, NON-LINEAR NATURAL SYSTEMS FOLLOW UNIVERSAL LAWS BUT ARE SO SENSITIVE THAT SMALL, INITIAL CHANGES CAN PRODUCE UNEXPECTED RESULTS THAT APPEAR RANDOM.**

-  **The Biosphere is a complex, non-linear natural system that functions as a single, self-regulating entity.¹**
-  **Small changes in the Biosphere can lead to passing the tipping points that signal irreversible changes.**
-  **Because the initial changes appear small, they may be disregarded or even missed entirely.**
-  **The “butterfly effect” posits that a tiny difference in initial conditions becomes amplified exponentially in the Biosphere and a major difference in trajectory may result.**





 **“WE ARE QUITE LITERALLY, IN A NEW WORLD, A MUCH MORE PECULIAR PLACE THAN IT SEEMED A FEW CENTURIES BACK, HARDER TO MAKE SENSE OF, RISKIER TO SPECULATE ABOUT, AND ALIVE WITH INFORMATION WHICH IS BECOMING MORE ACCESSIBLE AND BEWILDERING AT THE SAME TIME. IT SOMETIMES SEEMS THAT THERE IS NOT JUST MORE TO BE LEARNED, BUT THERE IS EVERYTHING TO BE LEARNED.”¹, p. x**

-  **What is humankind’s response to this concept that Earth is now a “new world”? Most people deny that massive changes are occurring, and they attack the bearers of “bad news” (i.e., scientists).**
-  **“Gaia theory forces a planetary perspective. It is the health of the planet that matters, not that of some individual species of organisms.”¹, p. xvii**
-  **“The health of the Earth is most threatened by change in natural ecosystems.”¹, p. xvii**

THE SHIFT IN OCEANIC pH FROM WEAKLY ALKALINE TO WEAKLY ACIDIC IS A “SMALL” CHANGE WORTH REVERSING SINCE THE OCEANS COVER APPROXIMATELY 70% OF EARTH’S SURFACE.




-  **The cause of pH change in the oceans, i.e., anthropogenic carbon dioxide emissions, has a pronounced effect in the Arctic since carbon dioxide is more soluble in cold water.**
-  **The pH “is likely to reach corrosive levels in less than 10 years. The water will then start to dissolve the shells of mussels and other shellfish and cause major disruption to the food chain.”²**
-  **Further acidification of the world’s oceans should be stopped through the major reduction of anthropogenic greenhouse gas emissions.**


“THE WORLD’S CORAL REEFS COULD BE WIPED OUT BY 2050 UNLESS URGENT ACTION IS TAKEN.”³

-  **Coral reefs are ecological “hot spots” with a diverse array of unique species.**
-  **Coral reefs process huge amounts of nutrients and energy, but occupy only a comparatively small space in the world’s oceans.**
-  **Multiple stresses act on coral reefs — “global warming; ocean acidification blamed on carbon dioxide pollution; shipping, overfishing, coastal development and agricultural runoff.”³**
-  **“... hundreds of millions of people depend on [coral reefs] for a living,” including both food and recreation.³**




“... A LARGE DISPARITY [EXISTS] IN AGRICULTURAL VULNERABILITY TO CLIMATE CHANGE BETWEEN DEVELOPED AND DEVELOPING COUNTRIES.”⁴


-  **The disparity has only worsened due to exponential human population growth and droughts, floods, wheat rust, and so on.**
-  **As chaos theory indicates, small initial changes can produce unexpected results that appear random.**
-  **When coping with multiple, interactive crises, developing policy on worst case scenarios is prudent, at least until predictive models based on interactive crises become available.**


 **“AMPHIBIAN DECLINES AROUND THE WORLD HAVE FORCED MANY SPECIES TO THE BRINK OF EXTINCTION, ARE MUCH MORE COMPLEX THAN REALIZED AND HAVE MULTIPLE CAUSES THAT ARE STILL NOT FULLY UNDERSTOOD.”⁵**

 **“An enormous rate of change has occurred in the last 100 years, and amphibians are not evolving fast enough to keep up with it.”⁶**

 **Amphibians are “one of Earth’s great survivors – evolving about 400 million years ago.”⁵ *Homo sapiens* evolved about 200,000 years ago.**





 **If frogs cannot evolve rapidly enough, what are humankind’s chances?**


 **Humans should be deeply concerned when one of the great survivors is facing extinction.**




 **“LOCAL EXTINCTION RATES OF AMERICAN PIKAS HAVE INCREASED NEARLY FIVE-FOLD IN THE LAST 10 YEARS, AND THE RATE AT WHICH THE CLIMATE-SENSITIVE SPECIES IS MOVING UP MOUNTAIN SLOPES HAS INCREASED 11-FOLD SINCE THE 20TH CENTURY.”⁷**

- 🌐 **When the pikas reach the top of the mountain, they have nowhere to go.**
- 🌐 **Humans have a similar situation — when sea level rise threatens low-lying islands (e.g., The Maldives) – since sovereign nations are not eager to welcome environmental refugees.**
- 🌐 **“The study’s most novel scientific contribution was that the factors apparently driving the local-extinction process were strongly different during the 20th Century than during 1999-2008, . . . knowledge of *past* population dynamics of a particular species may not always help researchers predict how and why distributions change in the *future*. That is, the rules of the ‘extinction game’ seem to be shifting.”⁷**

SCIENTIFIC RESEARCH MIGHT BE ABLE TO PROVIDE MEASUREMENTS FOR EFFECTS THAT CANNOT BE MEASURED NOW, BUT WILL THE SCIENTIFIC INFORMATION BE IGNORED?⁸

-  **Scientific predictive models can be used to take preventative measures before the risk becomes a reality.**
-  **Non-scientific misinformation presented as truth (i.e., fact) by special interest groups protecting their profits will probably lead to catastrophes.**
-  **Ignoring scientific information about global climate change places all of humanity at a huge risk — a risk that could be substantially reduced by enlightened use of scientific information.**
-  **Ignorance can be costly.**

 **“WHERE CHAOS BEGINS, CLASSICAL SCIENCE STOPS. FOR AS LONG AS THE WORLD HAS HAD PHYSICISTS INQUIRING INTO THE LAWS OF NATURE, IT HAS SUFFERED A SPECIAL IGNORANCE ABOUT DISORDER IN THE ATMOSPHERE, IN THE TURBULENT SEA, IN THE FLUCTUATIONS OF WILDLIFE POPULATIONS, IN THE OSCILLATIONS OF THE HEART AND BRAIN. THE IRREGULAR SIDE OF NATURE, THE DISCONTINUOUS AND ERRATIC SIDE — THESE HAVE BEEN PUZZLES TO SCIENCE, OR WORSE, MONSTROSITIES.”⁹, p. 3**

-  **Global systems will remain an enigma for many decades to come, but humankind’s survival requires an understanding of how they function.**
-  **Such endeavors will take scientists outside of their “comfort zone” of specialization.**
-  **Success requires that the assault on scientists and their evidence cease.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Stefan Cairns for comments on the first draft.

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CHAPTER 15

EARTH'S BIOSPHERE: THE GLOBAL COMMONS*

***The concept of “commons” originally defined an area for common use in a village, which each villager could see on a daily basis and observe how each villager treated it. The global commons could never be continually observed by individuals and is vulnerable to misuse.**




THE COST OF EXPLOITING THE EARTH'S BIOSPHERE (THE GLOBAL COMMONS) IS PAID BY SOCIETY AS A WHOLE.*




- 🌐 **Garrett Hardin believed that “individuals will exploit anything that is free in order to maximize their own advantage.”¹**
- 🌐 **“ . . . coupling the concept of freedom to breed with the belief that everyone has an equal right to the commons “locks” the world into a tragic course of action.”²**
- 🌐 **Hardin also believed that the human population explosion would damage the environment, deplete natural resources, and markedly degrade the quality of life.³**
- 🌐 **In the 21st century, eight global interactive crises — human economy, climate change, exponential human population growth, ecological overshoot, biotic impoverishment and the reduction of biodiversity, renewable resource depletion, energy allocation,² and environmental refugees — are creating an alien planet. Any of these crises could cause biospheric collapse.⁴**


***The “tragedy of the commons” is defined as an archetypical social phenomenon where an attempt to exploit others (or “the system”) in one way or the other eventually turns out to be self defeating (<http://www.businessdictionary.com/definition/tragedy>).**




BIOSPHERIC (THE GLOBAL COMMONS) COLLAPSE MUST BE PREVENTED NOW BECAUSE, IF IT OCCURS, HUMANKIND WILL SUFFER GREVIOUSLY.

- 🌍 **“Garrett Hardin has made three critical assumptions: (1) that there exists, or can be developed, a ‘criterion of judgment and a system of weighting’ . . . that will ‘render the incommensurables . . . commensurable . . .’ in real life; (2) that, possessing this criterion of judgment, ‘coercion can be mutually agreed upon,’ and that the application of coercion to effect a solution to problems will be effective in modern society; and (3) that the administrative system , supported by the criterion of judgment and access to coercion, can and will protect the commons from further desecration.”⁵**
- 🌍 **The main barrier to preventing biospheric collapse is the inability to incorporate scientific evidence into political policy.**
- 🌍 **The default position (depending on the universal laws of nature) will produce horrific consequences.**

 **THE BEST WAY TO PROTECT THE GLOBAL COMMONS IS TO DEVELOP A QUALITY CONTROL SYSTEM THAT DOES NOT PERMIT DAMAGE TO THE BIOSPHERE BY ANY NATION OR INDIVIDUAL FOR ANY REASON.**

-  **Sovereign nations have, thus far, been unable or unwilling to develop such systems.**
-  **For example, the proposed Keystone XL, a 1700-mile pipeline, would stretch from Canada's Alberta tar sands to the Texas Gulf Coast. Extracting, transporting, and burning this fossil fuel would damage the global commons, and full development will accelerate this damage.⁶**
-  **In the case of damage to the global commons, future generations will probably suffer most and, at present, the poor will suffer most.**

 **“INEQUALITY IS NOT ONLY NATURAL AND INBORN, IT GROWS WITH THE COMPLEXITY OF THE CIVILIZATION. . . . THE CONCENTRATION OF WEALTH IS NATURAL AND INEVITABLE, AND IS PERIODICALLY ALLEVIATED BY VIOLENT OR PEACEABLE PARTIAL REDISTRIBUTION.”⁷**

-  **Wealth is being interpreted here as both money and resources (e.g., food, timber) since money can be used to purchase resources.**
-  **The present distribution of wealth is the most unequal in human history so the only uncertainty is whether the partial redistribution will be violent or peaceable.**
-  **In the last part of the 20th century and the beginning of the 21st century, sovereign* nations have not demonstrated an ability to manage global problems (e.g., overpopulation, climate change).**

**Sovereignty* is defined as “The supreme, absolute, and uncontrollable power by which an independent state [nation] is governed and from which all political powers are derived, the intentional independence of a state, combined with the right and power of regulating its internal affairs without foreign interference (<http://legal-dictionary.thefreedictionary.com/Sovereign>).



THREE SCENARIOS ON HUMANITY'S PROTECTION AND NURTURING OF THE GLOBAL COMMONS

The Overly Optimistic Scenario

Scientific evidence has a major influence on policy decisions and leaving a habitable planet for posterity is a major societal goal. This scenario is the most likely to have a high variability in response. Nations with a high regard for scientific evidence and responsibility for posterity do everything possible to protect and nurture the global commons. Nations with a contempt for scientific evidence and a history of passing problems on to future generations do the least.

The Last Minute Panic Scenario


A series of catastrophes show both policy makers and the general public that something is seriously wrong and that immediate action is needed. Geoengineering to alter the planetary heat balance is the most probable choice in this scenario at the global level. This solution will almost certainly have unexpected side effects.



The Default Scenario

The decision to do nothing is still a decision, and the highly probable result is collapse of the present Biosphere and, thus, a new, quite different Biosphere and a new global commons will develop over evolutionary time. If the past five biospheric collapses are a useful guide, the new Biosphere will consist of species suited to the new conditions, which may or may not include *Homo sapiens*. Their selection will be determined by the universal laws of biology, chemistry, and physics.

Preserving Some Attributes of the Present Biosphere/Global Commons

Most complex systems have multiple tipping points that produce irreversible changes. Reducing anthropogenic greenhouse gas emissions and taking other measures to protect the global commons (e.g., preserving remaining old growth forests, topsoil, brood stock of oceanic fisheries, etc.) might protect enough ecosystem services and renewable resource production to enable many species, including *Homo sapiens*, to survive.

 **“A CENTRAL TENENT OF DEMOGRAPHY IS THAT GLOBAL POPULATION WILL PEAK AT 9 TO 10 BILLION THIS CENTURY AND THEN GRADUALLY DECLINE AS POORER COUNTRIES DEVELOP. BUT THAT ASSUMPTION MAY BE OVERLY OPTIMISTIC — AND IF IT IS, POPULATION WILL CONTINUE TO RISE, PLACING ENORMOUS STRAINS ON THE ENVIRONMENT” [THE GLOBAL COMMONS].⁸**






-  **One consequence of continued exponential population growth is further damage to the global commons, which has already been severely damaged.**
-  **“Forgetting” is most often a positive act. Likewise, failure to see an obvious fact is often an act of willful blindness to something subconsciously feared as unpleasant.⁹**



CLIMATE CHANGE IS ALTERING THE GLOBAL COMMONS.

- 🌐 **Climate change deniers are more vocal but are still without robust, peer-reviewed scientific evidence to support their assertions.**
- 🌐 **Earth is changing — the mean global surface temperatures are steadily increasing, the trend is increased ferocity and frequency of storms, rainfall patterns are shifting, glaciers are melting, wildfires are more frequent and intense, and tropical diseases are expanding their range.**
- 🌐 **Almost entirely ignored at present is the UK's Richard Branson's "Carbon War Room" in Washington, DC, which advocates that businesses make investments that cut their carbon footprint.¹⁰**
- 🌐 **". . . overwhelming scientific evidence indicates the world is heating up, and the downside effects of that could be severe."¹⁰**


“THE DESIRE TO DISBELIEVE DEEPENS AS THE SCALE OF THE THREAT GROWS.”¹¹

-  **Disbelief in global warming is blocking protection of the large portion of the biosphere located in the United States, which is the “last redoubt of climate naysayers.”¹²**
-  **Irreversible changes have already occurred and more are in store if business as usual continues.**
-  **No one knows how many tipping points can be passed before biospheric collapse occurs.**
-  **Since tipping points can only be identified in retrospect, precautionary measures to protect and nurture the Biosphere are prudent.**
-  **The Biosphere will be in peril as long as it is treated as a global commons to which access is not limited.**

“THERE IS NOW LITTLE TO NO CHANCE OF MAINTAINING THE GLOBAL MEAN SURFACE TEMPERATURE AT OR BELOW 2°C [INCREASE], . . .”¹³

- 🌍 “. . . the impacts associated with 2°C [increase] have been revised upwards sufficiently so that 2°C now more appropriately represents the threshold between ‘dangerous and extremely dangerous’ climate change.”¹³
- 🌍 The only way to hold risks at the dangerous level is to regulate anthropogenic greenhouse gas emissions.
- 🌍 None of the conferences on global climate change have had even modest success in setting limits for greenhouse gas emissions.
- 🌍 The goal should be reducing atmospheric carbon dioxide equivalents to 350 ppm or below.
- 🌍 The default position is to let the universal laws of biology, chemistry, and physics solve the problem, which will almost certainly result in a less habitable planet for *Homo sapiens*.

RAPID SOCIAL EVOLUTION IS THE BEST OPTION FOR SAVING THE PRESENT GLOBAL COMMONS (THE BIOSPHERE) SINCE BIOLOGICAL EVOLUTION IS TOO COMPLICATED AND SLOW.

-  **“Evolutionary adaptation can be rapid and potentially help species counter stressful conditions or realize ecological opportunities arising from climate change. The challenges are to understand when evolution will occur and to identify potential evolutionary winners as well as losers, such as species lacking adaptive capacity living near physiological limits. Evolutionary processes also need to be incorporated into management programmes designed to minimize biodiversity loss under rapid climate change. These challenges can be met through realistic models of evolutionary change linked to experimental data across a range of taxa.”¹⁴**


Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg, Shireen Parsons, and Paul Ehrlich for calling useful references to my attention.




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CHAPTER 16


ELIMINATING THE BIOSPHERIC REFUGEE CRISIS



 **A *BIOSPHERIC REFUGEE* IS AN INDIVIDUAL MEMBER OF A SPECIES (E.G., *HOMO SAPIENS*) FORCED TO LEAVE A FORMERLY HABITABLE AREA OF THE BIOSPHERE BECAUSE THE AREA HAS BECOME LESS HABITABLE.**

-  Humans living in the Maldives Island group who are likely to be displaced by rising sea levels are an example of potential biospheric refugees.
-  The concern for biospheric refugees is already one of the major global crises of the 21st century.
-  Using the term *biospheric refugee* highlights the point that the Biosphere is global and has finite resources and a finite carrying capacity for humans.

ONE OF THE PRIMARY FORCING FACTORS PRODUCING BIOSPHERIC REFUGEES IS OVERPOPULATION.



-  **New projections indicate the global human population could reach 17.5 billion by 2100.¹**
-  **Religious, political, and anti-science ideology have made free and open discussion of the human population a taboo in most cultures.**
-  **No global problem can be addressed unless a free and open discussion includes the evidence accepted by mainstream science.**

 **A MAJOR OBSTACLE TO AN INFORMED DISCUSSION OF OVERPOPULATION IS THE REJECTION OF THE PREPONDERANCE OF SCIENTIFIC EVIDENCE IN FAVOR OF A “BALANCED APPROACH.”**




-  **The news media’s concept of balance is to have equal representation from both “sides” and ignore the preponderance of scientific evidence from credentialed scientists who have published in peer-reviewed scientific journals. This approach gives the impression that a dispute exists among scientists when none does.**
-  **The disregard for mainstream scientific evidence has led to another important point: “Everyone’s entitled to his own opinion, but not to his own facts” (Senator Daniel Patrick Moynihan).**



ANOTHER PRIMARY FORCING FACTOR PRODUCING BIOSPHERIC REFUGEES IS CLIMATE CHANGE.

-  **Climate change affects both agricultural productivity and renewable resource regeneration.**
-  **Climate change is already making some regions less habitable or uninhabitable.**

THE MERCHANTS OF DOUBT² HAVE SIGNIFICANTLY INCREASED THE RISKS TO ALL HUMANITY BY DELAYING ACTION ON GLOBAL CLIMATE CHANGE (E.G., REDUCTION OF GREENHOUSE GAS EMISSIONS).

-  In the United States and elsewhere in the world, denial of climate change by special interest groups that feel threatened by the scientific evidence has blocked action on greenhouse gas emissions and denigrated the scientists whose research provided the evidence.
-  The best remedial, immediate action is for all citizens to become more scientifically literate. Just understanding the scientific process and how to check scientific credentials is a big step in the right direction.
-  Scientific literacy, even a modest amount, will make casting doubt on robust scientific evidence orders of magnitude more difficult.







“THE ESSENTIAL POINT IS THIS: ONE DEFAULT POSITION OR THE OTHER MUST BE EMBRACED, FOR THE MOST PRACTICAL REASONS. NO GOOD CAN COME OF DEMANDING ABSOLUTE PROOF. THE DEFAULT POSITION REVEALS WHERE MEN OF COMMON SENSE, IN A CERTAIN JURISDICTION, HAVE AGREED TO PLACE THE BURDEN OF PROOF. IT IS THE DENIAL OF THE DEFAULT POSITION THAT MUST BEAR THE BURDEN OF PROOF.”³

- 🌐 The default position (i.e., doing nothing) means that the universal laws of biology, chemistry, and physics will determine the consequences of no action, and the default position will almost certainly involve more misery and loss of human life, plus still more damage to the Biosphere.
- 🌐 In the Maldives, sea level rise⁴ will make these low-lying island uninhabitable. By taking no action, humankind leaves the fate of the Maldivians to the universal laws.
- 🌐 Somalia is at the top of the Failed States Index,⁵ where severe shortages of food and potable water exist.
- 🌐 In some cases, what effective action to take might be unclear; in other cases, the will and motivation to take action may be lacking.





THE TWO MOST ASTONISHING DEFAULT (DO NOTHING) POSITIONS ARE EXPONENTIAL POPULATION GROWTH AND CLIMATE CHANGE.


- 🌍 Humanity has the means to prevent ever more humans from living in misery, but chooses to do nothing.
- 🌍 Humanity has the means to reduce anthropogenic greenhouse gas emissions and is approaching the atmospheric greenhouse gas threshold between dangerous and extremely dangerous almost casually.⁶
- 🌍 Why should humanity believe the doubts cast on scientific evidence after all that scientific research has done for *Homo sapiens*?
- 🌍 Why is an intelligent species avoiding tough choices when doing so will result in catastrophe and misery?
- 🌍 Does humanity want to see how much misery will result or is the present-level, persuasive evidence sufficient to ensure that something should be done?



 **“FOR WHO DECEIVES ME ONCE, GOD FORGIVE HIM; IF TWICE, GOD FORGIVE HIM; BUT IF THRICE, GOD FORGIVE HIM, BUT NOT ME BECAUSE I COULD NOT BEWARE” (1611 Tarlton’s Jests [1844]).**


-  **Why are US citizens so reluctant to defend science that has improved health and well being and agricultural productivity and helped make US workers the world’s most productive?**
-  **The assault on science began to intensify after World War II and has increased into the 21st century.**
-  **Many of the world’s leading scientists fled from Nazi Germany and Stalin’s USSR to the United States because of the assault on science in Europe and Asia.**





FINANCIAL GLOBALIZATION HAS RESULTED IN THE BIOSPHERE BEING TREATED AS A COMMONS WITH MONEY BEING THE PRIMARY ACCESS TO ITS RESOURCES.

-  **The Biosphere's components (i.e., species) are being treated as commodities rather than as components of the planet's life support system.**
-  **The vast disparity of wealth per capita means that the poor, and increasingly the middle class, cannot compete for finite resources (e.g., food) on a finite planet.**
-  **In addition, food production and distribution has been placed in the hands of a few large corporations.**
-  **“... The concentration of wealth is natural and inevitable, and is periodically alleviated by violent or peaceable partial redistribution.”⁷ This situation is not conducive to a society's stability.**

 **A HUMAN POPULATION THAT IS INCREASING EXPONENTIALLY AND A SHRINKING RESOURCE BASE DUE TO DAMAGE TO THE BIOSPHERE ARE ALMOST CERTAIN TO PRODUCE SOCIAL UNREST.**

-  **Inhabitants of compromised regions will inevitably attempt to move to areas they perceive as more attractive, putting more pressure on finite resources in those areas.**
-  **Since biospheric resources are finite in any region, refugees are unlikely to derive much benefit from relocation, but refugees are desperate and not always rational.**

 **“ONE OF HARDIN’S MOST STARTLING CONCLUSIONS (ALSO NOTED BY CHARLES GALTON DARWIN IN 1960) IS THAT, UNDER CERTAIN CIRCUMSTANCES, CONSCIENCE MAY ELIMINATE ITSELF FROM A POPULATION.”⁸**

-  **Survival of civilization requires a commitment to preserve and nurture the Biosphere from all of humanity. Even a few despoilers will not work.**
-  **Global cooperation will be possible only if the number of biospheric refugees is minimal. Even if starving people remain in place, they are a destabilizing factor.**
-  **Humanity is dependent upon the Biosphere and must be responsible for maintaining its health and integrity. Society must be willing to provide funds to monitor the condition of the Biosphere, which is essential to maintain its health and integrity.**
-  **Biospheric resources and services must be shared more equitably.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication.

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CHAPTER 17

Partially Global to Tribal: Will Humankind Be Forced to Make the Transition?

Our loyalties must transcend our race, our tribe, our class, and our nation; and this means we must develop a world perspective.

Martin Luther King, Jr.

Wisdom is your perspective on life, your sense of balance, your understanding of how the various parts and principles apply and relate to each other. It embraces judgment, discernment, comprehension. It is a gestalt or oneness, and integrated whole.

Stephen R. Covey

Humankind has transitioned over thousands of years from being a primarily tribal species to becoming a partially global community (Cairns 2009). Globalizing the financial system is underway, but the downside is already becoming apparent. One undesirable consequence is the expanding disparity of wealth, which brings wealth to a few individuals but not to most of the middle class and many of the poor, even though a marked increase in affluence has occurred in some developing nations. However, increased affluence has also increased the demand for material goods, which caused the first ecological overshoot/debt day in 1987 (consumption of over 100% of regenerated resources) and soared to 150% consumption in August 2010. Globalization has also resulted in a “race to the bottom” in wages, which is creating societal unrest, particularly in some developed countries (e.g., the United States).

Eight interactive global crises have become a threat to the Biosphere (Cairns 2010). All eight crises are continuing to worsen, indicating that globalization has increased damage to the Biosphere, with no strategy for protecting or nurturing it. In fact, the risk of biospheric collapse has markedly increased. Any management plan for ensuring the health and integrity of the Biosphere would require robust scientific information; however, science is under assault and scientific evidence is being denigrated and cast in doubt with minimal public outrage.

Since the present Biosphere (#6) is the life support system of the planet and also the source of the renewable resources that “fuel” the human economy, prudence requires a consideration of the consequences of a partial or complete biospheric collapse. The threat to both the human economy and, indeed, civilization itself is likely to be severe. As systems, including social and ecological ones, become more complex, they are more vulnerable to perturbations. The global financial meltdown in the beginning of the 21st century is a good example of this reality.

In the early years of the 21st century, one of the US political parties cast doubt on scientists and their preponderance of evidence because it believed that “science is uncertain” and that no decision should be made on the cause of climate change. The tactic worked surprisingly well until the global financial meltdown occurred and posed a greater uncertainty that demanded quick action. The solution to the financial crisis most commonly recommended was to restore economic growth. How can economic growth be restored to former levels when resource shortages (e.g., food, water) are increasing steadily so that 1.2 to 1.5 Earths (Press Association 2011) are needed to supply the global human population? Resource consumption varies and tends to decline during bad economic times. However, as long as more resources are consumed and produce more wastes than the Biosphere can assimilate, the situation will be unsustainable.

Global warming is adversely affecting both resource availability and waste assimilation. For example, in the state of Montana in the United States, “evergreens [are] falling victim to beetles that used to be controlled in part by bitterly cold winters. As the climate warms . . . that control is no longer happening” (Gillis 2011). Trees are both a renewable resource and a carbon sink. As wildfires burn dead trees, carbon dioxide is returned to the atmosphere. Although this example is in Montana, this devastation occurs worldwide. Forests can only “restrain the increase [of atmospheric carbon dioxide accumulation], not halt it (Gillis 2011). If forests cease growing, they will not be able to absorb carbon dioxide, and, if they burn, they will add carbon dioxide to the atmosphere. Even if these conditions are continued on a more limited scale, the Biosphere will not recover in a time span that will not require a major rearrangement of policies and a major change in human lifestyles.

Living sustainably is possible — the genus *Homo* did so for at least 2.3 to 2.5 million years, and the last surviving species, *Homo sapiens*, has done so for approximately 200,000 years (<http://www.newworldencyclopedia.org>). Humankind must rapidly adapt to irreversible change, and, the longer it is postponed, the more difficult adaptation will become.

The rush of the world's nations to use up all of the world's oil supply as fast as possible is causing terrible things to happen to the biosphere. Global industrialization, which is made possible by fossil fuel, is causing the 'sixth extinction' on planet Earth — the loss of an estimated 30,000 species per year. If global industrialization continues to the full term of the petroleum age, it may cause a greenhouse-gas death of the biosphere and the extinction of man (Caldwell 2003).

At present, the United States and Canada are trying to add tar sands to the fossil fuel list. Giving up the burning of coal and natural gas and beginning extensive use of wind and solar energy will speed the transition, but solar energy must be the primary, even the sole, source of energy. Currently, all other alternative sources (e.g., nuclear) increase the risks of an already perilous era.

Whether burning all remaining fossil fuels will drive *Homo sapiens* to extinction is not known, but what is the ethical/moral decision in this situation? Multiple, stable equilibria do exist in some ecosystems (e.g., Seabloom and Richards 2003). Even so, the universe is not a secure place, so taking unnecessary risks just to prolong the fossil fuel era a few more years is not rational.

Respecting Carrying Capacity

Most species on Earth are ruled by limits to growth, termed *carrying capacity*. However, *Homo sapiens* discovered fossil fuels and temporarily became, or so it seemed, above the universal laws of biology, chemistry, and physics. Even before fossil fuels were exhausted, carbon dioxide and other greenhouse gases began altering Earth's climate and damaging the present Biosphere. These events and many others have reduced Earth's carrying capacity for humans, even though the planet was overpopulated before they occurred. Many economists (e.g., Julian Simon) and political leaders (e.g., those who gave subsidies to increase birth rate) do not believe in the concept of carrying capacity; they believe it applies to other species but not *Homo sapiens*. After all, humans are intelligent, creative, have developed technological and economic systems, and believe in human rights. However, humankind has crossed the threshold between sustainable and unsustainable lifestyles by ignoring the reality of carrying capacity.

Rate of Transition

The rate of transition from partially global to tribal will depend on a number of factors that are either weakly or strongly interactive.

- (1) How long will the global fixation on economic growth continue?
- (2) How many of the eight global interactive crises have been “solved” by default?
- (3) Is a non-carbon energy plan underway?
- (4) Are climate change and evolution, two pivotal concepts in biology and endorsed overwhelmingly by mainstream scientists, still being denied?
- (5) Has a major increase in scientific literacy occurred in politicians and the public they serve?

- (6) Are corporations still funding the groups that cast doubt on science?
- (7) Will it be possible to have a civil, free, and open discourse on exponential human population growth?
- (8) Will sovereign nations relinquish some of their “rights” to save the present Biosphere?
- (9) Will representatives of sovereign nations remain at a global conference intended to recommend actions to save the Biosphere even when the conferences appear to threaten a particular nation’s special interests?
- (10) Will sovereign nations assist (and not interfere with) data gathering by qualified scientists about parts of the Biosphere within their national boundaries? If the Biosphere is to be protected, nurtured, and managed as a single, global functioning system, this action is essential.

The answers to these questions will determine the chance of preserving the present Biosphere in a condition not too different from its present state. One of the probable consequences of not doing so is a massive reduction in the size of the human population. Anyone horrified by this fact, as I am, must remember that humans both caused the problem and have for many decades failed to address it. The global population of humans has increased by 5 billion in the last 80+ years — an unprecedented event. Exponential human population growth has been occurring for thousands of years, but short doubling time did not appear threatening when the total population was small.

The Case for Tribal Living

Many years ago, philosopher Thomas Hobbes, in his book *Leviathan* published in 1651, described the status quo of early humans: “. . . and which is worst of all, continual feare, and danger of violent death; And the life of man, solitary, poore, brutish, and short.” Studies of present day hunter/gatherers and the fossil record provide evidence that this description is not entirely accurate. Humans who lived before the Agricultural and Industrial Revolutions had a varied diet and expended much less effort acquiring it than most present-day humans. Tribal members had a substantial amount of leisure time, which is not true of humans in today’s society.

The great disparity of wealth that exists in the 21st century did not exist previously, and the fate of the tribal members was more closely linked than is true in present-day societies where the disparity in wealth is huge and still increasing. Since most tribes were comparatively small, tribal members could observe their leaders closely on a daily basis rather than briefly and impersonally on a television set.

Still, most present-day humans would not exchange their lifestyle, however insecure, for a tribal lifestyle since most would not be skillful nor knowledgeable hunters/gatherers. The encyclopedic knowledge of tribal members of the strong regional, seasonal life cycle components is accumulated over a life time and is not quickly transmitted. Migratory species are especially attuned to nature’s variability. Hunters/gatherers must be sensitive to the risks involved since animals can be dangerous and plants can be poisonous and the location of even a temporary shelter requires informed judgment.

Fossil Fuels and Transition Time

Humankind’s continued use of the remaining fossil fuels will have a major impact on transition time. As the global temperature increases, so does the danger of rapid release of the billions of tons of carbon stored as frozen hydrated methane on the ocean floor and in the permafrost on land. A sudden, massive release of this carbon would almost certainly cause runaway climate change and reduce the time for humankind to learn to adapt to the new, challenging conditions. Simultaneously, available food would be influenced by the new and changed variety of food species and the increased competition for less available food. Human mortality and that of other species, under conditions of very rapid change, would increase. Over evolutionary time, a diverse array of new species would probably emerge, as happened after past great extinctions. During the transition period, continual adaptation would be necessary for survival. A major reduction in use of fossil fuels coupled with an increased biospheric assimilative capacity for carbon dioxide could make a slow transition possible. In this scenario, the concentration of carbon dioxide should be reduced to 350 ppm or less.

Conclusions

A society that espouses the type of economic growth that is destroying its life support system is flawed, and assaults on scientists who are merely reporting the truth.* Persecution of individuals for seeking the truth is not new. In ancient Greece, espousing the search for knowledge and truth was viewed by the power elite as corruption of the young. In the 21st century, scientific truths are perceived as a threat by both persons and corporations with special interests.

Humankind will never make the transition from a partially global society back to a tribal society if bearers of “bad news” (the truth) are punished. The result of punishing “bearers of bad news” is that most cautious people will only bring “good news” regardless of its accuracy. Fortunately, most scientists will continue to report what confirmed, scientific data reveal. No “good news” can be reported until something is done about the “bad news.”

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich for calling a useful reference to my attention.

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*Scientists usually avoid the words *truth* and *falsehood* and use different levels of confidence instead. Since the general public and their political representatives are not accustomed to probabilistic statements, I believe occasional use of the word *truth* is acceptable.

CHAPTER 18

Biospheric Resources and Growth

There are some people who live in a dream world, and there are some who face reality, and then there are those who turn one into the other. Douglas H. Everett

There is no worse screen to block out the Spirit than confidence in our own intelligence. John Calvin

We should ask God to increase our hope when it is small, awaken it when it is dormant, confirm it when it is wavering, strengthen it when it is weak, and raise it up when it is overthrown. John Calvin

Except for the few very wealthy during the Great Depression, everyone made sacrifices during that time. Shoes were re-soled either by purchasing rubber soles and a glue kit for self repair or by taking them to a shoe repair shop. Home vegetable gardens were common, and surplus vegetables were shared with neighbors. Clothing, especially children's garments, was shared within families or passed along. Government programs, such as Work Progress Administration (WPA) and the Civilian Conservation Corps (CCC), worked on projects that benefited society and the environment. Of course, the population of the United States was much smaller in the 1930s.

After World War II, material goods were more abundant and were frequently better and cheaper than the same items were before the war. People adjusted to this new cornucopian era rapidly and began to view it as normal. However, MORE requires resources that are limited on a finite planet, and, at the end of the 20th century, the realization of limits came as an unpleasant surprise. WANTS and not just NEEDS had become an individual's right. This scenario has led to the current situation in which humankind needs both total commitment and a plan/vision for and of the future to merely survive. In addition to a plan/vision, a candid statement is needed of the sacrifices that will be essential to the success of the plan.

Peak Water and Human Wastes

“. . . more and more regions of the world, including the United States, may be reaching the point of 'peak water'" (Gleick 2011). The concept of peak water is difficult to grasp since approximately 71% of Earth's surface is covered by water. However, of all water on the planet, 99% is unsuitable for humans (<http://ga.water.usgs.gov/edu/earthwherewater.html>). Water is truly a renewable resource and moves continuously around the Biosphere. Mother Nature was able to maintain potable water until *Homo sapiens* began discharging wastes that the Biosphere could not assimilate as a resource, even though it had done so for the wastes of 30+ million other species on the planet.

For most of humankind's existence, human feces and urine were returned to the global commons in the same way most other animals eliminated them. After the Agricultural Revolution, many cultures in Asia and Europe disposed of "night soil" by adding it on agricultural lands directly or by mixing it with irrigation water. This process returned human and animal feces to the land, which was more likely to treat the organic matter as a "beneficial input" rather than as a pollutant as do many aquatic systems (Kinnicutt et al. 1919). Ancient Rome's sewer system, the Cloaca Maxima, was built in the 6th century BCE (http://www.livius.org/ro-rz/rome/rome_cloaca.html) and marks an important transition point in the disposal of human wastes. Municipal and industrial waste discharges expelled into moving waters in the early 20th century were comparatively small and widely spaced and sometimes did not exceed the aquatic ecosystem's assimilative capacity for them. Water, especially flowing water, carries wastes (e.g., sewage) away into someone else's backyard.

Placing large amounts of fecal material into the global commons is an irresponsible act unless robust scientific evidence is available on how the receiving ecosystem will respond. Even more irresponsible is adding or allowing persistent, hazardous chemicals (such as endocrine disrupters) to be expelled into the global commons because of the damage they do. The costs of the damage are paid by society as a whole, and little or no part of the cost is paid by

the persons or corporations that reap the financial benefits. In 2011, calls were made by politicians to curtail the authority of the US Environmental Protection Agency to regulate hazardous substances in the environment under the guise of reducing the US national deficit. The increased risk to the general public was not mentioned.

The Oceans

The planet's oceans contain practically all Earth's water. They are a major source of food, but also play a key role in shaping global climate by regulating atmospheric concentrations of carbon dioxide. As applies to this discussion, they represent the largest surface area of the planet and, arguably, the area most in need of both protection and nurturing. As the global food crisis worsens, many nations will be tempted to indulge in unregulated harvesting of marine life from krill to whales. As the climate warms, the temptation may be to utilize ocean iron fertilization (OIF) in some marine systems since increased phytoplankton blooms might temporarily boost the ocean's ability to act as a carbon sink. Planning ahead is mandatory since scientific quality control is essential when attempting to deliberately change global climate

Using Water as a Unifying Theme of Planning to Nurture the Global Commons

An essential beginning point is to accept that neither ignorance nor denial reduces the risks inherent in multiple global crises. Also essential to acknowledge is that the human economy is a subset of the Biosphere, and the human economy will collapse if access (e.g., discharge of pollutants) to the global commons is not restricted by mutually agreed upon coercion. Water is the ultimate renewable resource and has been essential to a wide variety of life forms for billions of years. Substitutes exist for money (e.g., barter), but no substitutes are available for water. Quality is especially important for the very limited freshwater resource. In addition, quality, albeit a different quality, is also important in the vast oceans (e.g., change from mildly alkaline to, at present, mildly acidic). Destroying the global commons in the name of economic growth is mindless and must cease!

The Terrestrial Component of the Global Commons

Increasing population and consumption are placing unprecedented demands on agriculture and natural resources. Today, approximately a billion people are chronically malnourished while our agricultural systems are concurrently degrading land, water, biodiversity and climate on a global scale. To meet the world's future food security and sustainability needs, food production must grow substantially while, at the same time, agriculture's environment footprint must shrink dramatically. . . . tremendous progress could be made by halting agricultural expansion, closing 'yield gaps' on underperforming lands, increasing cropping efficiency, shifting diets and reducing wastes. Together these strategies could double food production while greatly reducing the environmental impacts of agriculture (Foley et al. 2011).

Humans collectively have damaged the global commons so collective action will be required to stop the damage and to rehabilitate as much as possible. Since humanity lives on the terrestrial portion of the global commons, local and regional participation will not require much travel. However, what happens on land has a strong impact on the oceans. For example — carbon dioxide emissions from coal fired power plants enter the atmosphere, which circulates freely over political and ecological boundaries, and pesticides and other hazardous materials discharged into rivers soon reach the ocean currents and are widely circulated in water and the food chain. Even though scathing comments may be voiced from climate change deniers, droughts, wildfires, and permanently hotter summers (Hesterman 2011) should change public opinion — perhaps before runaway climate change occurs.

The cornucopian era is over, as revealed by unmanageable debt at individual and national levels, and has brought unrest and insecurity and loss of confidence in any self regulating free market or policy makers and financial institutions. Worse yet in this time of crisis, the loss of civility has been dramatic with the majority of Americans longing for moderate politics (Klein 2011). Instead of free and open discussions of values, incivility has emerged with people holding megaphones and shouting slogans or worse. Polarization is the new norm, which is not a useful basis for long-range resource management and planning. Most of the conferences are on land, but the oceans are an important component of the Biosphere and must not be neglected. The biosphere is global and all plans must be in a global context.

ECONOMIC GROWTH IS NOT THE SOLUTION — IT IS THE PROBLEM

What type of economy is suitable for a finite planet with finite resources? Not economic growth based on natural resources! Economists often point out that increasing the average economic growth rate in the United States by 1% over the next 20 years would not only result in much higher incomes and more jobs, but would also obviate the need for drastic spending cuts today to reign in the government deficit. However, a 1% growth rate based on natural

resources would require the resource base to double in 70 years (<http://www.ecofuture.org/pop/facts/exponential70.html>).

Conclusions

Humanity must now plan ahead in the 21st century to cope with the consequences of not planning ahead in the 20th century and the first part of the 21st century. These crises are both global and interactive (Cairns 2010), so they must be addressed concurrently, not sequentially. A free and open discourse is essential before any meaningful action can be taken.

The sacrifices humanity must make to eliminate the eight interactive global crises is unprecedented in human history. Worse yet, humankind may have waited too long to take remedial action. "Our planet is approaching a perfect storm of population growth, climate change and peak oil. . . . The planet is not actually sustaining 7 billion people" (Roger Martin of Population Matters as quoted in Harris 2011). "The United Nations will warn this week that the world's population could more than double to 15 billion by the end of this century, putting a catastrophic strain on the planet's resources unless urgent action is taken to curb growth rates, . . ." (Harris 2011).

Humanity has been given warnings about exponential population growth since Thomas Malthus published on population growth in 1798. Despite these warnings, population and economic growth rates have continued to increase exponentially — humankind has ignored all warnings and preferred instead to deny the reality that MORE, BETTER, and CHEAPER are neither sustainable nor feasible on a finite planet. What is needed are realists who recognize that humanity lives on a finite planet with finite resources and that perpetual growth makes no sense and will only produce ever greater catastrophes until the facts are recognized.

Acknowledgment. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich and Paula Kullberg for calling useful references to my attention.


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CHAPTER 19

ECONOMIC GROWTH AND THE BIOSPHERE

✚ ***“[...] THERE SEEMS TO BE ONLY ONE CAUSE BEHIND ALL FORMS OF SOCIAL MISERY: BIGNESS. OVERSIMPLIFIED AS THIS MAY SEEM, WE SHALL FIND THE IDEA MORE EASILY ACCEPTABLE IF WE CONSIDER THAT BIGNESS, OR OVERSIZE, IS REALLY MUCH MORE THAN JUST A SOCIAL PROBLEM. IT APPEARS TO BE THE ONE AND ONLY PROBLEM PERMEATING ALL CREATION. WHENEVER SOMETHING IS WRONG, SOMETHING IS TOO BIG. [...] AND IF THE BODY OF A PEOPLE BECOMES DISEASED WITH THE FEVER OF AGGRESSION, BRUTALITY, COLLECTIVISM, OR MASSIVE IDIOCY, IT IS NOT BECAUSE IT HAS FALLEN VICTIM TO BAD LEADERSHIP OR MENTAL DERANGEMENT. IT IS BECAUSE HUMAN BEINGS, SO CHARMING AS INDIVIDUALS OR IN SMALL AGGREGATIONS, HAVE BEEN WELDED INTO OVERCONCENTRATED SOCIAL UNITS.”¹***

 **RECENT HEADLINES IN THE UNITED STATES HAVE FOCUSED ON SUCH ISSUES AS THE DEBT CEILING, THE RECENT CREDIT RATING DOWNGRADE, AND UNEMPLOYMENT.²**

-  ***“ . . . increasing the average growth rate in the U. S. by one percentage point over the next 20 years would not only result in much higher incomes and more jobs but would also obviate the need for drastic spending cuts today in order to rein in the government deficit.”²***



ALL GROWTH, EVEN IN WISDOM AND KNOWLEDGE, REQUIRES RESOURCES – MORE GROWTH, MORE RESOURCES.

- 🌍 **Renewable resources are available on Earth from the Biosphere.**
- 🌍 **On a finite planet, even renewable resources are finite and this restriction limits growth.**
- 🌍 **Using more renewable resources than the Biosphere can regenerate is only possible by consuming natural capital, which reduces the rate of resource generation.**
- 🌍 **Consuming natural capital is unsustainable and is similar to using capital in a bank to maintain an unsustainable lifestyle instead of living on the interest (sustainable).**

EXPONENTIAL GROWTH CANNOT LAST LONG ON A FINITE PLANET.




- 🌍 **A growth rate of 1% per year results in a doubling time of 70 years, and 1% economic growth is considered modest (<http://www.ecofuture.org/pop/facts/exponential70.html>).**
- 🌍 **A growth rate of 3% per year results in a doubling time of 23 years.**
- 🌍 **If the global population experiences a 1% annual growth rate, then twice as much food, housing, energy, shelter, schools, medical services, clothing, and so on would be needed to care for everyone every 70 years.**
- 🌍 **At the current population level of 7 billion, resources are not sufficient to provide a quality life for all.**







AN ESTIMATED 30+ MILLION OTHER SPECIES SHARE EARTH WITH HUMANKIND AND ALL REQUIRE SPACE, FOOD, WATER, AND OTHER RESOURCES.

- 🌍 **Humans are reluctant to admit their dependence on other species; however, these species thrived without humans for billions of years, but humans could not exist without them.**
- 🌍 **What percentage of Earth's resources should be allocated to *Homo sapiens*?**
- 🌍 **What percentage of Earth's resources are needed to maintain the biospheric life support system in good health and integrity.**





ALL EXPONENTIAL GROWTH, INCLUDING ECONOMIC GROWTH, SHOULD BE VIEWED WITH EXTREME CAUTION BECAUSE GROWTH CAN QUICKLY PRODUCE SURPRISES.


-  Resource depletion is one such surprise.
-  Thomas Malthus³ noted that human population increases exponentially and that food does not. He is still being denounced today for this statement.
-  M. King Hubbert predicted in 1949 that the fossil fuel era would be of short duration⁴ and predicted in 1956 that peak oil would occur in about 1970 and that exponential growth in consumption was the cause.⁵ Consequently, energy problems should not be surprises.





THE 30+ MILLION OTHER SPECIES ON THE PLANET ARE ALSO CAPABLE OF EXPONENTIAL GROWTH. WHY IS EXPONENTIAL GROWTH NOT A PROBLEM FOR THEM?

-  Any species that exhausts or damages its resource base is in peril.
-  Mother Nature (i.e., the universal laws of biology, chemistry, and physics) favors quantity (exponential potential) from which she selects quality (survival of the fittest).
-  For most all of the 200,000 years that *Homo sapiens* has been on Earth, exponential growth was not a problem — food had to be hunted or gathered daily, which was more difficult than driving to the local grocery store.
-  Diseases, starvation, tribal warfare, and even predation kept exponential growth reasonably under control.




DENIERS THAT RESOURCES ARE LIMITING ASSERT THAT HUMAN CREATIVITY AND INGENUITY ARE THE ULTIMATE RESOURCES THAT WILL REPLACE SCARCE RESOURCES WITH SUBSTITUTES.⁶

-  In the 21st century, the financial bubble burst with the collapse of institutions in September 2008 (<http://www.telegraph.co.uk/finance/financialcrisis/>), with no robust signs of recovery.
-  The disparity of human access to financial resources (i.e., wealth) has never been greater and is still widening.
-  Inevitably, a redistribution of resources will occur as a result of a pandemic disease, revolution, or political edict.
-  This solution will only be temporary if exponential human population growth continues.

 **ALL SPECIES ON THE PLANET HAVE
“ECONOMIES” THAT ARE SIMILAR TO THE
ECONOMY OF *HOMO SAPIENS* IN THAT
AVAILABLE RESOURCES LIMIT
POPULATION GROWTH.**

-  **Fossil fuel has temporarily given humans increased energy availability and consequently more access to resources than any other species.**
-  **However, economic growth based on access to resources enhanced by technology is temporary because technology accelerates exhaustion of resources.**
-  **Human economic growth has impoverished most other species on the planet by habitat destruction, appropriation of space (e.g., urbanization), use of freshwater, and climate change (e.g., spread of pine bark beetles).**
-  **In short, humans have reduced Earth’s carrying capacity for other species and diminished the health and integrity of the Biosphere.**

ECONOMIC GLOBALIZATION HAS RESULTED IN AN UNPRECEDENTED RELOCATION OF PLANETARY RESOURCES AND DEPLETED THE NATURAL CAPITAL OF MANY REGIONS.

-  *“We can now redefine human carrying capacity as the maximum rates of resource harvesting and waste generation (the maximum load) that can be sustained indefinitely without progressively impairing the productivity and functional integrity of relevant ecosystems wherever the latter may be located.”*⁷
-  The source of renewable resources (natural capital) is rapidly diminishing and the human population is expanding exponentially.
-  The pressures of economic growth are destabilizing human society by excessive resource use and damage to natural capital.



“AFTER REMAINING FAIRLY CONSTANT FOR MOST OF HUMAN HISTORY, LIFE EXPECTANCY (THE AVERAGE NUMBER OF YEARS A PERSON CAN EXPECT TO LIVE) HAS NEARLY DOUBLED IN THE PAST CENTURY. THE MAXIMUM LIFE SPAN — THE LONGEST NUMBER OF YEARS A HUMAN BEING HAS LIVED — HAS INCREASED SPECTACULARLY AS WELL.”⁸

- ① ***The food crisis of 2011 will probably determine whether life expectancy of humans can continue to increase spectacularly.***
- ① ***“Population growth, rising affluence, and the use of grain to fuel cars” has caused a spike in commodities prices.⁹***
- ① ***“Soil erosion, aquifer depletion, the loss of cropland to nonfarm uses, the diversion of irrigation water to cities, the plateauing of crop yield in agriculturally advanced countries, and . . . crop-withering heat waves and melting mountain glaciers and ice sheets” have impacted supplies of food.⁹***



“THOSE WHO MAKE PEACEFUL REVOLUTION IMPOSSIBLE WILL MAKE VIOLENT REVOLUTION INEVITABLE.”¹⁰

- 🌍 Higher prices for resources (e.g., food) are causing social unrest globally.
- 🌍 Technological solutions are always short term in exponential population growth circumstances.
- 🌍 Biospheric refugees in crowded, unsanitary camps increase the likelihood of a pandemic disease.
- 🌍 The Biosphere can no longer be treated as a common ground.
- 🌍 Exponential population growth is not sustainable on a finite planet.
- 🌍 A peaceful revolution in lifestyle is necessary to cope with the eight interactive global crises.¹¹ Growth, including economic growth, is the problem — not the solution.
- 🌍 Humankind must never forget it lives on a finite planet with finite resources.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich and Paula Kullberg for calling useful references to my attention.






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CHAPTER 20

PRIMARY SOURCES OF HUMAN WEALTH: THE BIOSPHERE AND KNOWLEDGE

ALL RENEWABLE RESOURCES ESSENTIAL TO THE HUMAN ECONOMY ARE GENERATED BY THE PRESENT BIOSPHERE.

-  All life on Earth, including *Homo sapiens*, is part of the Biosphere, not apart from it.
-  One biospheric service is the assimilation and transformation of wastes (including carbon dioxide) that result from transformation of natural resources into products valuable to human society.
-  The Biosphere is a finite component of a finite planet so its ability to produce resources and assimilate wastes is limited.
-  The Biosphere is a complex, multivariate, interactive system with tipping points which, if passed, result in irreversible change.
-  Since the Biosphere produces resources essential to the human economy, it should be protected and nurtured.

KNOWLEDGE IS THE OTHER PRIMARY SOURCE OF HUMAN WEALTH, AND ONE OF THE CRUCIAL SOURCES IN THE 21ST CENTURY IS SCIENCE.





- 🌐 **Society makes an investment in education for the young that is essential at present in the era of global competition for jobs.**
- 🌐 **Some young, educated individuals will invest 4-10 years of their lives and considerable amounts of money in obtaining one or more degrees in science.**
- 🌐 **Many fields of science also require the investment of more time and money for keeping up with the latest publications, equipment, and methodology in that particular field.**
- 🌐 **Scientists will also spend much time as mentors of aspiring scientists who will ensure continuity in the various fields of science.**
- 🌐 **Research scientists will spend as much as 60 to 70 hours weekly in their professional activities, such as teaching, advising, service on academic committees, and out-of-town conferences and lectures.**



THE WEALTH IS ACTUALLY PRODUCED BY 99% OF THE HUMAN POPULATION (WHO OBTAIN BIOSPHERIC RESOURCES AND PROCESS, TRANSPORT, AND RETAIL THEM) AND SCIENTISTS, WHO ARE ONE OF THE GENERATORS OF KNOWLEDGE.

- 🌐 **The wealthy 1% of the population rarely interacts with either of these processes.**
- 🌐 **A few of the 99% may be in the 10% of the wealthy through promoting the consumption of processed resources and the use of knowledge generated.**
- 🌐 **Individuals who collect and process the resources and who generate knowledge are not the primary beneficiaries of the wealth generated.**
- 🌐 **Most 99 percenters appeared satisfied until late in the 20th century when foreclosures on houses and repossession of cars was coupled with the loss of financial security.**

IN TOO MANY INSTANCES, BENEFICIARIES OF WEALTH, BOTH INDIVIDUALS AND CORPORATIONS, ARE TRYING TO ELIMINATE REGULATIONS THAT PROTECT THE BIOSPHERE (ENVIRONMENT).





-  **If not diminished, the increasing disparity in wealth will produce social unrest and ultimately revolution, which is harmful to individuals, corporations, the Biosphere, and the human economy.**
-  **Only when social unrest is minimal will civil discourse about global crises be possible.**
-  **If the present Biosphere collapses or is functionally impaired, wealth will be no protection from the consequences.**
-  **Biospheric resources are already diminished as evidenced by ecological overshoot, which is primarily the result of loss of natural capital.**



THE ECOLOGICAL COST OF MAKING A FEW INDIVIDUALS WEALTHY (1% IN THE UNITED STATES) HAS BEEN EXTREMELY HIGH, AND THE ANTHROPOGENIC BIOSPHERIC DAMAGE CONTINUES.

- 🌍 **Many species have been driven to extinction, and many other species are so impoverished (e.g., small surviving populations) that they are of little or no ecological significant.**
- 🌍 **Even in “successful” species, billions of individuals are living in misery.**
- 🌍 **Damaging natural capital at present rates, or very likely any rate, is unsustainable, so gains in monetary wealth will be of short duration.**
- 🌍 **Every time an ecological tipping point is passed, the change is irreversible.**

THE BIOSPHERE IS GLOBAL, SO PROTECTION AND NURTURING MUST BE GLOBAL.



-  The number of starving humans has been estimated at 1.1 billion, and at least 1 billion more are malnourished. Why should these people protect the Biosphere when their future is already grim?
-  Much must be done in the second decade of the 21st century to keep Earth habitable for *Homo sapiens* and many millions of other species.
-  Climate change forcing factors (e.g., droughts) that reduce agricultural productivity could kill those living in misery and lower living conditions for many more who now have barely adequate living conditions.
-  What will be done to relocate the many millions of refugees displaced by rising sea levels in deltas (e.g., the Ganges) and coastal areas (e.g., some of the world's major cities)?





IN ADDITION TO ENVIRONMENTALLY LITERATE PEOPLE, CLIMATE CHANGE AFFECTS THE “UNINFORMED (OR MISINFORMED)”.¹

- 🌐 **Environmentally literate individuals must keep up with the latest scientific publications and dispense evidence about climate change. Reason and evidence may not prevail, but it may and that is what matters.**
- 🌐 **The uninformed are seeing more evidence of climate change, which may convince them to become better informed. The news media will be pivotal because people often remember what they read. Responsible journalism should inform the public about risks to which it is exposed.**²

THE MISINFORMED MAY HAVE BEEN DUPED, BUT THEY HAVE CHILDREN AND GRANDCHILDREN AND ARE FOND OF THEM.

-  **As these youngsters fall victim to pollutants, the misinformed will surely look for causes, and objective reporting on scientific investigations should persuade them to reexamine their values.**
-  **One can only hope that transformation occurs before life on Earth, including humankind, has suffered loss of health and life.**

 **SURELY, THE TRUE SOURCES OF HUMAN WEALTH — THE BIOSPHERE AND KNOWLEDGE — SHOULD GET MORE RESPECT THAN THE TOP 1% OF WEALTHY INDIVIDUALS WHO MERELY EXPLOIT THE BIOSPHERE AND KNOWLEDGE TO THEIR MONETARY ADVANTAGE.**

-  The two sources of human wealth should be nurtured and passed on to future generations instead of being exploited and damaged for short-term financial gain that primarily benefits 1% of the population.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich and Paula Kullberg for calling useful references to my attention.

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CHAPTER 21


CARRYING CAPACITY FOR HUMANS IN A FINANCIALLY GLOBALIZED WORLD







“FOR PURPOSES OF GAME AND RANGE MANAGEMENT, CARRYING CAPACITY IS USUALLY DEFINED AS THE MAXIMUM POPULATION OF A GIVEN SPECIES THAT CAN BE SUPPORTED INDEFINITELY IN A DEFINED HABITAT WITHOUT PERMANENTLY IMPAIRING THE PRODUCTIVITY OF THAT HABITAT. HOWEVER, BECAUSE OF OUR SEEMING ABILITY TO INCREASE OUR OWN CARRYING CAPACITY BY ELIMINATING COMPETING SPECIES, BY IMPORTING LOCALLY SCARCE RESOURCES, AND THROUGH TECHNOLOGY, THIS DEFINITION SEEMS IRRELEVANT TO HUMANS.”¹

 ***“Since not all countries can be net importers of carrying capacity, the material standards of the wealthy cannot be extended sustainably to even the present world population using prevailing technology.”¹***

 **At a biospheric level, the concept of carrying capacity is still valid. The ability to increase carrying capacity by moving resources to another location is a deadly illusion.**





 **Damage to the Biosphere, which is the result of treating it as a global commons, is reducing global carrying capacity and is the major issue of the 21st century.**

 ***“WE CAN NOW REDEFINE HUMAN CARRYING CAPACITY AS THE MAXIMUM RATES OF RESOURCE HARVESTING AND WASTE GENERATION (THE MAXIMUM LOAD) THAT CAN BE SUSTAINED INDEFINITELY WITHOUT PROGRESSIVELY IMPAIRING THE PRODUCTIVITY AND FUNCTIONAL INTEGRITY OF RELEVANT ECOSYSTEMS WHEREVER THE LATTER MAY BE LOCATED.”¹***

-  **Abundant scientific evidence indicates that excessive anthropogenic greenhouse gas emissions are damaging the Biosphere, which is the source of all renewable resources that are the raw materials of the human economy.²**
-  **Carbon dioxide from fossil fuels is clearly in excess of biospheric assimilative capacity as evidenced by oceanic water changing from mildly alkaline to mildly acidic, which is harming the marine biota. The acid could become corrosive if present trends continue.**
-  **Just the numbers on ecological overshoot/debt are enough to indicate that humanity is beyond Earth’s carrying capacity.**



SINCE ANTHROPOGENIC CARBON DIOXIDE EMISSIONS ARE AN IMPORTANT FACTOR IN CLIMATE CHANGE, HOW SHOULD THEY BE REDUCED TO BE AT OR BELOW THE BIOSPHERE'S ASSIMILATIVE CAPACITY FOR THEM?

-  **All governments could be assigned emissions rights on a per capita basis according to population size.**
-  **Such an approach would require a major per capita reduction in carbon dioxide emissions in high-emissions countries as vast differences exist in metric tons per capita CO₂ emissions.³**
-  **Economic and human population growth have created ecological overshoot/debt and simultaneously increased anthropogenic wastes (e.g., carbon dioxide) so that they exceed biospheric assimilative capacity.**
-  **Going below the Biosphere's assimilative capacity for greenhouse gases would add a safety factor that would be very prudent.**



AS THE RESULT OF EXCESSIVE GROWTH “WE ARE SEEING CLIMATE DISRUPTION LEADING TO RISING FOOD PRICES, LOSS OF BIODIVERSITY, DETERIORATING ECOSYSTEM SERVICES, INCREASED CHANCES OF VAST EPIDEMICS AND NUCLEAR RESOURCE WARS AND A GENERAL REDUCTION IN THE ODDS OF AVOIDING THE FIRST CATASTROPHIC COLLAPSE OF A GLOBAL CIVILIZATION.”⁴




🌍 ***“Will the additional 2 billion people projected to arrive by 2050 have the same environmental impact as adding the last 2 billion? . . . To support 2 billion more, it will be necessary to farm ever poorer lands, use more dangerous and expensive agricultural inputs, win metals from ever-poorer ores, drill wells deeper or tap increasingly remote or more contaminated sources to obtain water, and then spend more energy to transport that water ever greater distances. All this will require vastly more energy than is now used. As a result the next 2 billion people probably will do disproportionately much more damage to our life-support systems than did the last 2 billion. Of course, if humanity got serious about protecting the environment, and now especially the atmosphere, the next 2 billion could do less damage.”⁴***






THE QUESTION OF THE 21ST CENTURY IS: WHICH WILL COME FIRST – COLLAPSE OF THE BIOSPHERE , A PANDEMIC DISEASE, OR ENLIGHTENMENT ABOUT CARRYING CAPACITY?

- ⊗ Although no biospheric collapse has occurred during the brief time *Homo sapiens* has been on the planet, one is possibly, even probably, now in progress. Moreover, each of the five great extinctions differed from the others. Multiple temporary steady states may occur during a collapse.
- ⊗ Crowded, unsanitary refugee camps are an ideal location for the origin of a pandemic disease. The Black Death resulted in more resources per capita in Europe but is far from an ideal way to balance resources and population.
- ⊗ “*When the time is ripe, human societies have shown an incredible ability to shift gears and move in a new direction.*”⁴ World War II is often used as an example of how a society (the United States) can rapidly shift gears. However, the attack on Pearl Harbor was dramatic and unmistakable. Climate change is gradual and not as urgent to most people.




THE COLLAPSE OF THE PRESENT BIOSPHERE WOULD RESULT IN MANY MORE DEATHS THAN WORLD WAR II, BUT WOULD INITIALLY BE LESS DRAMATIC THAN A BOMBING RAID.

-  Complex ecosystems probably have one or more equilibrium stages during a collapse. Since the present Biosphere consists of a large number of ecosystems, it may have one or more equilibrium stages as well, but, at present, no robust scientific evidence exists on this possibility.
-  The collapse of the present Biosphere would almost certainly require humanity to become more adaptive than protecting and nurturing the present Biosphere would require.
-  Some evidence indicates that the business community is becoming more aware of climate change thresholds – *“A group of 285 large investors, representing more than \$20 trillion in assets, urged world governments to forge a binding treaty at upcoming climate negotiations . . . ”*⁵

THE SCARCITY OF FOOD AND POTABLE WATER FOR OVER A BILLION PEOPLE, PLUS CROWDED, UNSANITARY REFUGEE CAMPS INCREASES THE PROBABILITY OF BOTH EPIDEMICS AND PANDEMICS (WORLDWIDE EPIDEMICS).


-  **Epidemics and pandemics are not compassionate ways to reduce Earth's carrying capacity for humans, but it is the default position if humankind lacks the courage to face the problem now.**
-  **Starvation, misery, and disease are also not compassionate ways to keep Earth's human population within Earth's carrying capacity for humans.**
-  **Three billion + more additions to Earth's already overcrowded human population is predicted for the 21st century. Will humanity's inability to have a free and open discussion of this issue result in starvation and misery for billions in the 21st century?**

OPTIMISM IS JUSTIFIED FOR WHAT SOCIAL EVOLUTION COULD DO WITH INFORMATION ON GLOBAL CARRYING CAPACITY OF THIS PLANET FOR HUMANS, BUT NOT FOR WHAT WILL BE DONE.

-  *“... [scientific] tools are enabling scientists to look at human changes to the planet’s atmosphere, hydrology, lithosphere, and biota – and infer which changes are profound enough to be measurable millions of years hence.”⁶*
-  **Social evolution requires information feedback about biospheric health and integrity, so how disturbing to learn that “*Two popular Southern California fisheries have collapsed right under the noses of management agencies that had inadequate data . . .*”⁷**
-  **Robust social evolution is unlikely to preserve the present Biosphere while well financed anti-science attacks are being given prominent coverage by the news media.**



EFFORTS TO PRESERVE THE PRESENT BIOSPHERE MUST CONTINUE SO THAT FUTURE GENERATIONS HAVE A HABITABLE PLANET.

 If the present Biosphere collapses, *Homo sapiens* will not likely survive the long transition until the next Biosphere is formed or the conditions that will result at that time.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Peter Leigh, Paul Ehrlich, and Paula Kullberg for calling useful references to my attention.

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CHAPTER 22

FACING REALITY ON SUSTAINABILITY



SUSTAINED ANTHROPOGENIC CHANGES ARE NECESSARY TO PROTECT AND NURTURE THE BIOSPHERE.

- 🌍 **For almost all of the 200,000 years that *Homo sapiens* has existed, the present Biosphere has been self sustaining.**
- 🌍 **In the 20th and 21st centuries, humans have caused eight interactive global crises¹ that threaten the health and integrity of the present Biosphere.**
- 🌍 **Enlightened self interest should persuade *Homo sapiens* to develop policies and conditions that would keep the present Biosphere in robust health.**




POPULATION OVERSHOOT OCCURS WHEN POPULATION EXCEEDS RESOURCES AND BILLIONS OF PEOPLE ARE LIVING IN MISERY.




- 🌐 **In the 12 years between November 1999 and November 2011, another 1 billion people were added to the global population.**
- 🌐 **Since many of these births were in poor countries, the probability that many will die while young or will live in misery if they do not is high.**
- 🌐 **Failure to have a free and open discourse on this tragic situation is due to an unwritten but effective taboo preventing discussion of population size and resource availability.**
- 🌐 **The consequences of this taboo is the control of population size by misery, starvation, disease, and death.**
- 🌐 **Exponential population growth is not sustainable!**







ECOLOGICAL OVERSHOOT IS REDUCING NATURAL CAPITAL, DAMAGING THE BIOSPHERE, AND REDUCING RENEWABLE RESOURCE REGENERATION.

- 🌍 **Failure to have a global discourse on this crises will result in a reduction in Earth's carrying capacity for *Homo sapiens*.**
- 🌍 **This situation will significantly reduce the probability of leaving a quality planet for future generations.**
- 🌍 **The decision to postpone remedial action ensures that Mother Nature (the universal laws of biology, chemistry, and physics) will determine the consequences as She does for all species that exceed carrying capacity.**
- 🌍 **This situation is not sustainable!**

 **ALL GROWTH, INCLUDING ECONOMIC GROWTH, REQUIRES RESOURCES. ON A FINITE PLANET, LIMITS EXIST TO GROWTH SINCE RESOURCES ARE NOT UNLIMITED.**

-  **The fossil fuels used for economic growth have resulted in a “*world headed for irreversible climate change in five years.*”²**
-  **Irreversible climate change would seriously impair the agricultural system and markedly reduce the regeneration of all renewable resources.**
-  **These events may represent an irreversible detour on the road to sustainability, which humanity has barely, mostly ineffectively, begun to travel.**

SPECIES ARE THE BASIC COMPONENTS OF THE BIOSPHERE, AND BIOTIC IMPOVERISHMENT AND LOSS OF BIODIVERSITY IMPAIR BOTH BIOSPHERIC STRUCTURE AND FUNCTION.

-  Extreme weather³ will also disrupt biospheric structure and function, but robust scientific information will enable humanity to anticipate catastrophes and develop goals and conditions that will reduce risk.
-  However, the scientific evidence will not result in policy changes if the assault on scientific evidence continues.⁴
-  If the attempts to cast doubt on the scientific process are successful, humanity will have lost the best source of information about the condition of the biospheric life support system.
-  Humanity cannot accept only “good” scientific information because all scientific evidence is generated by the same process.




“... THERE ARE THREE PRIMARY FACTORS THAT STAND FIRMLY IN THE WAY OF FURTHER ECONOMIC GROWTH:




- ① ***The depletion of important resources including fossil fuels and minerals;***
- ② ***The proliferation of negative environmental impacts arising from both the extraction and use of resources (including the burning of fossil fuels) — leading to snowballing costs from both these impacts themselves and from efforts to avert them; and***
- ③ ***Financial disruptions due to the inability of our existing monetary, banking and investment system to adjust to both resource scarcity and soaring environmental costs — and their inability (in the context of a shrinking economy) to service the enormous piles of government and private debt that have been generated over the past couple of decades.”⁵***




ECONOMIC GROWTH HAS BADLY DAMAGED THE BIOSPHERE AND IS CLEARLY UNSUSTAINABLE.

- 🌍 **The human economy is a subset of the Biosphere, without which the human economy could not exist.**
- 🌍 **Therefore, damage to the Biosphere cannot be viewed as an “externality.”**
- 🌍 **In living systems, an initial period of growth is followed by a longer period of maintenance (i.e., no growth).**
- 🌍 **Sustainable use of the planet (i.e., end of growth) should be culturally and psychologically rewarding since the goal is to leave a habitable planet for future generation**

 **FAILURE TO FACE REALITY (I.E., THE GROWTH ERA IS OVER) WILL ALMOST CERTAINLY RESULT IN RUNAWAY CLIMATE CHANGE AND MISERY AND DEATH FOR BILLIONS OF PEOPLE.**

-  **The vast disparity in individual wealth (i.e., access to resources) will probably be significantly reduced by either political means or revolution.**
-  **The longer redistribution of access to resources is delayed politically, the greater the probability the redistribution will be attempted by resource wars or revolution.**
-  **All wars, especially resource wars, consume vast quantities of resources, so they exacerbate the problem of resource scarcity.**



CLIMATE CHANGE IS ALREADY MARKEDLY REDUCING RENEWABLE RESOURCE REGENERATION BY THE BIOSPHERE.

- 🌍 **Exponential human population growth is also markedly reducing the available resources per capita globally.**
- 🌍 **On a finite planet, resources can only be temporarily increased by technology, and exponential human population growth ensures this solution will be temporary.**
- 🌍 **Since resource supply cannot be markedly increased, the only option is to reduce demand.**
- 🌍 **This option could be accomplished by social evolution – less consumption of resources per capita, especially in wealthy countries, and long-term reduction in population size.**
- 🌍 **If humans do not act, Mother Nature will via the universal laws of biology, chemistry, and physics.**



“I’VE LEARNED . . . THAT TO IGNORE THE FACTS DOES NOT CHANGE THE FACTS.”

(Andy Rooney)

- ① **The scientific process is under assault by believers in two quite different ideologies.**
- ① **One holds that scientists are engaged in a conspiracy on climate change to perpetuate a hoax on the general public.**
- ① **The other believes that perpetual economic growth is sustainable on a finite planet with finite resources.**
- ① **All growth requires resources, so resources limit growth.**
- ① **Curiously, most of those attacking the scientific process benefit from scientific research daily.**


Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication.





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CHAPTER 23

THE ULTIMATE TIPPING POINT: DESTRUCTION OF THE PRESENT BIOSPHERE

 **“THE DOOR IS CLOSING, . . . I AM VERY WORRIED — IF WE DON’T CHANGE DIRECTION NOW ON HOW WE USE ENERGY; WE WILL END UP BEYOND WHAT SCIENTISTS TELL US IS THE MINIMUM [FOR SAFETY]. THE DOOR WILL BE CLOSED FOREVER” (Fatih Birol, chief economist at the International Energy Agency).¹**

-  *“The world is likely to build so many fossil-fuelled power stations, energy-guzzling factories and inefficient buildings in the next five years that it will become impossible to hold global warming to safe levels, and the last chance of combating dangerous climate change will be “lost forever” . . .”¹*
-  *“Anything built from now on that produces carbon will do so for decades, and this “lock-in” effect will be the single factor most likely to produce irreversible climate change, . . .”¹*
-  *“Yet, despite intensifying warnings from scientists over the past two decades, the new infrastructure now being built is constructed along the same lines as the old, . . .”¹*
-  The clear path forward is more investment in alternative energy, but much political opposition exists to this transition.



HOW DID *HOMO SAPIENS* DEVELOP A SOCIETY THAT USES FOSSIL FUEL SO CARELESSLY AS TO BECOME A THREAT TO THE BIOSPHERE — THE PLANET'S LIFE SUPPORT SYSTEM AND THE SOURCE OF RENEWABLE RESOURCES ESSENTIAL TO THE HUMAN ECONOMY?





- 🌍 **A major, well financed campaign to cast doubt on science, the best source of information on risks to human health and the Biosphere, has been in existence since the tobacco wars that began over three decades ago and is still continuing on issues such as climate change.²**
- 🌍 **Many people believe that technology and economic growth can eliminate any problem.**
- 🌍 **Humanity is not moving up on the learning curve about climate change, overpopulation, resource depletion, and other global problems.**
- 🌍 **Neither the general public nor policy makers displays any sense of urgency about any global crisis except the financial crisis.**
- 🌍 **Since the Agricultural Revolution, global climate has been relatively stable, so visualizing abrupt change is difficult for most people.**



HOMO SAPIENS HAS LIVED ON EARTH FOR APPROXIMATELY 200,000 YEARS, AND SEVEN OTHER SPECIES OF THE GENUS *HOMO* EXISTED FOR ABOUT 4 MILLION YEARS. WHY IS HUMANKIND IN TROUBLE NOW?

- 🌐 Petroleum has been used for thousands of years (http://en.wikipedia.org/wiki/History_of_petroleum), but only in the last 200 years has it been used in huge quantities.
- 🌐 Petroleum and coal have given humans a tremendous amount of energy compared to other species.
- 🌐 This increased energy consumption and the technology it has made possible have given humans a huge advantage over other species. However, this advantage is only temporary if the supply is finite.
- 🌐 *“Any technical improvement can only relieve misery for a while, for so long as misery is the only check on population, the [technical] improvement will enable populations to grow, and will soon enable more people to live in misery than before.”³*

IN 1927, THE GLOBAL HUMAN POPULATION REACHED 2 BILLION — A MAJOR TIPPING POINT FOR BOTH HUMANS AND THE BIOSPHERE.





-  **Earth's first ecological overshoot day occurred in December 1987.**
-  **The era between 1927 and 1987 was unique because of the overconsumption of Earth's resources, although starvation and misery existed during that period.**
-  **At present, with eight, interactive, worsening, global crises, calculations of carrying capacity are meaningless until a biospheric dynamic steady state is reached.**
-  **The long-term human population might be much less than 7 billion, and it will be determined by the universal laws of biology, chemistry, and physics rather than a consortium of nations.**






THE DANGER OF RESOURCE WARS IS VERY REAL SINCE RESOURCE DEMAND IS MUCH GREATER THAN SUPPLY AND CLIMATE CHANGE EFFECTS ARE DAMAGING RESOURCE REGENERATION.


- 🌍 **Wars deplete resources and damage the Biosphere.**
- 🌍 **Wars also damage infrastructure.**
- 🌍 **Wars increase national debt, although the actual financial burden is often difficult to determine.**
- 🌍 **The worst aspect of war is the loss of time — all of one's time if a life is taken; much family togetherness time is lost; and educations are interrupted.**
- 🌍 **At the end of a war, both the “winner” and the “loser” are impoverished.**
- 🌍 **Biospheric refugees are displaced from their impoverished homeland, and their “host” area must divert scarce resources for the refugees.**



A DAMAGED BIOSPHERE WILL GENERATE FEWER RENEWABLE RESOURCES, AND THE DELIVERY WILL BE MORE ERRATIC AND LESS RELIABLE.


-  **Most, probably all, changes that occur after passing a tipping point are irreversible.**
-  **All global crises are interactive⁴ — population affects climate and climate affects population.**
-  **A badly damaged Biosphere could collapse at any time — tipping points are only clearly evident in retrospect.**
-  **No number of global conferences can develop policies to repair irreversible damage.**




ALL GROWTH, INCLUDING ECONOMIC GROWTH, REQUIRES RESOURCES, AND EXCESSIVE GROWTH CAUSES ECOLOGICAL OVERSHOOT/DEBT, WHICH IS DAMAGING EARTH'S BIOSPHERE.

-  “. . . ‘*growth*’ is not synonymous with ‘*betterment*.’”⁵
-  Although both the words *ecology* and *economics* are derived from the Greek word *oikos*, the term *carrying capacity* is used commonly in ecological publications, but rarely in economic publications. However the term *carrying capacity* recognizes limits to growth for a household or a population.
-  All growth requires resources, and all resources are limited on a finite planet — even renewable resources are limited by the regenerative capacity of the Biosphere.

 ***“ENVIRONMENTAL DEGRADATION IS AN IATROGENIC DISEASE INDUCED BY THE ECONOMIC PHYSICIANS WHO ATTEMPT TO TREAT THE BASIC SICKNESS OF UNLIMITED WANTS BY PRESCRIBING UNLIMITED PRODUCTION. WE DO NOT CURE A TREATMENT-INDUCED DISEASE BY INCREASING THE TREATMENT DOSAGE!”⁵***

-  **If humanity cannot escape its addiction to growth, the universal laws of biology, chemistry, and physics will “solve” the problem by starvation, disease, and death, just as they do for all other species that exceed carrying capacity.**
-  **Global, interactive crises are still worsening, but no substantive remedial action at the global level is evident.**

 **SINCE NO ROBUST EFFORTS ARE EVIDENT TO PROTECT AND NURTURE THE BIOSPHERE, THEN OTHER MEASURES, SUCH AS “HAIL MARY” APPROACHES, ARE NEEDED TO PREVENT RUNAWAY CLIMATE CHANGE.**




-  **Even if successful, “Hail Mary” geoengineering techniques to reduce atmospheric carbon dioxide cannot repair irreversible damage to the Biosphere.**
-  **The effort and expense of adapting to markedly changed global conditions after runaway climate change will undoubtedly be greater than the effort to avoid runaway climate change.**
-  **Denial can be very expensive, even fatal.**








AVOIDING THE ULTIMATE TIPPING POINT FACES SERIOUS OPPOSITION.

- 🌍 **Scientific evidence on climate change has increased dramatically, but has not reduced the fervor of climate deniers.**
- 🌍 ***“The [climate change] deniers did not decide that climate change is a left-wing conspiracy by uncovering some covert socialist plot. They arrived at this analysis by taking a hard look at what it would take to lower global emissions as drastically and as rapidly as climate science demands. They concluded that this can be done only by radically reordering our economic and political systems in ways antithetical to their “free market” belief system.”⁶***
- 🌍 **The pain of living within limits appears greater than the pain of climate change catastrophes.**

THE NEWS MEDIA AND CLIMATE CHANGE DENIERS ARE TREATING THE MARKED DIFFERENCES OF OPINION AS AN IDEOLOGICAL BATTLE.

-  **This situation explains why huge amounts of new scientific evidence is received with indifference by deniers and policy makers.**
-  **It also explains why, when a prominent climate change skeptic becomes an ex-skeptic, the news media pays a lot of attention and policy makers are not impressed.⁷**
-  **How regrettable that scientists and the scientific process are so badly misunderstood at this defining moment in human history!**

 ***HOMO SAPIENS* IS FACING AN UNPRECEDENTED SERIES OF CRISES, INCLUDING OVERPOPULATION AND CLIMATE CHANGE, WITHOUT THE BENEFIT OF SCIENTIFIC EVIDENCE WHEN MAKING POLICY DECISIONS.**

-  A huge body of scientific evidence demonstrates climate change is real and influenced by human practices (i.e., burning fossil fuel).
-  Discourse on exponential human population growth is taboo.
-  The universal laws of biology, chemistry, and physics remain unaffected by human policies and rhetoric.
-  The ultimate tipping point, the destruction of the present Biosphere, is probably nearer than most humans think it is.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg and Paul Ehrlich for calling useful references to my attention.

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CHAPTER 24

The Ultimate Feedback Loop and the Inevitable Ultimate Tipping Point

Congress should be forward thinking in the policies we set, instead of waiting until catastrophe looms.

Bill Frist
Former US Senator

History is a race between education and catastrophe.

H. G. Wells

Life improves slowly and goes wrong fast, and only catastrophe is clearly visible.

Edward Teller

Understanding the laws of nature does not mean we are immune to their operations.

David Gerrold

Questioning what we believe and want is difficult at the best of times, and especially difficult when we most need to do it, but we can benefit from the informed opinion of others.

Daniel Kahneman (2011, p. 1)

The Genesis of a Major Global Catastrophe

Humanity knows

- (1) that atmospheric greenhouse gases cause global warming,
- (2) that amounts of atmospheric greenhouse gases in excess of biospheric assimilative capacity accumulate in the atmosphere,
- (3) that burning fossil fuels releases carbon dioxide — a major greenhouse gas,
- (4) that a huge amount of carbon is stored in permafrost and frozen hydrated methane on the floor of oceans, and
- (5) that global warming has melted glaciers and would also thaw the stored carbon, releasing it to the atmosphere; the feedback loop would probably cause runaway climate change.

However, economic growth has been given a high priority over dealing with climate change despite all this knowledge. In addition, economic growth requires vast amounts of energy, which is, at present, generated by combustion of fossil fuels, especially coal. The result of giving climate change a low priority and continuing to use fossil fuels is major environmental changes. “Global warming has brought a ‘new normal’ in the Arctic, with warmer air and ocean temperatures, thinner and less expansive summer sea ice, and greener vegetation in coastal regions abutting the open water” (Spotts 2011). This situation does not bode well for keeping permafrost frozen — thawing will release vast amounts of stored carbon (Schuur and Abbott 2011). “The latest estimate is that some 18.8 million square kilometers of northern soils hold about 17,000 billion tonnes of organic carbon — the remains of plants and animals that have been accumulating in the soil over thousands of years. That is about four times more than all the carbon emitted by human activity in modern times and twice as much as in present in the atmosphere now” (Schuur and Abbott 2011). These estimates are the classic positive feedback loop — the release will speed up global warming which, in turn, will thaw more frozen carbon and increase both the rate and magnitude of warming. “It’s [the Arctic] melting at near record pace, and it’s darkening and absorbing too much of the sun’s heat. A new report card from the National Oceanic and Atmospheric Administration rates the polar region with blazing red stop lights on three of five categories and yellow cautions for the other two. Overall, these are not good grades, but it doesn’t mean the Arctic is doomed and it still will freeze in the winter . . .” (Borenstein 2011).

The positive feedback loop will almost certainly begin working again the next summer since no substantive action on reducing carbon emission has emerged. “The consumer nations of the world possess an enormous amount of leverage over developing countries (and the U.S.) to influence carbon emission reductions. If they began to

collectively impose tariffs on imports from nations that do not place a price on carbon, those exporting nations will face a choice: Either they can watch the consumer nations collect tariff revenue from incoming goods, or they can adopt policies to collect such revenues themselves” (Belleville 2011). Such an action would be a meaningful way to reduce anthropogenic emissions since the scientific evidence clearly demands it.

The Psychology of Protection

The way one sees things changes (Aldag 2011). In addition, people psychologically alter information so that it is more palatable. “Selective perception is our bias toward ignoring information that is at odds with our worldview. Subjective perception explains our tendency to couple uncomfortable information with reaffirming facts in order to make ourselves feel better” (Aldag 2011). Such cognitive tricks do not lead to objective analysis at the regional level, and, at national and global levels on subjects such as global warming, such tricks could be suicidal. Politicians and policymakers routinely refuse to discuss climate change or answer questions about their position on it (Davenport 2011). Congressional representatives in the United States who represent coal-mining states are unlikely to support any policy to curb climate change (Davenport 2011). Some lawmakers acknowledge the “need to address the crisis that climate science says is coming while somehow saving jobs that could be lost in the fossil-fuel industry. . . . plenty of them [politicians] clam up when asked about controversial proposals such as cap-and-trade and pollution regulations” (Davenport 2011).

Some global tipping points have already been activated (e.g., glaciers melting), and others wait in probably the not too distant future. Humanity is clearly not prepared to discuss climate change, let alone take precautionary measures (e.g., regulating greenhouse gas emissions), until more can be learned about the tipping points that produce irreversible global change.

The Blame Game

Politicians in the United States have blocked regulatory measures that would have reduced anthropogenic greenhouse gas emissions, yet they criticize the US Army Corps of Engineers for an inadequate response to floods that almost certainly are related to global climate change (<http://www.msnbc.msn.com/id/45501855>). Floods are one of the symptoms of climate change, which is caused primarily by more greenhouse gas emissions than the Biosphere can assimilate and so they accumulate in the atmosphere.

Research is beginning the United States on injecting carbon dioxide for storage into the Mt. Simon sandstone more than a mile beneath the Illinois surface at Decatur (<http://www.isgs.illinois.edu/research/sequestration/seq-11-17-2011.shtml>). Alternative non-carbon energy sources are the wave of the future, but humanity is still clinging to fossil fuel despite the serious risk of activating the positive global warming feedback loop.

“Social scientists in the 1970s broadly accepted two ideas about human nature. First, people are generally rational, and their thinking is normally sound. Second, emotions such as fear, affection, and hatred explain most of the occasions on which people depart from rationality. . . . both assumptions [can be challenged] . . . systematic errors in the thinking of normal people [can be] traced . . . to the design of the machinery of cognition rather than to the corruption by emotion. . . . People tend to assess the relative importance of issues by the ease with which they are retrieved from memory — and this is largely determined by the extent of coverage in the media. Frequently mentioned topics populate the mind even as others slip away from awareness. In turn, what the media chooses to report corresponds to their view of what is currently on the public’s mind” (Kahneman 2011, p. 8). An example of such thinking is the debate on tobacco smoking. Even with a mass of scientific evidence, the defining moment in the debate was provided by the US Surgeon General’s 1964 report, which officially focused on the link between smoking and cancer. Arguably, the opposition to the report was the genesis of the strong, well-financed anti-science movement in the United States.

The Anti-Science War

A handful of scientists have obscured the truth amassed from scientific evidence on issues from tobacco smoke to global warming (Oreskes and Conway 2011). The disinformation campaign against science tries, very successfully, to create the impression that an ongoing debate exists among scientists about the reality of global warming and that anthropogenic greenhouse gas emissions are a major factor. The news media reinforce this impression with the “balanced view” approach (i.e., statements from both sides) when the preponderance of scientific evidence is on one side and little or no peer-reviewed, scientific evidence exists on the other side. Such “balanced reporting” is clearly impractical in this case, but the news media is using this approach for all reporting on global warming and the other consequences of climate change.

Silence Can Be Deadly

“If there is to be any hope of avoiding civilization-threatening climate disruption, the U.S. and other nations must act immediately and aggressively on an unprecedented scale. . . . The consensus in American politics today is

that there's nothing to be gained from talking about climate change. It's divisive, the electorate has more pressing concerns, and very little can be accomplished anyway" (Roberts 2011). Climate change and the destruction of the present Biosphere are not spectator sports. "The whole climate-change negotiation process is a drawn-out and horrible exercise in lying — to each other, to ourselves, and especially to our children. And the lies are starting to corrupt our civilization from inside out" (Gray and Homer-Dixon 2011). The present generation should be prepared for discerning questions from the next generation.

- (1) Mom, what did you do to prevent climate change from stealing my future?
- (2) Dad, why is economic growth more important than the environment?
- (3) Grandmother, why are we still using fossil fuels when wind turbines, solar cells, and geothermal energy have been available for years?
- (4) Grandfather, what do people actually do at climate change conferences?
- (5) Uncle Aristotle, why are corporations given the same rights as humans?
- (6) Aunt Faith, what does the word *nurture* mean?
- (7) Why did people ignore the warnings given by scientists — are scientists bad people?
- (8) Didn't anyone know that radioactive substances last a long time?
- (9) When toxic chemicals get into the environment, where do they go?

Get Ready to Answer Now!

"The problem with the future is that it keeps turning into the present" (Watterson 2009). Humanity has very little time to acknowledge that it has been a major influence on climate change and that the fossil fuel era is over. If humanity fails to reach this acknowledgment, civilization is doomed and survival of *Homo sapiens* is increasingly threatened.

The most disturbing news is that the positive carbon feedback loop is rapidly growing. "Dramatic and unprecedented plumes of methane — a greenhouse gas 20 times more potent than carbon dioxide — have been seen bubbling to the surface of the Arctic Ocean by scientists undertaking an extensive survey of the region" (Connor 2011). If this growth is confirmed, especially if the scale of methane release increases, runaway climate change is the highly probable result. An angry, fearful global populace will be demanding an explanation for the failure to anticipate a number of global catastrophes by sovereign nations and their leaders and legislatures.

Flirting with Extinction

During the five previous great extinctions, extinction of species was estimated to be as high as 95%. These lost species were the basic components of the existing, at that time, Biosphere. The extinct species were replaced in evolutionary time. Of course, to even approach thinking in evolutionary time, one must accept the robust scientific evidence on which the concept is based, i.e., the evidence produced by the scientific process. Rejecting scientific evidence requires robust scientific evidence that no evolutionary process exists.

Conclusions

The preponderance of scientific evidence confirms that anthropogenic (human) activities (i.e., burning fossil fuel) are a major factor in climate change. The universal laws of biology, chemistry, and physics have caused climate change on Earth for approximately 4.5 billion years. However, *Homo sapiens* has only been on Earth for about 200,000 years and evolved in the environment of the sixth Biosphere, as did many millions of other species. Only the climate of the last 19,000 years has been very favorable, and, in this period, both the Agricultural and Industrial Revolutions occurred.

All complex systems have tipping points beyond which irreversible change occurs. At present, these tipping points are only evident in retrospect, but scientists may someday be able to predict when they will occur.

If the present Biosphere collapses, most of its component species will become extinct. The stress from the positive carbon dioxide feedback loop could cause the Biosphere to collapse as the ultimate tipping point. Of course, a nuclear war or an impact by a large object from outer space could also end the present Biosphere. Humanity may still have time to reduce anthropogenic carbon dioxide emissions or a nuclear war, but neither will be possible if policymakers disregard scientific evidence. Both the general public and the new media have a responsibility to see that this possibility is not neglected. Humankind must leave a habitable planet for posterity.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Karen Cairns, Paula Kullberg, and Paul Ehrlich for calling useful references to my attention.

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CHAPTER 25

LIVING WITHIN BIOSPHERIC LIMITS



***“OH, BEAUTIFUL FOR SMOGGY SKIES,
INSECTICIDED GRAIN,
FOR STRIP-MINED MOUNTAIN’S MAJESTY
ABOVE THE ASPHALT PLAIN.
AMERICA, AMERICA, MAN SHEDS HIS WASTE
ON THEE, AND HIDES THE PINES WITH
BILLBOARD SIGNS, FROM SEA TO OILY SEA.***

George Carlin


- 🌍 **The urge to alter natural systems and replace them with human artifacts (e.g., malls, parking lots, roads) has greatly damaged the biospheric life support system.**
- 🌍 **The Biosphere is also the repository for all types of human wastes (e.g., municipal, industrial), which are a major threat to human health and the environment.**
- 🌍 **Taking more from the Biosphere (e.g., oceanic fisheries) than the regenerative capacity can replace is clearly unsustainable, but such actions are the norm.**



“THERE ARE NO PASSENGERS ON SPACESHIP EARTH. WE ARE ALL CREW.”

(Marshall McLuhan 1964)

- 🌐 **The present battles in the public arena and news media, often acrimonious, are indicative that some crew members are trying to save Spaceship Earth, others are destroying the life support system in zealous support of economic growth, and still others are so totally preoccupied with their own personal problems that they lack environmental literacy.**
- 🌐 **Some corporations are using a significant portion of immense profits to cast doubt on robust scientific evidence.**
- 🌐 **Some anti-environmental activists in the United States are branding “*government action for things like expanding public transportation routes and preserving open space as a United Nations-led conspiracy to deny property rights and herd citizens toward cities.*”¹**
- 🌐 **The activists “*are showing up at planning meetings to denounce bike lanes on public streets and smart meters on home appliances they equate with a big-government blueprint against individual rights.*”¹**

 **“I AM A FIRM BELIEVER IN THE PEOPLE. IF GIVEN THE TRUTH, THEY CAN BE DEPENDED UPON TO MEET ANY NATIONAL CRISIS. THE GREAT POINT IS TO BRING THEM THE REAL FACTS.”**

(Abraham Lincoln)

- 🌐 How does one get the facts to the people when the aggressive, well financed merchants of doubt² are actively spreading disinformation?
- 🌐 The Internet is a good source of information, but people tend to visit sites that confirm previously held beliefs (Jonathan Haidt, interview by Bill Moyers on Public Television February 6, 2010).
- 🌐 Scientific evidence will be essential in a rapidly changing world, but “*a new report by the Thomas B. Fordham Institute gives a majority of states in the U.S. a D or F when it comes to state science standards.*”³



“I OBJECT TO VIOLENCE, BECAUSE WHEN IT APPEARS TO DO GOOD, THE GOOD IS ONLY TEMPORARY, THE EVIL IT DOES IS PERMANENT.”

(Mohandas Gandhi)

- 🌍 **When resources become scarce, a likely result is resource wars that, even if “successful,” deplete resources, damage infrastructure, create refugees, and only temporarily solve resource scarcity for a limited number of people while simultaneously depriving many others of resources.**
- 🌍 **Ecological overshoot (humans are consuming renewable resources more rapidly than they are being regenerated) is an unsustainable but common global solution to resource scarcity.**
- 🌍 **Ecological overshoot increases the probability of resource wars, which diminish resource regeneration.**
- 🌍 **Living within resource limits (i.e., not exceeding carrying capacity) reduces both the probability of resource wars and damage to the Biosphere.**



“ACTION EXPRESSES PRIORITIES.”

(Mohandas Gandhi)

- 🌍 **Humanity has spent decades talking about sustainability while actually living more unsustainably each year.**
- 🌍 **Economic growth remains a high political priority despite damaging the Biosphere to continue growth.**
- 🌍 **Anthropogenic greenhouse gas**
- 🌍 **emissions continue to rise and change Earth’s climate, and one gas, carbon dioxide, is acidifying the oceans.**
- 🌍 **Biodiversity continues to decline.⁴**
- 🌍 **Exponential human population growth continues on a finite planet.**



“OFTEN IT TAKES SOME CALAMITY TO MAKE US LIVE IN THE PRESENT. THEN SUDDENLY WE WAKE UP AND SEE ALL THE MISTAKES WE HAVE MADE.”

(Bill Watterson)

“DELAY IS THE DEADLIEST FORM OF DENIAL.”

(C. Northcote Parkinson)

- 🌐 In an era of decreasing resources/capita, “wants” must decrease proportionately, but expectations, at least in the United States remain high.
- 🌐 Civility has been an early casualty of the inevitable problems of ecological overshoot. Desiderus Erasmus, a 16th century scholar, noted that civility is a vital part of the social contract that enables humans to live together as a society.



“FOR 200 YEARS WE’VE BEEN CONQUERING NATURE. NOW WE’RE BEATING IT TO DEATH.”⁵

- 🌍 Exponential human population growth, 1 billion in the last 12 years, requires exponential economic growth just to maintain the status quo in material goods per capita.
- 🌍 Exponential growth based on resource consumption is harmful to the biospheric life support system.
- 🌍 If the Biosphere collapses due to increased depletion of natural capital that civilization is based on, “business as usual” is doomed.
- 🌍 So why is *Homo sapiens* beating nature (structured by the universal laws of biology, chemistry, and physics) to death?
- 🌍 Humanity can prepare to cope with the increasing frequency of extreme events⁶ or, better yet, take steps to prevent or reduce the number of extreme events.

 **“WE ARE FACING AN IMMINENT CATASTROPHIC COLLAPSE ‘AND’ OUR ONLY HOPE IS TO TRANSFORM HUMANITY INTO A GLOBAL INTERDEPENDENT SUSTAINABLE SOCIETY, BASED ON RESPECT AND REVERENCE FOR THE EARTH.”** *(The Club of Rome <http://clubofrome.org>)*

- 🌍 Even though this statement was published in 1974, no one was listening. Consequently, in 2012, making people concerned about the future of their children, grandchildren, and their descendents is essential.
- 🌍 Asserting that scientists are perpetuating a hoax about global warning has not worked because the universal laws of nature are implacable and not altered by rhetoric.
- 🌍 Face it – *Homo sapiens*, like 30+ million other species, is governed by these universal laws.
- 🌍 Live accordingly.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg and Paul Ehrlich for calling useful references to my attention.

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CHAPTER 26

DENIAL OF SCIENTIFIC EVIDENCE: A MAJOR THREAT TO THE BIOSPHERE (AND YOU)

Delay is the deadliest form of denial.

C. Northcote Parkinson

Doubt, indulged and cherished, is in danger of becoming denial; but if honest, and bent on thorough investigation, it may soon lead to full establishment of the truth.


Ambrose Bierce

It's not denial. I'm just selective about the reality I accept.

Bill Watterson


Security is when everything is settled. When nothing can happen to you. Security is the denial of life.


Germaine Greer




 ***“INSTEAD OF FACING CLIMATE CHANGE, SOCIAL ETIQUETTE, CULTURAL NARRATIVES AND BELIEFS HELP FORM A SHIELD ALLOWING US TO ‘LOOK THE OTHER WAY’ AND LEAD OUR DAILY LIVES CALMLY.”¹***

- 🌐 Eighty-three percent of Americans believe Earth is heating up (<http://www.reuters.com/assets/print?aid=USTRE78D5B220110915>).
- 🌐 However, most Americans live as though global warming is not occurring, even while knowing it is.
- 🌐 Some common denial statements follow.
 - (1) It will not happen in my lifetime.
 - (2) Technology will solve the problem.
 - (3) I did not do this.
 - (4) Wind turbines (non-carbon alternative energy sources) kill bats and birds and ruin the view.
 - (5) And, from enlightened cynics: “When on the Titanic — go first class.”

HOWEVER, CULTURAL/GROUP DENIAL IS FAR MORE FORMIDABLE AN OBSTACLE TO FREE AND OPEN DISCOURSE.

 ***“Norway has the highest standard of living in the world and the highest percentage of newspaper readership, as well as extremely high grassroots political and voting activity.”² Global warming has affected Norway dramatically because of its northerly location, but Norwegians still have a global warming denial pattern similar to that in the United States.²***

 **MOST PEOPLE PROFESS SUPPORT OF SCIENCE; HOWEVER, WHEN THEY REJECT TWO OF THE MOST ROBUST BODIES OF EVIDENCE THE SCIENTIFIC PROCESS HAS GENERATED (I.E., CLIMATE CHANGE AND EVOLUTION), THEIR ACTIONS ARE ANTI-SCIENCE.**



-  **The scientific process has not generated contrary evidence to either climate change or evolution.**
-  **Rejecting scientific evidence just because it conflicts with one's ideology or generates fear is irrational.**
-  **One cannot rationally reject the science on selected issues (e.g., climate warming) while simultaneously benefiting from the scientific evidence on disease control, drugs that increase longevity, electronics, and national security.**



THE IDEA OF “BALANCE” AS USED BY THE NEWS MEDIA IS TO HAVE A SPOKESPERSON(S) FROM EACH SIDE (BELIEVERS VS DENIERS) ON THE GLOBAL WARMING EVIDENCE.


- ① The distribution in the “balance” is far from equal — “*The UE [unconvinced by the evidence] group comprises only 2% of the top 50 climate researchers as ranked by expertise (number of climate publications), 3% of researchers of the top 100, and 2.5% of the top 200 . . .*”³
- ① In cases such as climate change, “balance” gives the impression that scientists are divided on the issue when they are not.
- ① Use of “balance” distorts the amount of evidence and the number of scientists confident in the evidence.
- ① Science uses the preponderance of evidence usually generated by the majority of qualified scientists in that area of research.

THE UNITED STATES DEFENSE REVIEW TAKES CLIMATE CHANGE SERIOUSLY.

-  ***“Climate change and energy are two key issues that will play a significant role in shaping the future security environment. . . . Although they produce distinct types of challenges, climate change, energy security, and economic stability are inextricably linked.”⁴***
-  ***“If the QDR [Quadrennial Defense Review] gets any play from the press, it could help convince skeptical Americans — both in and out of public office — that climate change is not a fiction cooked up by environmentalists. It represents the consensus opinion of the American military establishment, and it declares in no uncertain terms that climate change is a grave danger, set to ‘act as an accelerant of global instability and conflict.’”⁴***










RESISTING SCIENTIFIC EVIDENCE ABOUT CLIMATE CHANGE HAS NOTHING TO DO WITH SCIENCE.




 *“That global warming has been made a battleground in the wider culture war is most apparent from the political and social views of those who reject climate science outright. In 2008, they accounted for seven per cent of US voters, rising to 18 per cent if those with serious doubts are added. Among those who dismiss climate science, 76 per cent describe themselves as ‘conservative’ and only three per cent as ‘liberal’ (with the rest ‘moderate’). They overwhelmingly oppose redistributive policies, programs to reduce poverty and regulation of business. They prefer to watch Fox News and listen to Rush Limbaugh. Like those whose opinions they value, these climate deniers are disproportionately white, male and conservative — those who feel their cultural identity most threatened by the implications of climate change.”⁵*

 Clearly, more scientific evidence will not reduce the denial of climate change.

ECONOMIC GROWTH IS DOING MORE HARM, ESPECIALLY LONG TERM, THAN GOOD. CONSIDERING A STEADY STATE ECONOMY IS LONG OVERDUE.

-  Humanity acts as if the human economy is its life support system, not the Biosphere.
-  How else can statements such as “Protecting the environment is acceptable if doing so does not pose a threat to the economy!” be regarded as common sense?
-  Humans act like conquerors of nature, not nature’s dependents.
-  By burning fossil fuel in amounts that, if continued, will result in collapse of the Biosphere, humans are acting as if they are immune from natural law.
-  Mother Nature (the universal laws of biology, chemistry, and physics) can neither be ignored nor appeased by statements of “respect.”
-  “*We [humans] are the giant meteorite of our time.*”⁶

 **CLIMATE CHANGE DENIAL IS A FUTILE, ALTHOUGH POLITICALLY POWERFUL, ATTEMPT TO ASSERT THAT HUMANS NEED NOT OBEY UNIVERSAL LAWS AND TO DENIGRATE THE SCIENTISTS AND SCIENTIFIC EVIDENCE THAT CONFIRM THE CONSEQUENCES OF IGNORING THESE LAWS.**

-  **The universal laws will triumph — they always do — but, the collapse of the present Biosphere will cause enormous suffering and probably the extinction of *Homo sapiens*.**
-  **Perpetual economic growth is simply not possible on a finite planet with finite resources.**
-  **The anti-science war is a pyrrhic “victory” that is being achieved by staggering damage to the Biosphere.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg and Paul Ehrlich for calling useful references to my attention.

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CHAPTER 27

Preserving the Present Biosphere Requires Steady State Economics

First a preliminary point. The verb 'to grow' has become overladen with positive value connotations that we have forgotten its first literal denotation, namely, 'to spring up and develop to maturity.' Thus the very notion of growth includes some concept of maturity or sufficiency, beyond which point physical accumulation gives way to physical maintenance; that is growth gives way to a steady state. It is important to remember that 'growth' is not synonymous with 'betterment.'
Daly 2010

We [humans] are the giant meteorite of our time.
E. O. Wilson 2007

If it is agreed that economic output is a good thing it follows by definition that there is not enough of it.
The US President's Council of Economic Advisors
1971, p. 92

The existing propensities of the population and policies of the government constitute claims upon GNP that can only be satisfied by economic growth.
The US President's Council of Economic Advisors
1971, p. 88

The Basic Situation

Humanity occupies a finite planet with finite resources. Nonrenewable resources (e.g., metals) are clearly finite but can be recycled. Even renewable resources are finite because they are regenerated by a finite biosphere. Finite resources limit the growth of the human population because it has been growing exponentially, and neither nonrenewable nor renewable resources are. In fact, climate change is, at least temporarily, reducing agricultural productivity and, thus, is also reducing Earth's carrying capacity for humans. If ecological overshoot continues, more humans will be forced to live in misery.

The Biosphere is a dynamic system and varies within limits. So, a steady state human economy would have to be based on the reality that the availability of renewable resources would not be constant. Inevitably, a temptation would be to use natural capital when the availability of renewable resources diminished, but this lure would be a fatal, unsustainable error.

Steady State is Not Stagnation

Humanity would do well to emulate nature, i.e., a comparatively short period of rapid growth is followed by a much longer period of maintenance. This situation is not stagnation but rather a model of efficient use of resources, especially energy. Humankind copies nature in only one major way — once a human has completed the rapid growth phase and reaches maturity, every effort is made to increase that individual's longevity. Until recently, the results have been remarkable because human life expectancy in developed countries nearly doubled in the 20th century. Inhabitants of third world countries are still likely to have a short life.

The prospects for sustainable use of resources for the remainder of the 21st century do not look good. Humanity has badly neglected maintenance of societal infrastructure during a period of rapid economic growth. Dams, roads, and municipal water treatment and delivery systems are badly in need of repair or replacement; the same is true of waste treatment systems and some coal-fired electricity generating plants that are very old. If old, coal-fired plants are replaced with more coal-fired power plants, runaway climate change will be the result. This threat could also be increased if more carbon is released into the atmosphere by the thawing permafrost and/or frozen hydrated methane on the ocean floor.

The Decline of the “Shop ‘Til You Drop” Mentality

Humanity has already entered the era of resource scarcity, or, as Garret Hardin frequently stated: “There is an overage of demand.” This situation is the result of both exponential human population growth and increased individual consumption of resources. Hardin (1972) used a spaceship, named Beagle (the ship that took Charles Darwin to the Galapagos Islands was the HMS Beagle), as a metaphor for the problem of finite resources and finite space that are similar to those of Spaceship Earth. The major difference is one of scale. On a spaceship, space and resources are finite and growth is limited. Humanity is either unwilling or unable to admit that the same limits operate on “Spaceship Earth.”

In this country [the United States], shopping is not just a national pastime. Consumer spending . . . is a sort of patriotic duty — never more so than in the last four years of economic malaise. . . . But what if all roads to prosperity don't lead to the shopping mall, as most economists would have us believe? What if, in fact, all that shopping — and the imperative to grow corporate profits quarter after quarter and continuously expand the economy — was actually the root of many of the problems we face today? (MacDonald 2011).

What about finite resources on a finite planet with an increasingly damaged Biosphere?

The problem . . . is that the economy [human economy], once an inconsequentially small part of the natural world, has become so supersized that — sort of like an ingrown toenail or an evasive Japanese knotweed bush — it's now growing into the remaining ecosphere [Biosphere] and jeopardizing our ecological life supports: things like drinkable water, fresh air and stable climate (Daly as quoted in MacDonald 2011).

The human economy is a subset of the Biosphere rather than the Biosphere being a subset of the human economy, which is the unstated but acted upon belief of the perpetual economic growth advocates. Both renewable resources and ecosystem services are generated by the finite Biosphere and are essential for human survival. The human economy could not survive without humans who are, like it or not, one of the millions of species that are the basic components of the Biosphere. However, humans almost certainly could not survive without the present Biosphere in which they evolved.

Will the Real Renegades Please Stand Up?

The general public cannot determine whether economists or ecologists are accurately predicting the future of life on Earth if “business as usual” continues.

Broadly stated, most ecological problems reduce to the single problem of balancing supply and demand. That may sound simple enough, but the two words supply and demand stand for utterly disparate things. Supply is strictly limited, though we often cannot state the limits with any precision. Demand, however, is essentially unlimited, because the word implies demands made by human beings. There is no intrinsic limit to the demands that can be made by people (Hardin 1993, p. 3).

Uncertainty in science has been used to delay action on reduction of anthropogenic greenhouse gas emissions in the United States despite the fact that uncertainty exists in all aspects of life — politics, football, the stock market, retirement, longevity, and even the supply of food. Scientists have been accused of conspiracy, perpetuating a hoax, misuse of research funding, altering data, and so on (e.g., Oreskes and Conway 2011). Such assaults would not be possible if the general public, their elected representatives, and the news media were more literate about the way scientists work, the scientific process of quality control, and the careful monitoring of research funding. The anti-science movement, reductions in funding for education, decline in human values, and obsession with economic growth have kept environmental literacy at bay.

“. . . a society's overall happiness is linked to income equality. . . . less equal societies like the United States have higher rates of anxiety and illness, violence, teenage pregnancies, obesity, drug abuse and eroding public trust. And they tend to consume excessively, among other negative effects” (Wilkinson and Pickett 2009). “In a world of finite resources, constrained by strict environmental limits, still characterized by ‘islands of prosperity’ within ‘oceans of poverty,’ are ever-increasing incomes for the already-rich really a legitimate focus for our continued hope and

expectations? Or is there perhaps some other path towards a more sustainable, a more equitable form of prosperity?" (Jackson 2011, p. 4).

Accepting a New World View

Well some people believe in climate change, but the main thing is they don't believe that humans have anything to do with climate change. And it isn't about the science, because when you delve deeper into it and ask why people don't believe in it, they say that it's because they think it's a socialist plot to redistribute wealth. . . . But something very different is going on on the right, and I think we need to understand what that is. Why is climate change such a threat? I don't believe it's an unreasonable fear. I think it's unreasonable to believe that scientists are making up the science. They're not. It's not a hoax. But actually climate change really is a profound threat to a great many things that right-wing ideologues believe in. So, in fact, if you really wrestle with the implications of the science and what real climate action would mean, here's just a few examples what it would mean (Klein 2011) [list condensed].

(1) It would mean upending the whole free trade agenda, because it would mean that we would have to localize our economies, because we have the most energy-efficient trade system that you could imagine.

(2) You would have to deal with inequality. You would have to redistribute wealth. . .

(3) You would have to regulate corporations. . . . You would have to subsidize renewable energy, which also breaks their worldview.

(4) You would have to have a really strong United Nations, because individual countries can't do this alone. You absolutely have to have a strong international architecture.

So when you go through this, you see, it challenges everything that they [the deniers] believe in. So they're choosing to disbelieve it, because it's easier to deny the science than to say, 'OK, I accept that my whole worldview is going to fall apart,' that we have to have massive investments in public infrastructure, that we have to reverse free trade deals, that we have to have huge transfers of wealth from the North to the South. Imagine actually contending with that. It's a lot easier to deny it (Klein 2011).

The denial of scientific evidence also includes evolution. Almost certainly, a religious component exists to the denial of scientific evidence on evolution.

Can the Worldview be Changed Before Runaway Climate Change Occurs?

Any prospect of developing a sustainable worldview must include

- (1) a steady state economy
- (2) a reduction in human population size to fit Earth's carrying capacity
- (3) a rapid transition to non-carbon energy sources
- (4) an acceptance that the Biosphere is humanity's life support system and the source of the renewable resources essential to the human economy
- (5) an acceptance of science as essential to humanity's future and an expression of public disapproval of both individuals and corporations that attack scientists and scientific evidence without robust scientific evidence of their own
- (6) an overturn of the US Supreme Court's ruling that corporations should be regarded as human although they do not belong to the genus *Homo* or the species *Homo sapiens*
- (7) an acceptance that global problems cannot be resolved by individual nations — a global political organization with more authority than the United Nations is essential

Conclusions

"A new politics of the common good isn't only finding more scrupulous politicians. It also requires a more demanding idea of what it means to be a citizen, and it requires a more robust public discourse — one that engages more directly with moral and even spiritual questions" (Sandel 2009).

"Society is faced with a profound dilemma. To resist growth is to risk economic and social collapse. To pursue it relentlessly is to endanger the ecosystems [i.e., the Biosphere] on which we depend for long-term survival" (Jackson 2011, p. 187). "We've seen how a faulty economics drives and is driven by a distorted social logic. But

we've also seen that a different economics is achievable. A better and fairer social logic lies within our grasp. Neither ecological limits nor human nature constrain the possibilities here: only our capacity to believe in and work for change" (Jackson 2011, p. 204).

The denial of science and scientific evidence may really be a rejection of the worldview that will be essential to reduce the risk of collapse of the present Biosphere. The polarization of political ideologies is a major obstacle to reaching the worldview that might save the present Biosphere. Uncertainties abound, but one thing is abundantly clear — "business as usual" is unsustainable.


Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich, Paul Kullberg, and Shireen Parsons for calling useful references to my attention.




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CHAPTER 28

THE NINTH THREAT TO THE BIOSPHERE: HUMAN THOUGHT PROCESSES

 **“PEOPLE TEND TO ASSESS THE RELATIVE IMPORTANCE OF ISSUES BY THE EASE WITH WHICH THEY ARE RETRIEVED FROM MEMORY — AND THIS IS LARGELY DETERMINED BY THE EXTENT OF COVERAGE IN THE [NEWS] MEDIA. FREQUENTLY MENTIONED TOPICS POPULATE THE MIND EVEN AS OTHERS SLIP AWAY FROM AWARENESS.”¹**

-  When did the news media last print or broadcast a threat to the Biosphere?
-  Human thought processes strongly influence the perception of risk from biospheric collapse; consequently, they will determine the probability of future civilizations and the survival of *Homo sapiens*. This possibility constitutes the ninth interactive global crisis (eight crises are listed by Cairns²).
-  Clearly, the news media will bear a heavy responsibility for communicating the level of scientific confidence that can be placed on climate change statements as well as statements on all global crises.


POLICY MAKERS, THE GENERAL PUBLIC, AND THE NEWS MEDIA MUST BECOME MUCH MORE LITERATE ABOUT THE PROBABILITY OF MAJOR THREATS TO THE BIOSPHERE.





-  For example, huge releases of stored methane in oceanic sediment possibly will produce a powerful positive feedback loop that could accelerate the rate of global warming.
-  Release of stored methane is not congruent with either sustainability (which implies use for an indefinite period of time) or the precautionary principle (which states that precautionary action is appropriate, even if scientific evidence is not robust, if the consequences of inaction might be catastrophic).
-  Humanity must take a long-term view of each crisis if it wishes to leave a habitable planet for posterity.



SINCE THE AGRICULTURAL REVOLUTION ABOUT 12,000 YEARS AGO, EARTH'S CLIMATE HAS BEEN RELATIVELY STABLE COMPARED TO ABRUPT CHANGES IN THE DISTANT PAST.

- 🌐 One trigger of abrupt climate change is “. . . shutdowns of the Great Ocean Conveyor — the vast network of ocean currents that circulate water, heat, and nutrients . . .” over about 71 percent of Earth's surface.³
- 🌐 One of the important issues of the 21st century is whether global warming could cause the conveyor to shut down, resulting in rapid change from one global state to another.
- 🌐 Humanity's governance systems and personal mind sets are unprepared for such rapid transitions.
- 🌐 “The climate models are bigger and more sophisticated than ever, . . . but they are yielding the same wide range of possible warming and precipitation changes as they did 5 years ago.”⁴
- 🌐 Can human thought processes cope with these challenges?


 **“... WE ALSO TEND TO EXAGGERATE OUR ABILITY TO FORECAST THE FUTURE, WHICH FOSTERS OPTIMISTIC OVERCONFIDENCE. IN TERMS OF ITS CONSEQUENCES FOR DECISIONS, THE OPTIMISTIC BIAS MAY WELL BE THE MOST SIGNIFICANT COGNITIVE BIAS.”⁵**


-  In 2011, *“the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling . . . recommended sweeping changes in the way industry and government manage offshore drilling.”⁶*
-  *“But few of the recommendations have been implemented. [The US] Congress has taken no action at all.”⁶*
-  The US administration has approved plans for exploratory drilling in the Arctic Ocean, but *“... the drilling plan ignores the urgent need to transition to a sustainable energy economy that would stabilize climate and provide economic and environmental security.”⁶*
-  This situation appears to be due to excessive optimism as a substitute for robust scientific information or it results from appalling ignorance.




“THE EVIDENCE SUGGESTS THAT AN OPTIMISTIC BIAS PLAYS A ROLE — SOMETIMES THE DOMINANT ROLE — WHENEVER INDIVIDUALS TAKE ON SIGNIFICANT RISKS.”⁷

- ① ***“The most detailed data yet on heat-trapping gases show that U.S. power plants are responsible for the bulk [72%] of the pollution blamed for global warming.”⁸***
- ① **However, new power plants are still being built, although regulations on pollution could be released as early as January 2012.⁸**
- ① ***“Eventually the EPA will have to tackle facilities already in operation.”⁸***
- ① **At present, the transition to alternative energy sources is dangerously slow.**

 **“OUR SOCIETAL INFRASTRUCTURE WAS BUILT WITH AND EXPECTED TO CONTINUE ON CHEAP LIQUID FUELS AND FEW EXTERNALITIES. THIS FIXED INFRASTRUCTURE COUPLED WITH A PRETTY MUCH INSATIABLE HUMAN DEMAND DRIVE FOR ENERGY SERVICES MAY RESULT IN A ONCE-IN-A-SPECIES CRISIS IF OUR PLANETARY RESOURCES AND ECOSYSTEMS CAN NO LONGER KEEP PACE.”⁹**

 *“It’s not that I don’t believe that oil will peak someday — it’s just that the doom and gloom people are always wrong — somehow something will come along and in 5 years you’ll say ‘well, how could I have about XXX?’”⁹*

 The “deniers” do not feel a responsibility to provide contrary scientific evidence, but merely state that someone (a deity?) or something (new technology?) will save humanity.

 This attitude is a superb example of the mindless dismissal of scientific evidence when environment concerns are expressed, even when the quality of the evidence is very high.



THE MONKEY TRAP STORY IS A SUPERB METAPHOR FOR THE HUMAN TENDENCY TO HANG ON TO RISKY, INAPPROPRIATE THOUGHT PROCESSES.

- 🌐 *“Monkey-hunters use a box with an opening at the top, big enough for the monkey to slide its hand in. Inside the box are bananas. The monkey grabs the banana and now its hand becomes a fist. The monkey tries to get its hand out but the opening is big enough for the hand to slide in, but too small for the fist to come out. Now the monkey has a choice, either to let go of the banana and be free forever or hang on to the banana and get caught”* (<http://mylifemantras.blogspot.com/2009/11/monkey-trap-story-how-to-catch-monkeys.html>).
- 🌐 The moral of the story: *“We [humans] are no different from monkeys. We all hang on to some bananas that keep us from going forward in life. We keep rationalizing by saying, ‘I cannot do this because . . . ‘ and whatever comes after ‘because’ are the bananas that we are hanging on to which are holding us back”* (<http://mylifemantras.blogspot.com/2009/11/monkey-trap-story-how-to-catch-monkeys.html>).
- 🌐 Humanity is facing nine threats to the Biosphere, but instead of drawing people together, they have polarized humankind into ideological groups that emphasize differences rather than common values.



HOMO SAPIENS HAS BEEN A SMALL GROUP SPECIES FOR ALMOST ALL OF ITS 200,000 YEARS ON EARTH, AND HUMANITY'S THOUGHT PROCESSES HAVE PRIMARILY REMAINED AT THE LOCAL/REGIONAL LEVEL.

- 🌍 *“And as our nation [the United States] becomes more polarized at the national political level, it becomes all the more important to nurture the commonality we have at the local level, where people care about what they’ve always cared about: their children, their families, their schools, their communities. And it’s our mayors who are best positioned to take advantage of these bonds — especially given that many of our national leaders have given up even trying.”¹⁰*
- 🌍 **Of course, global crises would require attention, but the present political system has not had any notable success with them.**
- 🌍 **If economies were regionalized, they would almost certainly be less harmful than financial and corporate globalization have been.**



“THE MIND IS GOOD WITH STORIES, BUT IT DOES NOT APPEAR TO BE WELL DESIGNED FOR THE PROCESSING OF TIME.”¹¹

- 🌐 **Global crises involve exponential growth — in population, economic expectations, resource consumption, greenhouse gas emissions, and expectations for improved standards of living.**
- 🌐 ***“The belief that bigness is best that dominated the 1950s and 1960s has faded.”¹²***
- 🌐 **Time perspective is lacking when considering lifting a moratorium on uranium mining in Virginia despite the risk from radiation from tailings disposal sites for thousands of years.¹³**
- 🌐 **To make sustainability a reality, humanity must acknowledge that its survival is closely linked with the health and integrity of the present Biosphere.**



QUOTES FROM CARL SAGAN

(http://en.wikiquote.org/wiki/Carl_Sagan) ESTABLISH A
CONTEXT FOR DEALING WITH GLOBAL CRISES.

- 🌍 *“We find that we live on an insignificant planet of a hum-drum star lost in a galaxy tucked away in some forgotten corner of a universe in which there are far more galaxies than people.”*
- 🌍 *“If we long for our planet to be important, there is something we can do about it. We make our world significant by the courage of our questions and by the depth of our answers.”*
- 🌍 *“The suppression of uncomfortable ideas may be common in religion or in politics, but it is not the path to knowledge and there is no place for it in the endeavor of science.”*
- 🌍 *“If we are to survive our loyalties must be broadened further to include the whole human community, the entire planet Earth.”*

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication.

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CHAPTER 29

WARNINGS FROM THE BIOSPHERE


***“OFTEN IT TAKES SOME CALAMITY
TO MAKE US LIVE IN THE
PRESENT. THEN SUDDENLY WE
WAKE UP AND SEE ALL THE
MISTAKES WE HAVE MADE.”***




Bill Watterson






THE DELETERIOUS CHANGES IN THE BIOSPHERE, WHICH ARE NOW OCCURRING WITH INCREASED RAPIDITY, SHOULD SERVE AS WARNINGS, UNLIKE THE FAIRLY STABLE, FAVORABLE CONDITIONS THAT HAVE EXISTED FOR THE PAST 10,000 YEARS.

- 🌐 These warnings are detected and reported by research scientists who are increasingly under assault by the “merchants of doubt”¹ funded by special interest corporations.
- 🌐 *“Most people are concerned about climate change, but not enough to embrace it as reality. . . 12 percent of people are alarmed about climate change, 27 percent are concerned, 25 percent are cautious, 10 percent are disengaged, 13 percent are dismissive.”²*
- 🌐 These conditions are not encouraging for coping quickly and effectively with nine rapidly worsening interactive global crises.³

 **WARNINGS CAN MANIFEST THEMSELVES AT THE SPECIES LEVEL (E.G., POLAR BEARS). FOR EXAMPLE, “*RISING HUMAN CARBON DIOXIDE EMISSIONS MAY BE AFFECTING THE BRAINS AND CENTRAL NERVOUS SYSTEM OF SEA FISHES WITH SERIOUS CONSEQUENCES FOR THEIR SURVIVAL . . .*”⁴**

-  The responses of other life forms should persuade humans that dangerous changes are occurring on the planet that place *Homo sapiens* at risk either directly or indirectly.
-  One major conceptual obstacle to addressing such problems is the delusion that *Homo sapiens* is apart from nature rather than a part of nature (i.e., the Biosphere).
-  Charismatic species (e.g., tiger) are useful in focusing public attention on ecosystem damage.

AT THE OTHER END OF THE COMPLEXITY SCALE (I.E., FROM SPECIES) IS THE COMPLEX BIOSPHERE, OF WHICH ABOUT 71 PERCENT OF EARTH'S SURFACE IS THE OCEANS.




-  *“Might a penguin’s next meal be affected by the exhaust from your tailpipe? The answer may be yes when you add your exhaust fumes to the total amount of carbon dioxide lofted into the atmosphere by humans since the industrial revolution. One-third of that carbon dioxide is absorbed by the world’s oceans making them acidic and affecting marine life.”⁵*
-  *“Although our primary guide to the future will remain the simulations carried out in coupled atmosphere ocean computer models, they have, as yet, proven incapable of replicating some important features of the paleo record. The reason is that they fail to properly represent powerful amplifiers and feedback mechanisms present in the real-world system, thus the interplay between these two ways of looking at the climate system has become an important aspect of our science.”⁶*
-  Abrupt climate change has happened in the past and could happen again, placing humanity at greatly increased risk.






THE AGRICULTURAL SYSTEM, WHICH IS PART OF THE BIOSPHERE, IS NOT PROVIDING THE FOOD SUPPLY SECURITY IT DID IN THE LAST CENTURY.⁷


- ① ***“The world’s farmers produced more grain in 2011 than ever before. Estimates from the U.S. Department of Agriculture show the global grain harvest coming in at 2,295 million tons, up 53 million tons from the previous record in 2009. Consumption grew by 90 million tons over the same period to 2,280 million tons. Yet with global grain production actually falling short of consumption in 7 of the past 12 years, stocks remain worrying low, leaving the world vulnerable to food price shocks”***
(www.earth-policy.org/indicators/C54/grain/2012).
- ① **The FAO⁸ describes the results of food scarcity and insecurity: *“Under-nourishment is not merely a symptom of poverty but also one of its causes. Poverty is not simply a lack of income or consumption but includes deprivation in health, education, nutrition, safety, legal and political rights and many other areas. All these dimensions of deprivation interact with and reinforce each other.”***
- ① **Scientists gather evidence on biospheric warnings but are being attacked for doing so.**




OFTEN LOST IN THE DISCOURTEOUS ATTACKS ON THE SCIENCE OF CLIMATE CHANGE IS THE NEED FOR ENLIGHTENED DISCOURSE ON INTERGENERATIONAL ETHICS.

-  Intergenerational ethics espouse leaving a habitable planet for future generations, nurturing the present Biosphere to make this bequest possible, avoiding both ecological tipping points and amplifying feedback loops that increase the probability of runaway climate change.
-  Living unsustainably damages the Biosphere and steals a quality future from subsequent generations, which is both unethical and immoral.
-  *“Maintaining a climate that resembles the Holocene, the world of stable shorelines in which civilization developed, requires rapidly reducing CO₂ emissions.”⁹*





ANTHROPOGENIC DAMAGE TO THE BIOSPHERE IS AN ETHICAL/MORAL ISSUE OF UNPRECEDENTED SCOPE IN HUMAN HISTORY WITH FREQUENT WARNINGS FROM COMPONENTS OF THE BIOSPHERE.

-  For example, drought affects agricultural productivity and is evident in increased prices for staples (e.g., wheat), which consumers recognize quickly.
-  The dead zones in oceans reduce the harvest from fisheries.
-  Warming is a factor in increasing the range of human diseases and agricultural pests.

 **“THE TRAGEDY OF HUMAN-MADE CLIMATE CHANGE, SHOULD THE RUSH TO EXPLOIT ALL FOSSIL FUELS CONTINUE, IS THAT TRANSITION TO CLEAN ENERGIES AND ENERGY EFFICIENCY IS NOT ONLY FEASIBLE BUT ECONOMICALLY SENSIBLE. ASSERTIONS THAT PHASE-OUT OF FOSSIL FUELS WOULD BE UNACCEPTABLY COSTLY CAN BE TRACED TO BIASED ASSUMPTIONS THAT DO NOT ACCOUNT FOR THE COST OF FOSSIL FUELS TO SOCIETY OR INCLUDE THE BENEFITS OF TECHNOLOGY INNOVATIONS THAT WOULD EMERGE IN RESPONSE TO AN APPROPRIATE PRICE ON CARBON EMISSIONS.”⁹**

-  How can humanity be so indifferent to the effects on future generations? Biospheric collapse is not just possible — it is probable if “business as usual” continues.
-  Cumulative, irreversible changes will produce a planet quite different, almost certainly more hostile, than the planet on which *Homo sapiens* evolved and flourished.
-  “By 2100, global climate change will modify plant communities covering almost half of Earth’s land surface and will drive the conversion of nearly 40 percent of land-based ecosystems from one major community type — such as forest, grassland or tundra — toward another according to a new NASA and university computer modeling study.”¹⁰

REGRETABLY, EVEN WHEN BIOSPHERIC DAMAGE IS ABUNDANTLY CLEAR AND THE SCIENTIFIC EVIDENCE VERY STRONG, DESTRUCTIVE AND UNSUSTAINABLE PRACTICES CONTINUE.

-  An example is “*A school of jack mackerel in the Southern Pacific. Stocks of fish, rich in oily protein, have declined from 30 million metric tons to less than a tenth of that in two decades.*”¹¹ The cause is overfishing.
-  Climate change induced water shortages are a global reality not yet squarely faced by humanity. For example, snow drought is occurring in Colorado¹² and the Peruvian Andes,¹³ but not enough is being done to reduce anthropogenic carbon dioxide emissions.
-  Climatologist James “*Hansen argues that climate ‘loads the dice,’ . . . So, in an average year you might have a one in six chance of extraordinarily hot weather or a super-violent storm.*”¹²
-  However, the well funded campaign to cast doubt on scientific evidence has resulted in inaction.



THE HUGE AMAZON RAINFOREST IS OFTEN CALLED “THE LUNGS OF THE WORLD,” BUT THE EFFORTS TO PROTECT THE FOREST HAVE BEEN WEAKENED RECENTLY.

- 🌍 *“The fight over the [47-year-old] Forest Code [that protects the forest] has stoked the age-old struggle over development versus conservation in Brazil. . .”¹⁴*
- 🌍 *“We have to reconcile the generation of income with sustainability”¹⁵*
- 🌍 However, *“If people abide by the law — a big if — . . . The Brazilian Amazon has a chance by 2020 to become a ‘carbon sink,’ in which the amount of forest being replanted is larger than the amount being deforested.”¹⁴*
- 🌍 Even so, young trees require extended growth periods to mature and may not survive in the deforested area. What then?



OF THE NINE INTERACTIVE GLOBAL CRISES,³ ARGUABLY THE ONE IN WHICH THE MERCHANTS OF DOUBT HAVE MISREPRESENTED SCIENTISTS AND SCIENTIFIC EVIDENCE MOST IS EXPONENTIAL POPULATION GROWTH.

- 🌍 To adapt to a rapidly changing world, scientific evidence is essential.
- 🌍 For example, “*The world is running out of time to make sure there is enough food, water and energy to meet the needs of a rapidly growing population and to avoid sending up to 3 billion people into poverty. . .*”¹⁶
- 🌍 Of course, stabilizing the human population is an option to solving this problem, but no one wants to talk about population stabilization.
- 🌍 “*A drought . . . called the most severe Mexico had ever faced has left two million people without access to water and, coupled with a cold snap, has devastated cropland in nearly half the country.*”¹⁷



JAPAN HAS BEEN OVERPOPULATED FOR THE PAST 100 YEARS, HAS A HIGH PERCENTAGE OF ELDERLY PEOPLE, A FOOD AND ENERGY SHORTAGE, AND LACKS NATURAL RESOURCES FOR 128 MILLION PEOPLE.¹⁸

- 🌍 **Even with a stable population, Japan is facing resource shortages because of dependence on external sources.¹⁸**
- 🌍 ***“Without abundant cheap fuel and fertiliser, it is possible that if Japan reorganized most of its population into agricultural work units it [could] again feed the 30 million people it did in the Edo period in the 19th [century]. With abundant cheap fuel (and therefore fertiliser) it might feed half its present population.”¹⁸***
- 🌍 **In an era of resource scarcity/ecological overshoot, the entire population of Earth will face problems similar to Japan’s.**
- 🌍 **Global climate change may further diminish resource regeneration, which will necessitate “solving” resource scarcity; however, the probability of importing resources from other areas will diminish or disappear.**



HUMANITY IS FACED WITH A SEVERE RESOURCE CRISIS BECAUSE IT IGNORED AND CONTINUES TO IGNORE “WARNINGS” FROM THE BIOSPHERE AND ALLOWS SPECIAL INTEREST GROUPS TO DENIGRATE THE SCIENTISTS WHO PROVIDE ROBUST SCIENTIFIC EVIDENCE.

- ① **The longer humanity continues “business as usual,” the more difficult aspiring to sustainable use of the planet will be.**
- ② **Resource allocation is an ethical/moral issue and solutions must be framed in that context.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich and Paula Kullberg for calling useful references to my attention.

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CHAPTER 30

GETTING TO KNOW HUMANITY'S LIFE SUPPORT SYSTEM: EARTH'S BIOSPHERE*



“HUMANITY IS A BIOLOGICAL SPECIES IN A BIOLOGICAL WORLD.”¹

-  ***“In every function of our bodies and minds and at any level, we are exquisitely well adapted to live on this particular planet. We belong in the biosphere of our birth. Although exalted in many ways, we remain an animal species of the global fauna.”¹***
-  ***“Our lives are restrained by the two laws of biology: all of life’s entities and processes are obedient to the laws of physics and chemistry; and all of life’s entities and processes have arisen through evolution by natural selection.”¹***



***BIOSPHERE FEAR* — THE FEAR THAT PROTECTING THE BIOSPHERE FOR POSTERITY WILL REQUIRE A MAJOR CHANGE IN WORLDVIEW ON SUCH ISSUES AS ECONOMIC AND POPULATION GROWTH, INCOME EQUITY, RESOURCE CONSERVATION, CONSUMERISM, ENERGY, AND BIODIVERSITY.**

- 🌍 **People believe the deniers because they truly fear changing their worldview.**
- 🌍 **A new worldview is the only way to protect the present generation's children, grandchildren, and their descendants.**
- 🌍 **The human economy is a subset of the Biosphere and cannot rationally be higher on humankind's priority list than nurturing the biospheric life support system.**
- 🌍 **For almost all of the 200,000 years that *Homo sapiens* has existed, a sustainable life style has been the norm.**
- 🌍 **Unsustainable living must cease.**

HUMANITY DEVELOPED AND, AT TIMES, FLOURISHED IN THE PRESENT BIOSPHERE AND IS ACTING AS IF IT WILL PERSIST REGARDLESS OF THE AMOUNT OF HUMAN-CAUSED DAMAGE.

- 🌍 This perception that the Biosphere will persist regardless of treatment is simply not true. Five great biotic extinctions have occurred before the present Biosphere evolved.
- 🌍 The sixth great extinction is already in progress and will cause the sixth biospheric collapse if present unsustainable practices continue.
- 🌍 Life on Earth is probably not in danger because biodiversity has been restored, over evolutionary time, after each great extinction. However, the restored biodiversity may not include the human species.
- 🌍 What is threatened is human civilization, which is dependent on the present Biosphere and which could not have developed or persisted in previous Biospheres.



THE PRESENT BIOSPHERE PROVIDED CONDITIONS SUITABLE FOR SEVEN SPECIES IN THE GENUS *HOMO*, OF WHICH THE SOLE SURVIVOR IS *HOMO SAPIENS* (HUMANS).






- 🌍 **The present Biosphere provides renewable resources that are the basis of the human economy.**
- 🌍 **Since Earth is finite, the present Biosphere is limited in the amount of renewable resources it can regenerate each year.**
- 🌍 **Therefore, Earth has a finite, long-term carrying capacity for humans, which is far below the 7 billion now alive.**
- 🌍 **Sustainable use of the planet requires compassionate reduction in population size to match Earth's carrying capacity.**




PERPETUAL GROWTH IS VERY DANGEROUS, EVEN CATASTROPHIC, FOR A FINITE PLANET WITH FINITE RESOURCES.

- **The taboos on discussing the nine global crises² that humanity faces place it at enormous risk.**
- **For most species in the Biosphere, a short period of growth is followed by maturity and a comparatively long period of maintenance — a steady state phase.**
- **Nature's universal law is that exponential growth results in resource scarcity, which limits further growth.**
- **A universal political law is to ignore nature's universal law.**
- **How well has the political law worked? Has ignoring universal law negated universal law?**

REALITY CHECK — ON A FINITE PLANET WITH FINITE RESOURCES, EXPONENTIAL HUMAN POPULATION GROWTH IS SUICIDAL.






-  **Living unsustainably damages the biospheric life support system without which humans could not survive.**
-  **Humanity can live sustainably.**
-  **Living within resource limits is the only way to achieve sustainability.**
-  **In Australia, population growth is finally being associated with resource scarcity and high prices.³**
-  **However, in the United States, the heated “discussion” is about contraception and women’s rights rather than humanity’s ethical obligation to make an effort to leave a habitable planet for posterity.**






TO LIVE SUSTAINABLY, HUMANKIND MUST NURTURE THE PRESENT BIOSPHERE SO THAT THE REGENERATION OF RENEWABLE RESOURCES IS DEPENDABLE AND MUST LEARN TO LIVE WITHIN THE LIMITS IMPOSED BY FINITE RESOURCES.

- 🌍 **Ecological overshoot must cease or damage to the Biosphere will continue.**
- 🌍 **Living within limits will require personal sacrifices from all of humankind.⁴**
- 🌍 **Renewable resources regeneration will continue to diminish until the nine interactive crises² that threaten the Biosphere are eliminated.**
- 🌍 **Social unrest will increase as the 3½ billion low-income people have even more difficulty in acquiring food, potable water, shelter, clothing, and other necessities.**
- 🌍 **Income disparity is almost certain to become a major political issue.**



“DURING MOST OF THE EDO PERIOD [1603-1867], JAPAN WAS CLOSED TO THE WORLD. . .”⁵

-  Japan had a stable population of about 30 million and was self sufficient in all resources during the Edo Period.
-  *“As a result, everything was treated as a valuable resource, including materials that would otherwise be considered a nuisance, such as ash. Because brand new goods were expensive and newly manufactured items were virtually unaffordable for ordinary citizens, most ‘end of life’ goods were not discarded as waste, but rather reused and recycled.”⁵*
-  *“The society of Japan during the Edo period was driven only by solar energy.”⁵*
-  *“During the Edo period, about 80 percent of daily commodities was made from the solar energy of the previous year and 95 percent was derived from solar energy received in the past three years.”⁵*
-  This example is a good model of a sustainable society and a useful carrying capacity guide.




THE BIOSPHERE MAKES VERY EFFICIENT USE OF SOLAR ENERGY AND THE WASTES (OUTPUT) FROM SOME OF ITS SPECIES SERVE AS RESOURCES (INPUT) FOR OTHER SPECIES.


-  **The Biosphere is a model of sustainability and yet humankind is rapidly destroying it under the guise of economic growth and progress.**
-  **Sustainable use of the planet emphasizes frugality.**
-  **Sustainable use of the planet emphasizes intergenerational equity.**
-  **Sustainable use of the planet requires nurturing the Biosphere.**
-  **The entire crew of Spaceship Earth must nurture the Biosphere – no room is available for observers or deniers.**
-  **A sustainable culture must share resources (e.g., wealth) more equitably in order to aspire to sustainable use of the planet.**

MAKING SYSTEMATIC, ORDERLY PLANS FOR COPING WITH THE CONSEQUENCES OF CLIMATE CHANGE IS IMPOSSIBLE WHEN A SIGNIFICANT PORTION OF THE POPULATION EITHER DENIES CLIMATE CHANGE OR DOUBTS THE EXTENT OF THE CRISIS.


-  For example, a Natural Resources Defense Council⁶ report notes that “*Only nine states [in the United States] have taken comprehensive steps to address their vulnerabilities to the water-related impacts of climate change, while 29 states are unprepared for growing water threats to their economies and public health.*”
-  This dangerous situation will probably persist until the news media in the United States ceases in giving the releases of the “merchants of doubt”⁷ equal time to the scientific evidence gathered by qualified scientists.



INFORMED SKEPTICISM IS AN ESSENTIAL COMPONENT OF SCIENTIFIC QUALITY CONTROL. UNINFORMED SKEPTICISM IS NOT HELPFUL TO SCIENCE.

-  Climate change skeptics, most lacking robust scientific credentials, have claimed that carbon dioxide lagged increased global mean surface temperatures and did not cause global warming in the past⁸ despite scientific evidence that carbon dioxide traps heat (i.e., greenhouse effect).
-  “. . . the Palaeocene-Eocene Thermal Maximum (PETM), is characterized by a massive input of carbon, ocean acidification and an increase of global temperatures of about 5°C within a few thousand years.”⁹
-  Increasing carbon dioxide was probably the cause of an unusual increase in global mean surface temperature during the last deglaciation.⁸





 **AS THE SCIENTIFIC EVIDENCE MOUNTS THAT ANTHROPOGENIC (I.E., HUMAN) GREENHOUSE GAS EMISSIONS ARE A KEY FACTOR IN GLOBAL CLIMATE CHANGE, “*THE AMERICAN PUBLIC HAS GROWN INCREASINGLY SKEPTICAL OF THE EXISTENCE OF HUMAN-MADE CLIMATE CHANGE.*”¹⁰**

- 🌍 The “. . . *economy impacts the way people prioritize the problem of climate change. . .*”¹⁰
- 🌍 Giving the economy a higher priority than the environment (i.e., the Biosphere) is not rational since the human economy is a subset of the Biosphere, which provides the renewable resources essential to the economy but also serves as the planet’s life support system.
- 🌍 In addition, *Homo sapiens* is a part of the Biosphere, not apart from it.
- 🌍 Climate change is already diminishing the resource base (e.g., agricultural productivity) upon which the human economy is based.


 **“ . . . GREATER SUMMER TEMPERATURE VARIABILITY, A PREDICTED CONSEQUENCE OF CLIMATE CHANGE, IS CAUSING 10,000 ADDITIONAL DEATHS PER YEAR IN THE UNITED STATES. . . ”¹¹**


-  **As usual, the poor will be disproportionately affected, either because they have no air conditioning or they cannot afford the electricity to use it if they have air conditioning.**
-  **The dramatic increase in longevity, which characterized the 20th century in developed countries, will probably decline in the 21st century both because of the direct effects of climate change and the increased range of many diseases.**

DAMAGE TO THE BIOSPHERE WILL AFFECT THE HUMAN ECONOMY ADVERSELY BECAUSE THE BIOSPHERE IS BOTH A PLANETARY LIFE SUPPORT SYSTEM AND THE SOURCE OF RENEWABLE RESOURCES.




-  This situation is already a matter of concern. For example: *“Moving the global economy off its current decline-and-collapse path depends on reaching four goals: stabilizing climate, stabilizing population, eradicating poverty, and restoring the economy’s natural support systems.”*¹²
-  *“These goals . . . are mutually dependent. All are essential to feeding the world’s people. It is unlikely we can reach any one goal without reaching the others.”*¹²
-  *“The key to restructuring the economy is to get the market to tell the truth through full-cost pricing.”*¹²
-  *“If the world is to move into a sustainable path, we need economists who will calculate indirect costs and work with political leaders to incorporate them into market prices by restructuring taxes.”*¹²

TO NURTURE THE BIOSPHERE, HUMANKIND MUST DEVELOP A HARMONIOUS RELATIONSHIP WITH IT: A CO-EVOLUTIONARY RELATIONSHIP.¹³




 *“Achieving a positive balance between production in nature and consumption by humans is not merely one of the ‘options,’ it is an obligatory requirement for sustainability. We must eliminate overshoot as a prerequisite to preserving social justice, creating intergenerational equity and securing a future for global civilization. Otherwise, we will continue to undermine Earth’s natural resource assets, which will cause hardship and suffering for future generations of life on the planet.”¹⁴*


 The term *sustainable economic growth* is an oxymoron, as is *sustainable growth*, since it depends upon resources.




USE OF THE GLOBAL COMMONS MUST BE REGULATED, AS MUST ALL COMPONENTS OF THE BIOSPHERE UNDER CONTROL OF EACH NATION.

-  Global problems can only be solved by a global consensus on use, especially when they involve a global commons such as the oceans.
-  *“The cost of damage to the world’s oceans from climate change could reach \$2 trillion a year by 2100 if measures to cut greenhouse gas emissions are not stepped up . . .”¹⁵*
-  Garrett Hardin’s¹⁶ widely cited “Tragedy of the Commons” identified this problem long ago, but science and public opinion did not halt overexploitation (e.g., over fishing) of the oceanic commons.



THE NINTH THREAT TO THE BIOSPHERE AND THE SURVIVAL OF *HOMO SAPIENS* BOTH INVOLVE HUMAN THOUGHT PROCESSES.²


-  *“People tend to assess the relative importance of issues by the ease with which they are retrieved from memory — and this is largely determined by the extent of coverage in the [news] media. Frequently mentioned topics populate the mind even as others slip away from awareness.”¹⁷*
-  *“... We also tend to exaggerate our ability to forecast the future, which fosters optimistic overconfidence. In terms of its consequences for decisions, the optimistic bias may well be the most significant cognitive bias.”¹⁷*
-  Humanity is not prepared for the alien planet it is creating because it is using inappropriate thought processes (i.e., short-term rather than long-term thinking).





 **“... THAT ASSUMPTION [THAT HUMAN NATURE IS A UNITARY, UNCHANGING THING] OF A SINGLE ENDURING NATURE REMAINS WIDESPREAD, BUT IN MY VIEW IT HAS BECOME A MAJOR ROADBLOCK TO UNDERSTANDING OURSELVES.”¹⁸**

-  The increase in man’s power over his environment has not been accompanied by a concomitant improvement of his ability to make rational use of that power.¹⁹
-  **“Cultural evolution led many past civilizations to extinction. Our global civilization had better move rapidly to modify its cultural evolution and deal with its deteriorating environmental circumstances before it runs out of time.”¹⁸**
-  **“So here we are, small-group animals trying to live, with increasingly rare exceptions, in gigantic groups — trying to maintain health, happiness, and a feeling of connectedness in an increasingly impersonal world in which individual natures are based on an ever smaller fraction of society’s culture.”¹⁸**

HUMANS ARE TOO SMART FOR OUR OWN GOOD ... AND TOO DUMB TO CHANGE.²⁰

-  *“The fundamental problem as regards the continuing existence of the human species is that, while we are ‘smarter’ than other species in our ability to develop technology, we, like them, follow the reaction, pioneering and overshoot principles when it comes to dealing with situations of sudden, continuous or great surplus. In keeping with this, and also like other animals, we are not karyotypically built so as to care about coming generations, other than those with which we have direct contact.”²⁰*
-  *“From the point of view of evolution, to react spontaneously to one’s immediate environment has been the best policy for all species up to now. But now, in our case, in acting spontaneously we are not only worsening the situation for our own species, but for all other complex species as well.”²⁰*

 **REFLECT DEEPLY UPON WHICH HUMAN CONDITION IS PREFERABLE ON A FINITE PLANET WITH FINITE RESOURCES: (1) A GLOBAL POPULATION OF 7 BILLION, ADDING ANOTHER BILLION EVERY 12 YEARS OR (2) A STABLE, GLOBAL POPULATION LIVING WITHIN EARTH'S LONG-TERM CARRYING CAPACITY AND A MORE EQUITABLE DISTRIBUTION OF RESOURCES.**

-  **Note that, in the Edo Period, wealthy people could afford new material goods, but a more equitable distribution of resources resulted in stability.**
-  **Also note that the damage to the Japanese portion of the Biosphere must have been negligible or the population would have been less stable.**
-  **Humanity still has options remaining, but the universal laws of biology, chemistry, and physics will be the ultimate “judge” in determining the wisdom of the selections.**
-  **For *Homo sapiens*, living unsustainably is a sure path to catastrophes.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Karen Cairns for useful comments on the third draft.


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
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CHAPTER 31

TRANSITION FROM A HUMAN CENTERED TO A BIOSPHERE CENTERED WORLD VIEW

 ***“WE DON’T PERCEIVE THE WORLD AS IT IS, BECAUSE OUR NERVOUS SYSTEM EVOLVED TO SELECT ONLY A SMALL EXTRACT OF REALITY AND TO IGNORE THE REST.”¹***



-  ***“We never experience exactly the same situation twice, so it would be uneconomical to take in every occurrence.”¹***
-  ***“Instead of conveying everything about the world our nervous system is ‘impressed’ only by dramatic changes.”¹***
-  ***“This internal spotlight makes us sensitive to the beginnings and endings of almost every event more than the changes, whether gigantic or tiny, in the middle.”¹***







“ALTHOUGH PRELIMINARY ESTIMATES FROM PUBLISHED LITERATURE AND EXPERT SURVEYS SUGGEST STRIKING AGREEMENT AMONG CLIMATE SCIENTISTS ON THE TENETS OF ANTHROPOGENIC CLIMATE CHANGE (ACC), THE AMERICAN PUBLIC EXPRESSES SUBSTANTIAL DOUBT ABOUT BOTH THE ANTHROPOGENIC CAUSE AND THE LEVEL OF SCIENTIFIC AGREEMENT UNDERPINNING ACC.”²



“NEARLY 7-IN-10 (69%) AMERICANS SAY THAT THERE IS SOLID EVIDENCE THAT THE AVERAGE TEMPERATURE ON EARTH HAS BEEN GETTING WARMER OVER THE PAST FEW DECADES, COMPARED TO 26% WHO DISAGREE.”³

-  ***“Americans are divided along partisan and religious lines about the underlying causes of climate change.”³***
-  ***“Only 4-in-10 Americans believe that scientists generally agree that Earth is getting warmer because of human activity.”³***

 **“CHANGE DOES NOT ROLL IN ON THE WHEELS OF INEVITABILITY, BUT COMES THROUGH CONTINUOUS STRUGGLE. AND SO WE MUST STRAIGHTEN OUR BACKS AND WORK FOR OUR OWN FREEDOM.”** (Martin Luther King)










-  Clearly, the global general public is far from reaching a level of literacy about the impact of global warming and other climate changes upon the Biosphere to be motivated to take strong, immediate, and remedial measures.
-  One of the major causes of the disconnect between science and society is the scientific evidence that humanity's present lifestyle is unsustainable.
-  A sustainable lifestyle must be congruent with the universal laws of biology, chemistry, and physics.







“EVERYONE IS ENTITLED TO THEIR OWN OPINIONS, BUT THEY ARE NOT ENTITLED TO THEIR OWN FACTS.” (Daniel Patrick Moynihan)

- 🌍 Earth’s life support system, the Biosphere, is being damaged, and damage continues.
- 🌍 Deniers that global warming is worsening due to human greenhouse gas emissions have not produced any contrary scientific evidence.
- 🌍 In matters of human health, the principle is “First, do no harm.”
- 🌍 *“When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.”⁴*
- 🌍 Surely the planet’s life support system is a “must” situation for applying the precautionary principle.





THE TRANSITION TO A SUSTAINABLE RELATIONSHIP WITH THE BIOSPHERE WILL REQUIRE THAT ALL OF THE FOLLOWING CONDITIONS BE MET.


-  Atmospheric greenhouse gas concentrations must be reduced to the pre-industrial level.
-  The human population must be reduced to and remain within Earth's carrying capacity.
-  Ecological overshoot must be eliminated.
-  Biodiversity loss and biotic impoverishment must cease, accompanied by conditions that will favor evolutionary replacement of lost species.
-  The growth economy must be replaced by a steady state economy.
-  Refugees displaced from any part of the Biosphere must be halted or they will drain resources from the areas they perceive as advantageous and damage local portions of the Biosphere.
-  Widely disproportionate allocation of both energy and resources must be curtailed to reach societal stability.
-  Damaging natural capital to foster economic growth must cease.
-  Humanity must cease ignoring the universal laws.




 **IN ORDER TO MAKE AN EFFECTIVE TRANSITION TO A BIOSPHERE CENTERED WORLD VIEW, IT IS ESSENTIAL TO EMPHASIZE THAT THE BIOSPHERE IS EARTH'S LIFE SUPPORT SYSTEM AND THE SOURCE OF THE RENEWABLE RESOURCES THAT ARE THE RAW MATERIAL OF THE HUMAN ECONOMY.**

-  **To most people, the word *environment* means a miscellaneous collection of plants and animals with no apparent function. The word *system* conveys both structure and function.**
-  **Collapse of the Biosphere is the most serious threat to both global and national security, not the price of gasoline or a nuclear threat.**
-  **An equally serious threat to both global and national security is humanity's inability to take any substantive action on any of nine interactive threats to the Biosphere.⁵**

SAVING AND NURTURING THE PRESENT BIOSPHERE WILL REQUIRE A GLOBAL CONSENSUS ON THE GOALS AND CONDITIONS NECESSARY FOR ESTABLISHING A SUSTAINABLE WORLD.

-  **Sharply focused special interest groups are a major obstacle to achieving a holistic perspective on large, multivariate, interactive systems such as the Biosphere.**
-  **Science must play a major role in this endeavor by verifiable evidence to facilitate value judgments.**
-  ***“ . . . at the moment the gravest threat is our own inability to take action on fundamental threats, like global warming.”⁶***
-  **In order to adequately inform the public, the news media must give high priority to the preponderance of scientific evidence instead of giving equal weight to both “sides” regardless of the amount of evidence.**

 **IN ELEMENTARY AND MIDDLE SCHOOL, “. . . ‘SCIENCE EDUCATION’ WOULD BE REDEFINED, WITH A LASER-SHARP FOCUS ON GAINING THE SCIENTIFIC HABITS OF MIND THAT WILL BE NEEDED BY EVERYONE TO SUCCESSFULLY NEGOTIATE HIS OR HER WAY THROUGH OUR INCREASINGLY COMPLEX, CROWDED, AND CONFUSING SOCIETIES.”⁷**

-  If this strategy were implemented, then when scientists were accused of perpetuating a hoax or engaged in conspiracies, citizens would ask: “Where is the scientific evidence?”
-  A scientifically literate public would understand that the uncertainty in science is no different than uncertainty in all aspects of life — one cannot possibly include all the possible variables.
-  A scientifically literate public would not tolerate the misinformation of the “merchants of doubt.”⁸



“ONLY BY HEEDING THE VOICES OF THE NEXT GENERATION CAN WE SUCCEED IN BUILDING A BROAD-BASED SCIENTIFIC COMMUNITY THAT CAN ADDRESS THE DAUNTING CHALLENGES OF OUR TIMES — FOR IN A VERY REAL SENSE, THE FUTURE IS IN THEIR HANDS.”⁹

- ① **Humanity cannot restore the Biosphere to its condition when the present generation “inherited” it; however, human society can educate future generations so that they will better understand the present Biosphere and the need for goals and conditions to nurture it.**
- ① **Humanity can continue its present unsustainable lifestyle, possibly for a few decades, or make some immediate “sacrifices” to preserve the present Biosphere for its children and grandchildren. Your move, *Homo sapiens*.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich and Paula Kullberg for calling useful references to my attention.

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CHAPTER 32

The Loss of Biospheric Resources: Humanity's Ethical Challenge

The world is a dangerous place to live, not because of the people who are evil, but because of the people who don't do anything about it.
Albert Einstein

If the earth does grow inhospitable toward human presence, it is primarily because we have lost our sense of courtesy toward the earth and its inhabitants.
Thomas Berry

Low-lying islands and estuaries are threatened by sea level rise (Cairns 2009). The country of Kiribati (formerly Gilbert Islands) consists of 33 tiny islands with an average height of 6.5 feet. The islands cover an area over twice the size of the US state of Alaska. More than 90,000 people live there, and food and water are already scarce (<http://npr.org/2011/02/16/133650679/climate-change-and-faith-collide-in-kiribati?ps=rs>).

The crisis in Kiribati is both sad and useful — sad because global changes (sea level rise, food, water) are strongly impacting the lives of the inhabitants and the crisis requires a global solution, and useful because it may provide insights into response to global change. Island biogeography furnishes insights less evident at a global scale. Arguably, the most crucial factor will be humanity's awareness and response to this island crisis, including absence of empathy and remedial measures. Also crucial is the observation that inhabitants of Kiribati are confused about climate change science and their options if the science is persuasive.

Religion adds a new dimension to the crisis: the islands are 55 percent Roman Catholic and 36 percent Kiribati Protestants (Reed 2011). *"Of the more than 90,000 people counted in Kiribati's last census, . . . many are torn between what they hear from scientists and what they read in the Bible"* (Reed 2011). At least some residents who were interviewed apparently believed that the choice was religion or science, although residents of the "nearby" Tuvalu island group seem to show little doubt about the science. *"We live in constant fear of the adverse impacts of climate change. For a coral atoll nation, sea level rise and more severe weather events loom as a growing threat to our entire population. The threat is real and serious, and is of no difference to a slow and insidious form of terrorism against us"* (Prime Minister Saufatu Sopoanga, <http://www.tuvaluislands.com/warming.htm>).

"The Maldives is one of the small states. We are not in a position to change the course of events in the world. But what you do or do not do here will greatly influence the fate of my people. It can also change the course of world history" (H. E. Maumoon Abdul Gayoom at the 3rd Conference of the Parties of the UNFCCC, Greenpeace International 2006).

The well funded campaign to deny global warming and other types of climate change has been very successful despite a lack of evidence to support this assertion. Some people agree that climate change may be occurring but deny that climate is affected by human activities and deny that the changes are probably hazardous. Still others respond to scientific evidence by stating "it all happened before." Perhaps it has, but *Homo sapiens* has only been on Earth for 200,000 years out of 4.5 billion years. More important, this viewpoint is not a valid reason to avoid planning for highly probable events such as sea level rise.

Planning for Climate Change

"The world is close to reaching tipping points that will make it irreversibly hotter, making this decade critical in efforts to contain global warming, . . ." (Chestney 2012). However, the past can often help *Homo sapiens* plan for possible future change. For example, *"Scientists have found proof in Bermuda that the planet's sea level was once more than 21 meters (70 feet) higher about 400,000 years ago than it is now"* (ScienceDaily 2009a). If this sea level rise happened in the 21st century or later, it would be catastrophic for coastal cities, low islands (e.g., the Bahamas), and deltas (e.g., Ganges). *"About 3.7 million Americans live within a few feet [italics mine] of high tide and risk being hit by more frequent coastal flooding in coming decades because of sea level rise caused by global warming. . ."* (Gillis 2012a). An even more dramatic sea level rise occurred *"since the Last Glacial Maximum (LGM; about 21,000 years*

ago) . . . sea level has risen by 130 meters (430 feet), resulting in continental shelf submergence and a massive expansion of the surface area of the shelf seas” (ScienceDaily 2009b).

Precise replication of these illustrative global changes is unlikely to occur. However, they serve as a warning that dramatic changes, sometimes catastrophic changes, can occur. Such changes always reduce the regeneration of resources.

Achieving a New Worldview

Nothing was made by God for man to spoil or destroy.

John Locke

Use without abuse of natural systems [i.e., the Biosphere] is essential.

Ruth Patrick

Global problems can only be addressed at a global level, and a viable worldview must accept this reality. In the United States (and probably elsewhere in the world), some people believe that climate change is part of a conspiracy to enable the United Nations to control the planet. Jokes could be made about this situation, but it is a serious obstacle — the Biosphere and *Homo sapiens* are inextricably linked. The stress is global, so global policies are essential.

Following are some options for consideration in responding to global crises.

- (1) Humanity continues doing nothing and denying the existence of global warming and sea level rise.
- (2) Humanity is entering an age of resource scarcity and ecological overshoot/deficit has been unsustainable since about 1987. The Biosphere can only regenerate a finite amount of renewable resources annually. Therefore, when islands submerge, or deserts expand, or drought occurs, Earth’s carrying capacity for humans is diminished. Any new migrants/immigrants to an area will reduce per capita resources to the extent that resources are shared with migrants. The 20th century was atypical in expressing perceptions that resources were unlimited (e.g., Simon 1998).
- (3) Climate change is making the future very uncertain because of such problems as reduced agricultural productivity, exponential human population growth, spread of communicable diseases, freshwater shortages, decreased availability of renewable resources, ecological overshoot/deficit, migrants, and debt.
- (4) Earth’s renewable resources will probably diminish until humanity adjusts to the new global climate it has created.
- (5) Since no magic wand (e.g., affordable, effective technology) exists to diminish carbon dioxide and other greenhouse gases in Earth’s atmosphere, humanity will have to wait until natural processes do so. The Biosphere must be nurtured so that it can perform such ecosystem services expeditiously. This role is new to humans, who have taken biospheric services for granted.
- (6) In order to reduce Earth’s human population compassionately, wealth and resources must be shared more equitably.
- (7) Failure to share wealth and resources more equitably will probably result in pandemic disease, anarchy, or both.

No sovereign nation, however powerful, can resolve the global crises. Financial globalization alone is a sufficient example of this statement. *“Some 32 social scientists and researchers from around the world . . . have concluded that fundamental reforms of global environmental governance are needed to avoid dangerous changes in the Earth system. . . . the time is now for a ‘constitutional moment’ in world politics”* (ScienceDaily 2012).

In the absence of a global policy/regulatory group to protect biospheric regeneration of resources, resource wars are highly probable. They will divert already scarce resources from societal use and decrease resources per capita. This position is a classic lose/lose situation.

Krugman (2008) discusses three competing views on resource prices. (1) Speculation is driving the rise in resource prices. (2) Society will drill more oil wells and plant more acres. (3) *“The third view is that the era of cheap resources is over for good — that we’re running out of oil, running out of land to expand food production and generally running out of planet to exploit. . . . Don’t look now, but the good times may have just stopped rolling.”*

If humanity continues “business as usual,” the global crises will continue. The default position, the universal laws of biology, chemistry, and physics, will determine the outcome, and it will not be pretty.

Food Prices

“We have certainly seen intermittent price dips in between the spikes of the last few years, but prices are still at pretty high levels over all. There has been no return to the era of the slowly falling food prices that prevailed in the 1980s and 1990s. Sober forecasters like those in the United States Agriculture Department now expect the era of higher prices to extend into the foreseeable future” (Gillis 2012b). Biello (2009) states the challenge succinctly: humankind is now faced with *“solving climate change, the Sixth Great Extinction and population growth . . . at the*

same time.” Clearing more land for agriculture would mean loss of forests that are good carbon sinks. “Agriculture is the main driver in most ecological problems on the planet. . . . We are literally eating away the other species on the planet” (Economist Jeffrey Sachs as quoted in Biello 2009).

Biospheric Refugees

All refugees on Earth can only move from one part of the Biosphere to another, so they could be designated biospheric refugees. Earth has finite resources (even renewable resources are finite because the Biosphere can only regenerate a limited amount). So, resources per capita are decreasing both because of human population growth and decreased biospheric productivity. However, when refugees move to an area they perceive as richer in resources than the one they left, further regional reduction of resources per capita will occur. Sea level rise will significantly increase the number of refugees, and the areas to which they migrate may already be suffering from loss of jobs, overcrowded schools, needed infrastructure maintenance, water shortages, and tax revenues.

“Rising sea level threatens existing coastal wetlands. Overall ecosystems could often survive by migrating inland, if adjacent lands remained vacant. On the basis of 131 state and local land use plans, we estimate that almost 60% of the land below 1 m [meter] along the US Atlantic coast is expected to be developed and thus unavailable for the inland migration of wetlands. Less than 10% of the land below 1 m has been set aside for conservation” (Titus et al. 2009). A public discourse on this topic is badly needed, but it must include scientific evidence on probable consequences of continuing “business as usual” and the probable risks of changes likely to occur (e.g., sea level rise).

Managing the Risks of Extreme Events and Disasters

“Exposure and vulnerability are key determinants of disaster risk and impacts when risk is realized . . . Extreme and non-extreme weather or climate events affect vulnerability to future extreme events by modifying resilience, coping capacity, and adaptive capacity” (Intergovernmental Panel on Climate Change [IPCC] 2012).

The Summary for Policymakers in the IPCC report (2012) “relies on two metrics for communicating the degree of certainty in key findings” in the report

- *Confidence in the validity of a finding, based on the type, amount, quality, and consistency of evidence (e.g., mechanistic understanding, theory, data, models, expert judgment) and the degree of agreement. Confidence is expressed qualitatively.*
- *Quantified measures of uncertainty in a finding expressed probabilistically (based on statistical analysis of observations or model results, or expert judgment).*

Complex systems, such as the Biosphere, are poorly understood, but all are structured by the universal laws. Scientists gather evidence on how these laws function and increase humanity’s understanding of them. Scientists are not engaged in a conspiracy or perpetuating a hoax as the “merchants of doubt” would like the general public to believe. Almost every person on the planet benefits each day from past scientific research. Neither technology nor legislation can protect humanity from the consequences of ignoring universal laws. Carrying capacity merely means that, if population increases exponentially and resources (e.g., food) do not, then misery, disease, and death will result. If population is not stabilized within the Biosphere’s long-term carrying capacity by humanity, the universal laws will do so. No risk management can be undertaken without scientific evidence.

Conclusions

Stated bluntly, the climate wars predicated on various worldviews (e.g., Mann 2012) must cease. However, just this cessation is not enough. Casting doubt on scientific evidence without supporting evidence should be unacceptable. Mentioning the extinction of humankind is almost taboo, but this extinction could be an unintended consequence of the war on science. The Biosphere, the source of renewable resources and ecosystem services, could collapse if “business as usual” continues. Many species have already been driven to extinction by anthropogenic practices, and many more could follow. Scientists have not observed the collapse of a Biosphere, so the exact location of crucial tipping points resulting in irreversible change are not well known. Excessive optimism is not only unjustified — it is dangerous.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Karen Cairns, Paul Ehrlich, Paula Kullberg, and Peter Leigh for calling useful references to my attention.

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CHAPTER 33

REASON AWAKE:¹ CATASTROPHES MAY FAIL TO CHANGE PUBLIC INDIFFERENCE TO BIOSPHERIC DAMAGE




¹Rene Jules Dubos wrote *Reason Awake* in 1970, and I think that echoing his call is appropriate in 2012.

- ✚ **REASON – SENSIBLE OR LOGICAL THOUGHT OR VIEW**
- ✚ **WISDOM – THE QUALITY OF BEING WISE; KNOWLEDGE, AND THE CAPACITY TO MAKE DUE USE OF IT**
- ✚ **KNOWLEDGE – THE FACT OR CONDITION OF KNOWING SOMETHING WITH FAMILIARITY GAINED THROUGH EXPERIENCE OR ASSOCIATION**
- ✚ **JUDGMENT – THE PROCESS OF FORMING AN OPINION OR EVALUATION BY DISCERNING AND COMPARING**
- ✚ ***“A NATION’S TREASURE IS IN ITS SCHOLARS.”*** Chinese Proverb




 ***“OURS IS ALLEGEDLY A SCIENCE-BASED CULTURE. FOR DECADES, OUR BEST SCIENCE HAS SUGGESTED THAT STAYING ON OUR PRESENT GROWTH-BASED PATH TO GLOBAL DEVELOPMENT IMPLIES CATSTROPHE FOR BILLIONS OF PEOPLE AND UNDERMINES THE POSSIBILITY OF MAINTAINING A COMPLEX GLOBAL CIVILIZATION. YET THERE IS SCANT EVIDENCE THAT NATIONAL GOVERNMENTS, THE UNITED NATIONS, OR OTHER OFFICIAL INTERNATIONAL ORGANIZATIONS HAVE BEGUN SERIOUSLY TO CONTEMPLATE THE IMPLICATIONS FOR HUMANITY OF THE SCIENTISTS’ WARNINGS, LET ALONE ARTICULATE THE KIND OF POLICY RESPONSES THE SCIENCE EVOKES.”¹***



“THE CURRENT COEVOLUTIONARY PATHWAY OF THE HUMAN ENTERPRISE THEREFORE PUTS CIVILIZATION AT RISK – BOTH DEFECTIVE GENES AND MALICIOUS ‘MEMES’ CAN BE ‘SELECTED OUT’ BY A CHANGING PHYSICAL ENVIRONMENT. TO ACHIEVE SUSTAINABILITY, THE WORLD COMMUNITY MUST WRITE A NEW CULTURAL NARRATIVE THAT IS SPECIFICALLY DESIGNED FOR LIVING ON A FINITE PLANET, A NARRATIVE THAT OVERRIDES HUMANITY’S OUTDATED EXPANSIONIST TENDENCIES.”¹

-  **Coevolving with the Biosphere requires an understanding of and willingness to abide by the universal laws of biology, chemistry, and physics.**
-  **Only science can reveal the workings of these universal laws.**
-  **The war on science will impede investigation of the universal laws.**


THE NINE INTERACTIVE GLOBAL CRISES THAT THREATEN THE BIOSPHERE HAVE ALL WORSENERD, SO THE PROBABILITY OF CATASTROPHES HAS INCREASED.^{2,3}



-  I am assuming that human thought processes have worsened because, in the United States, polls show increased skepticism about global climate change science.
-  Since the crises are interactive, the probability is that the catastrophes will not happen one at a time but rather will occur as multiple crises.
-  Recent catastrophes have not changed “business as usual” enough to diminish any of the global interactive crises.






HUMANKIND HAS NOT DEVELOPED ABILITIES OR MENTAL PROCESSES TO RESPOND TO OR EVEN IDENTIFY LONG-TERM PROBLEMS UNTIL RECENTLY. HUMANITY IS NOT PREPARED FOR PROBLEMS THAT ARE DISTANT IN TIME AND SPACE (E.G., FUKUSHIMA NUCLEAR CATASTROPHE FOR MOST OF THE WORLD). SOCIAL EVOLUTION COULD PREPARE HUMANKIND TO RESPOND EFFECTIVELY TO GLOBAL CRISES BUT HAS NOT YET DONE SO.


- 🌍 For example, “*Humanity is now the dominant force driving changes of Earth’s atmospheric composition and thus future climate.*”⁴
- 🌍 Rene Jules Dubos⁵ evaluated the consequences of the application of scientific evidence to all aspects of the human condition. The use of reason and scientific evidence has come under attack in the 21st century and the latter part of the 20th century.


 **HUMANITY'S ABILITY TO COPE WITH LONG-RANGE PROBLEMS IS UNDERMINED BY THE INCREASING PERVASIVENESS OF INDIVIDUALISM.**

-  ***“ . . . the ethic of individualism elevates self-fulfillment over social obligations.”⁶***
-  **Excessive individualism not only undermines relationship stability, but also weakens the social contract upon which civilization is based.⁷**

EVEN PEOPLE WHO ACCEPT THE SCIENTIFIC EVIDENCE FOR CLIMATE CHANGE HAVE RESISTED MAKING PERSONAL LIFESYTYLE CHANGES.


-  One of the possible explanations for this resistance is the “When on the *Titanic*, you might as well go first class” viewpoint.
-  Another possible explanation is the failure to grasp how rapidly irreversible change can occur.
-  Denying scientific evidence in the absence of contrary evidence is an outright rejection of reason.


 ***“BIOLOGIST RACHEL CARSON FIRST CALLED OUR ATTENTION TO THESE MANIFOLD DANGERS [HAZARDOUS CHEMICALS] A HALF CENTURY AGO IN HER 1962 BOOK, SILENT SPRING. IN IT, SHE POSITED THAT ‘FUTURE GENERATIONS ARE UNLIKELY TO CONDONE OUR LACK OF PRUDENT CONCERN FOR THE INTEGRITY OF THE NATURAL WORLD THAT SUPPORTS ALL LIFE.’”⁸***


 ***“Recent studies indicate the U.S. and world could rely 100 percent on green sources within 20 years if we dedicate ourselves to that course.”⁹***


THE TWO PRIMARY BATTLES IN THE WAR ON SCIENCE ARE CLIMATE CHANGE AND EVOLUTION. WHY IS THIS CONFLICT HAPPENING?


- 🌍 All living species in the present Biosphere, including *Homo sapiens*, are products of the same evolutionary selective forces.
- 🌍 Humanity's technological progress, a result of scientific research, has resulted in the illusion that the universal laws do not apply to *Homo sapiens*.
- 🌍 The consequence is an unsustainable lifestyle that, if continued, will result in catastrophes caused by resource scarcity as a result of exceeding the Biosphere's regenerative capacity.
- 🌍 The cultural meme responsible for this crisis is economic growth exacerbated by population growth.


 ***“ANY SCIENTIST VENTURING INTO THE PUBLIC REALM, NO MATTER HOW RESPECTED BY HIS OR HER PEERS, IS TREATED LIKE AN INTELLECTUAL VARMINT BY POLITICIANS, SPECIAL INTERESTS, AND ARM-CHAIR CRITICS, WHO IMMEDIATELY OPEN UP WITH A VOLLEY OF PREFABRICATED REBUTTALS AND PERSONAL ATTACKS.”¹⁰***

 This period in history is not a good era for reason, reasonableness, or scientific evidence.

 ***“We live in an Era of Willful Ignorance. It is not only acceptable; it is fashionable to throw scientific caution to the wind.”¹⁰***

 **“CLIMATE CHANGE DENIERS SERIOUSLY IMPEDED THE DEVELOPMENT OF RATIONAL POLICIES TO DEAL WITH WHAT THE BEST SCIENCE TELLS US IS HAPPENING WITH OUR CLIMATE, A DISTORTION THAT MAY PROVE TO HAVE FATAL CONSEQUENCES.”¹¹**





 *“This antiqueness is a sure sign that denier arguments are based on attitude, not data. Deniers all display what can only be called willful ignorance.”¹¹*

 *“Nobel Laureate economist Paul Krugman has described the denier’s behavior in the debate leading up to the passage by the U.S. Congress of the Waxman-Markey climate-change bill. . . .”¹¹ “If you watched the debate . . . you didn’t see people who’ve thought hard about a crucial issue, and are trying to do the right thing. What you saw, instead, were people who show no sign of being interested in the truth. They don’t like the political and policy implications of climate change, so they’ve decided not to believe in it – and they’ll grab any argument, no matter how disreputable, that feeds their denial.”¹²*

HOW CAN HUMANITY COPE WITH NINE INTERACTIVE GLOBAL CRISES WITHOUT SCIENCE, REASON, AND WISDOM?

- ④ **As the human population grows and resources per capita decline, how can the “common good” be determined without the evidence and knowledge generated by science?**
- ④ **The development of new antibiotics to control “superbugs” that are evolving in developing countries, such as India, is necessary but not a fix where “Poor hygiene has spread resistant germs into India’s drains, sewers and drinking water, putting millions at risk of drug-defying infections.”¹³ Science and reason are essential to reduce risks in such circumstances.**
- ④ **How can humanity cope with long-term nuclear catastrophes, such as the Fukushima Daiichi power plant,¹⁴ without science, reason, and wisdom?**

IN THE ERA OF RAPID CLIMATE CHANGE JUST BEGINNING, HOW WILL HUMANKIND FARE WITHOUT THE EVIDENCE AND INFORMATION PROVIDED BY MODERN SCIENCE?

-  For example, *“If climate change continues on its course, the number of heat-related deaths will rise . . .”*¹⁵
-  *“In a stark call for renewable energy . . . IEA boss Maria van der Hoeven wrote in The Guardian newspaper that the world is on track to warm by 6 degrees C by the end of the century, when it needs to rein in the increase to 2 degrees C.”*¹⁶
-  A 2 degree C increase is the line between dangerous and very dangerous.¹⁷
-  Even staying at or below a 2 degree increase leaves a population/resource problem.



EXPONENTIAL HUMAN POPULATION GROWTH IS SUICIDAL ON A FINITE PLANET WITH FINITE RESOURCES.

- 🌍 Population analyst Paul Ehrlich states: *“The optimum population on Earth — enough to guarantee the minimal physical ingredients of a decent life to everyone — was 1.5 to 2 billion people rather than the 7 billion who are alive today or the 9 billion expected in 2050. . . .”*¹⁸
- 🌍 It is difficult to impossible for most women living in misery to obtain Depo-Provera a birth control method that needs only be taken 4 times per year.¹⁹
- 🌍 *“. . . 100,000 women annually die in childbirth after unintended pregnancies. Six hundred thousand babies born to women who didn’t want to be pregnant die in the first month of life.”*¹⁹
- 🌍 These tragedies are just a few that result from suppression of science and reason, and the number will increase as the planet becomes more crowded and unpredictable.
- 🌍 At the global level, *“World population needs to be stabilised quickly and high consumption in rich countries rapidly reduced to avoid ‘a downward spiral of economic and environmental ills’ . . .”*²⁰



“THERE GO THE PEOPLE, AND I MUST FOLLOW, FOR I AM THEIR LEADER.”

Benjamin Disraeli, England's Prime Minister¹⁰

- ④ **Humanity is united by a desire for a quality life for its children, grandchildren, and their descendants.**
- ④ **Beyond the basics of food, shelter, and clothing, a quality life (i.e., satisfaction with one's circumstances) is not determined by material goods but rather by leisure time, educations, social interactions, and the like.**
- ④ **On a finite planet with a finite Biosphere, limits exist to renewable resources regeneration upon which the human economy depends.**
- ④ **Learning to live within limits is the first requirement toward a quality life.**
- ④ **Nurturing the Biosphere for optimal regeneration of renewable resources is the second requirement.**
- ④ **An equitable sharing of resources to avoid civil unrest and resource wars is the third requirement.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich and Paula Kullberg for calling useful references to my attention.

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CHAPTER 34

DEFINING GOALS AND CONDITIONS FOR NURTURING THE PRESENT BIOSPHERE


NURTURING THE BIOSPHERE WILL REQUIRE DEFINING BOTH GOALS AND CONDITIONS TO WHICH HUMANITY MUST BE FIRMLY COMMITTED OR THE QUEST WILL FAIL.

-  **Previously defined goals and conditions^{1,2} for achieving a sustainable world would, if practiced, nurture the Biosphere, but are alone not enough.**
-  **Ethics and sustainability ethics^{3,4} furnish an ethical perspective essential to nurturing the Biosphere.**
-  **Although the Biosphere consists of a wide variety of ecoregions that require a regional approach, the unifying theme must be maintaining the integrity, health, and resilience of the Biosphere.**



“FOR MOST OF THE LAST CENTURY, ECONOMIC GROWTH WAS FUELLED BY WHAT SEEMED TO BE A CERTAIN TRUTH: THE ABUNDANCE OF NATURAL RESOURCES. WE MINED OUR WAY TO GROWTH. WE BURNED OUR WAY TO PROSPERITY. WE BELIEVED IN CONSUMPTION WITHOUT CONSEQUENCES. THOSE DAYS ARE GONE . . . OVER TIME THAT MODEL IS A RECIPE FOR NATIONAL DISASTER. IT IS A GLOBAL SUICIDE PACT.”⁵

- 🌐 A global paradigm change to a biospheric-centered worldview must occur now before it is too late.
- 🌐 Why now? A shift from one state to another in Earth’s Biosphere is possible because the collective global ecosystems are “. . . *approaching a planetary-scale critical transition as a result of human influence.*”⁶
- 🌐 “*Critical transitions lead to state shifts, which abruptly override trends and produce unanticipated biotic effects.*”⁶
- 🌐 Until forecasting the consequences of the state shifts improves, assuming that most or even any of the shifts would improve conditions for *Homo sapiens* is reckless.



***“IN BIOPHYSICAL TERMS,
HUMANITY HAS NEVER BEEN
MOVING FASTER NOR FURTHER
FROM SUSTAINABILITY THAN IT IS
NOW.”⁷***






GOAL #1: KEEP GLOBAL AND REGIONAL POPULATIONS FOR *HOMO SAPIENS* WITHIN LIMITS IMPOSED BY RESOURCE AVAILABILITY.

ILLUSTRATIVE CONDITIONS

- 🌍 **Although carrying capacity is difficult to determine, *Homo sapiens* clearly has been exceeding its limits since 1987 (first ecological overshoot).**
- 🌍 **If humanity does nothing about population size relative to resource availability, the universal laws of biology, chemistry, and physics will reduce the population size to or below carrying capacity through misery, starvation, disease, and death.**
- 🌍 **If the distribution of resources is vastly disproportionate between rich and poor, a partial equity will be restored by either political means or revolution.**
- 🌍 **Technology, however sophisticated, will not protect humanity from the universal laws.**

GOAL #2: STABILIZE GLOBAL CLIMATE BEFORE “RUNAWAY” CLIMATE CHANGE OCCURS BECAUSE AN UNSTABLE CLIMATE REDUCES RESOURCE PRODUCTIVITY.

ILLUSTRATIVE CONDITIONS

-  **A heavy carbon tax would stimulate a rapid transition from a carbon-intensive energy system to carbon-free energy system.**
-  **Stabilizing the climate is a necessary condition for leaving a habitable climate for humanity’s children and grandchildren.**
-  **Humanity must also remember that climate change affects the 30+ million other species with which it shares the planet and which, collectively, constitute the Biosphere.**







GOAL #3: STOP HUMAN CAUSED BIOTIC IMPOVERISHMENT AND SPECIES EXTINCTION.

ILLUSTRATIVE CONDITIONS

- Stop using economic justifications for harming other life forms with which *Homo sapiens* “shares” the planet.
- The “need” to burn fossil fuel by one species, *Homo sapiens*, does not justify drilling for oil in the Arctic, or anywhere, when burning it alters the pH of the world’s oceans and alters Earth’s climate.
- Although biotic impoverishment and species extinction are caused by overconsumption and economic growth, this condition is an ethical/moral dilemma.
- In hospital intensive care facilities, life support systems for individual patients are treated with great respect and are given regular maintenance. Humanity should do the same for its life support system — the sixth Biosphere.





GOAL #4: STOP APPROPRIATING NATURAL BIOSPHERIC HABITAT FOR AGRICULTURAL OR URBAN USE.

ILLUSTRATIVE CONDITIONS

-  “... about 43% of Earth’s land surface has been converted to agricultural or urban use ...”⁸
-  At present, predicting when the sixth Biosphere will collapse is not possible, but continuing “business as usual” has already badly damaged the Biosphere, which requires nurturing to avoid collapse and to continue the conditions under which *Homo sapiens* evolved and, at times, thrived.
-  The human economy is a subset of the present Biosphere —threats to the Biosphere are also threats to the human economy.
-  Ecological overshoot began in 1987 and cannot be sustained in the long term.

GOAL #5: DO NOT ALLOW HUMAN RESOURCE CONSUMPTION TO EXCEED THE REGENERATIVE ABILITY OF THE BIOSPHERE.





ILLUSTRATIVE CONDITONS


-  Excessive resource consumption produces misery, starvation, disease, and death for millions, even billions, of people.
-  Excessive consumption can only occur when natural capital (which provides the ecosystem services *Homo sapiens* needs to survive) is consumed.⁶
-  Advertising that leads to increased consumption beyond biospheric regenerative capacity damages Earth's life support system and endangers human lives and the lives of other species.
-  Limits to economic and population growth, when exceeded, result in damage to the Biosphere. Continuation of such growth will cause collapse of the sixth Biosphere.







GOAL #6: GO BEYOND MILITARY TERMS FOR HUMAN SECURITY AND INCLUDE NURTURING THE BIOSPHERE.

ILLUSTRATIVE CONDITIONS

-  ***“But the situation in which we find ourselves pushes us to redefine security in twenty-first century terms. The time when military forces were the prime threat to security has faded into the past. The threats now are climate volatility, spreading water shortages, continuing population growth, spreading hunger, and failing states.”⁹***
-  **Collapse of the present Biosphere will probably result in the collapse of human civilization.**
-  **For most of the time *Homo sapiens* has existed, the present Biosphere was self maintaining, but now human activities threaten it.**
-  **The Biosphere is finite and cannot supply enough resources and ecosystem services sufficient for an every growing economy and human population.**






 **GOAL #7: ACCEPT THAT THE SCIENTIFIC PROCESS IS THE BEST AND ONLY WAY TO BECOME INFORMED ABOUT THE UNIVERSAL LAWS OF BIOLOGY, CHEMISTRY, AND PHYSICS WHICH SHAPE BOTH THE BIOSPHERE AND HUMAN DESTINY.**

ILLUSTRATIVE CONDITIONS

-  **Attacking scientists and scientific evidence that displeases special interest groups without robust contrary scientific evidence must cease.**
-  **Labeling scientific evidence “bad news” when it reports on the consequences of the universal laws must cease.**
-  **Scientists accused of conspiracy or a hoax should be so charged if substantive evidence exists to support the accusation — otherwise, let them alone to continue their research.**
-  **The news media should abandon the use of “balance,” where both sides are given equal time, when the preponderance of evidence is on one side.**






GOAL #8: PAY ATTENTION TO “WARNINGS” FROM THE BIOSPHERE BASED ON SCIENTIFIC EVIDENCE.

ILLUSTRATIVE CONDITIONS

-  ***“The mysterious fall of the largest of the world’s earliest urban civilization nearly 4,000 years ago in what is now India, Pakistan, Nepal and Bangladesh now appears to have a key culprit — ancient climate change . . . ”*¹⁰**
-  **Global climate change and financial globalization have decreased human security.**
-  **Sea level rise is already causing some coastal residents to consider moving inland.¹¹ However, ecosystems will have trouble moving inland in many areas because the areas are already occupied.**
-  ***“The lower 48 [US] states set temperature records for the warmest spring, largest seasonal departure from average, warmest year-to-date, and warmest 12-month period, all new marks since records began in 1895.”*¹²**
-  **Not much systematic planning has resulted from this new evidence.**

GOAL #9: NURTURE THE BIOSPHERE BY DEVELOPING A SYSTEMS-LEVEL RISK AND MANAGEMENT-LEVEL WORLDVIEW.

ILLUSTRATIVE CONDITIONS

-  **Ecological overshoot must cease because it destroys natural capital and impairs the delivery of ecosystems services.**
-  **As sea level rises, inland areas must be allocated and prepared for colonization by wetland species displaced by sea level rise.**
-  **If climate change is too rapid for recolonization of new, now suitable areas, assisted recolonization may be essential.**
-  ***“ . . . the second Earth summit is a chance to take honest stock of the situation and present ways to break political deadlock and human progress on the ground, in the air and in the oceans.”¹³***
-  **Extinction is forever.**






GOAL #10: BAN NO WORDS AND SUPPRESS NO SCIENTIFIC EVIDENCE IN THE ESSENTIAL, BUT STILL LACKING, PUBLIC DISCOURSE ON NURTURING THE BIOSPHERE.

ILLUSTRATIVE CONDITIONS

- 🌍 Such sentiments as “*Obviously something needs to be done. About those damn scientists, of course. Not global warming*”¹⁴ are true but shouldn’t be necessary.
- 🌍 “*Like-minded legislators and state officials . . . erase offending words and passages [on global warming]. They made it flat out illegal for state planners and zoning officials to refer to nettlesome scientific findings that might hurt coastal property values.*”¹⁴
- 🌍 Human laws have no effect on the universal laws that are the basis of scientific investigations.
- 🌍 Humanity is facing trying times at present and in the future. Scientific evidence will be essential to save civilization.

GOAL #11: REVERE THE PARTS OF THE BIOSPHERE THAT ARE STILL IN A NATURAL STATE AS SACRED, INVIOLETE PLACES — THE ONLY REMAINING WILD SYSTEMS OF WHAT EARTH WAS LIKE BEFORE HUMAN DEVELOPMENT TOOK OVER.

ILLUSTRATIVE CONDITIONS

-  ***“Now with tough times crimping cities’ budgets, parks advocates . . . are seeing increasing efforts to privatize parks funded under the [US] Land and Water Conservation Act.”¹⁵***
-  **Loss of species is dangerous. For example, “Evidence is mounting that extinctions are altering key processes important to the productivity and sustainability of Earth’s ecosystems. Further species loss will accelerate change in ecosystem processes . . .”¹⁶**
-  **Lurking behind these losses are the tipping points, which are usually known only in retrospect, that mean irreversible change.**



GOAL #12: ELIMINATE INTERNATIONAL TRADE IN SPECIES, WHICH IS “... THE UNDERLYING CAUSE OF 30% OF THREATENED ANIMAL SPECIES EXTINCTIONS.”¹⁷







ILLUSTRATIVE CONDITIONS


- 🌍 Losing species faster than they are being replaced is dangerous unless one is willing to wait for replacement in evolutionary time after biospheric collapse.**
- 🌍 This problem, as usual, is in human hands and could cease immediately if humanity had the will to do so.**
- 🌍 The solution is simple — species are the product of millions of years of evolution and should not be driven to extinction for short-term, or even long-term, profits.**






GOAL #13: JUDGE ALL HUMAN ACTIONS AND INACTIONS (FAILURE TO LIMIT ANTHROPOGENIC GREENHOUSE GAS EMISSIONS) IN THE CONTEXT OF THE COMMON GOOD.

ILLUSTRATIVE CONDITIONS

-  **The common good includes all species on Earth that collectively comprise the present Biosphere since their fates are closely linked.**
-  **The Biosphere is a functional system and all species are a part of it.**
-  **No species, including *Homo sapiens*, is apart from the Biosphere.**
-  **Damaging the Biosphere has deleterious effects upon all species, and nurturing it has beneficial effects on all component species.**
-  **Local and regional actions collectively affect the Biosphere and must be evaluated at local, regional, and biospheric levels.**
-  **The human economy is a subset of the Biosphere and must be judged in that context despite pleadings of special interest groups.**

 **SOME ACTIONS (E.G., MOUNTAIN TOP REMOVAL TO ACCESS COAL DEPOSITS) HARM THE BIOSPHERIC LIFE SUPPORT SYSTEM AND DO NOT ADVANCE THE COMMON GOOD.**

-  **Carbon free energy, insulating houses, and public transportation are a few examples of alternative options that do not harm the Biosphere.**
-  **Any action that destroys ecological habitat does not advance the common good.**
-  **With numerous energy alternatives that do not threaten the Biosphere, no ethical or economic justification exists for activities that threaten the Biosphere.**



SUPPRESSING SCIENCE AND REASON DOES NOT ADVANCE THE COMMON GOOD.

- 🌐 **Hate mail, white powder in mail (“is it anthrax or not?”), name calling (“compulsive liar”), stress on climate scientists and their families, heckling during speeches, and other intimidation tactics by anonymous climate deniers¹⁸ do not advance the common good.**
- 🌐 **The acceptance of, or indifference to, the relentless attacks on scientists and the impassioned dismissal of the preponderance of scientific evidence by the general public are very disturbing, especially when the United States is one of the world’s leading nations in the generation of scientific knowledge.**
- 🌐 **Nations that permitted, even encouraged, attacks on science have always paid a heavy price for doing so; however, now the entire planet is paying the price, and the cost is steadily increasing.**
- 🌐 **Survival of a complex, partially globalized society requires a continuous, substantial flow of scientific evidence ideally generated by scientists not distracted by an assault on science.**



“WE FACE A CHOICE BETWEEN A SOCIETY WHERE PEOPLE ACCEPT MODEST SACRIFICES FOR A COMMON GOOD OR A MORE CONTENTIOUS SOCIETY WHERE GROUP(S) SELFISHLY PROTECT THEIR OWN BENEFITS.”¹⁹

- ① ***“The common good is a notion that originated over two thousand years ago in the writings of Plato, Aristotle, and Cicero.”²⁰***
- ① **Appeals for the common good sound utopian and naive in 2012 in an era of calls for “dynamic leadership,” rampant individualism, attacks on “free-loaders,” and calls FOR low taxes, but such a worldview should cause humanity to reflect on fundamental questions such as what kind of society humanity aspires to in the long term and what kind of relationship is most appropriate with the 30+ million other species that collectively compromise the Biosphere.**



***HOMO SAPIENS* EVOLVED IN THE SIXTH BIOSPHERE FOR WHICH NO “OPERATING MANUAL” WAS PROVIDED. AT THAT TIME, THE SPECIES WAS SPREAD THINLY OVER THE PLANET IN SMALL TRIBAL GROUPS AND WAS DOMINATED BY THE BIOSPHERE RATHER THAN HUMANS DOMINATING IT — THE SITUATION IN THE LAST PART OF THE 20TH CENTURY AND THE FIRST PART OF THE 21ST CENTURY. SINCE THE PRESENT BIOSPHERE IS BOTH A LIFE SUPPORT SYSTEM AND THE SOURCE OF RENEWABLE RESOURCES FOR THE HUMAN ECONOMY, IT IS ESSENTIAL TO NURTURE IT RATHER THAN EXPLOIT IT. HUMANITY MUST DEVELOP AN OPERATING MANUAL BASED ON THE GOAL OF DEVELOPING A HARMONIOUS, LONG-TERM RELATIONSHIP THAT WILL ENABLE HUMANITY TO USE THE PRESENT BIOSPHERE WITHOUT ABUSING IT. THIS WILL BE A LASTING GIFT TO POSTERITY.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Peter Leigh, Paul Ehrlich, Paula Kullberg, and Richard Rusk for calling useful references to my attention.

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
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CHAPTER 35




MUTUALLY ASSURED DESTRUCTION (MAD)*: THE BIOSPHERE, *HOMO SAPIENS*, AND THE HUMAN ECONOMY


*First used by the *Bulletin of the Atomic Scientists* for a major exchange of nuclear weapons.

 **DURING THE “COLD WAR” BETWEEN THE UNITED STATES AND THE USSR, THE *BULLETIN OF THE ATOMIC SCIENTISTS* ESTABLISHED A “DOOMSDAY CLOCK” BASED ON THE HIGH PROBABILITY THAT A FULL-SCALE EXCHANGE OF NUCLEAR WEAPONS WOULD ANNIHILATE BOTH COUNTRIES.¹**

-  The term describing this horrible situation was *mutually assured destruction* (MAD).¹
-  The security of the world was based on that probability.
-  During the Cold War, scientists realized that a full-scale nuclear exchange would alter the climate by producing quantities of small particles that would reflect sunlight.
-  A red button that, if pushed, would initiate a nuclear exchange was a prominent feature in stories of nuclear war — both countries had one.
-  Only the older generation remembers those days when a massive nuclear exchange was a distinct possibility, but the danger remains.

 IN 2012, THE *BULLETIN OF THE ATOMIC SCIENTISTS* ADDED THE CRISIS OF CLIMATE CHANGE TO THE DOOMSDAY CLOCK. HOWEVER, “PEOPLE DO NOT FEAR CLIMATE CHANGE THE WAY THEY FEAR NUCLEAR WAR BECAUSE NOBODY HAS HIS OR HER FINGER ON THE BIG RED BUTTON. INSTEAD IT’S BILLIONS OF PEOPLE PUSHING SMALLER BUTTON ALL THE TIME, AGAIN AND AGAIN AND AGAIN. UNTIL IT’S TOO LATE TO STOP.”¹

-  Another huge difference in the two situations is that no individuals and organizations were stating that nuclear war was a hoax and a conspiracy.
-  Climate change will not annihilate civilization in numerous mushroom clouds, but will, if business as usual continues to destroy the present Biosphere, end life as we know it.¹
-  The similarity between nuclear war and climate change is that neither nurtures either the Biosphere or the common good.



WEATHER AFFECTS AGRICULTURAL PRODUCTIVITY, ENERGY USE, AND OUR DAILY LIVES, AND IT IS ALREADY EXTREME. THIS SITUATION WILL CONTINUE TO WORSEN AS LONG AS ANTHROPOGENIC GREENHOUSE GAS EMISSIONS CONTINUE TO RISE.

- 🌍 *“The [U.S.] National Academy of Sciences reports that the hottest days are now hotter. And the fingerprint of global warming behind this change has been firmly identified.”²*
- 🌍 *“In the past several years, the global areas hit by extremely unusual hot summertime temperatures has increased 50-fold.”²*
- 🌍 *“The impact of these [climate] changes can be devastating. The drought, heat wave and associated record wildfires that hit Texas and the Southern plains [US] in the summer of 2011 cost \$12 billion.”²*
- 🌍 *“In storm-affected areas, many people had no electricity to run fans, air-conditioning and refrigerators.”³*
- 🌍 *“Climate scientists have this to say about the record-breaking heat wave rippling across the country: Get used to it.”⁴*

BOTH FOOD AND WATER ARE CLOSELY LINKED SO IT IS NO SURPRISE THAT SEVERE WORLDWIDE DROUGHTS ARE AFFECTING FOOD SUPPLIES AND INCREASING THE NUMBER OF WATER STRESSED POPULATIONS.




- 🌐 For example, both North and South Korea are suffering from the worst drought in a century.⁵
- 🌐 In the United States, “*The narrowing of the contract prices [for corn] has occurred as ‘abnormally dry’ or worse conditions affected 71 percent of the Midwest, the largest U.S. growing region . . .*”⁶
- 🌐 “*Water scarcity already affects every continent. Around 1.2 billion people, or almost one-fifth of the world’s population, live in areas of physical scarcity, and 500 million people are approaching this situation. Another 1.6 billion people, or almost one quarter of the world’s population, face economic water shortage (where countries lack the necessary infrastructure to take water from rivers and aquifers).*”⁷






CLIMATE CHANGE IS ALREADY A THREAT TO FOOD SECURITY. IN THE US MIDWEST “. . . A GROWING SEASON EXPECTED TO BE ONE OF THE BEST ON RECORD . . . EVAPORATE[D] UNDER A BLAZING SUN.”⁸


- For example: In Hill City, Kansas, *“For five days last week, a brutal heat wave here crested at 115 degrees. Crops wilted. Streets emptied. Farmers fainted in the fields. Air-conditioners gave up . . . Hill City was, for a spell, in the ranks of the hottest spots in the country.”⁹*
- *“The grinding drought that transformed much of the [US] West into a tinderbox has all but choked off the growing season here.”⁹*
- Even urban families that do not produce food suffered because they often store food in refrigerators and large freezers, and electric power outages during violent storms caused multi-day lost of power during which the food spoiled. Commercial supplies of food were also lost during extended power outages.


ACCEPTING SEA LEVEL RISE IS ESSENTIAL TO THE DEVELOPMENT OF GOALS AND CONDITIONS NECESSARY TO REDUCE IT OR, MORE LIKELY, ADAPT TO IT.


-  *“Rates of sea level rise due to global warming and climate change are increasing three-to-four times faster along highly populated sections of the US northeast Atlantic Coast than they are globally. . .”¹⁰*
-  *“As an example, 1 metre of sea level rise could raise the frequency of severe flooding for New York City from once per century to once every three years . . .”¹⁰*
-  Demand for freshwater has increased sea level rise: *“Trillions of tonnes of water have been pumped up from deep underground reservoirs in every part of the world and then channelled into fields and pipes to keep communities fed and watered. The water then flows into the oceans, but far more quickly than the ancient aquifers are replenished by rains.”¹¹*





INTRA-NATIONAL CLIMATE REFUGEES MAY OCCUR FOR A VARIETY OF REASONS. THREE ILLUSTRATIVE EXAMPLES FOLLOW.


-  Refugees may result from denial of scientific evidence — Acceleration of warming, which is not uniform, arises “*. . . from circulation and variations in temperature and/or salinity, and by static equilibrium processes, arising from mass redistributions changing gravity and the Earth’s rotation and shape.*”¹²
-  The assault on science and reason distracts scientists from their primary responsibility, the generation of scientific evidence — scientific evidence and predictions based on that evidence are essential to planning for regional crises.
-  Suppression of scientific evidence may result in refugees — “*Lawmakers in North Carolina, which has a long Atlantic Ocean coastline and vast areas of low-lying land, voted on Tuesday to ignore studies predicting a rapid rise in sea level due to climate change and postpone planning for the consequences.*”¹³

 **“NO PREVIOUS CIVILIZATION HAS SURVIVED THE ONGOING DESTRUCTION OF ITS NATURAL SUPPORTS. NOR WILL OURS. YET ECONOMISTS LOOK AT THE FUTURE THROUGH A DIFFERENT LENS. RELYING HEAVILY ON ECONOMIC DATA TO MEASURE PROGRESS, THEY SEE THE NEAR 10-FOLD GROWTH IN THE WORLD ECONOMY SINCE 1950 AND THE ASSOCIATED GAIN IN LIVING STANDARDS AS THE CROWNING ACHIEVEMENT OF OUR MODERN CIVILIZATION. DURING THIS PERIOD, INCOME PER PERSON WORLDWIDE CLIMBED NEARLY FOURFOLD, BOOSTING LIVING STANDARDS TO PREVIOUSLY UNIMAGINABLE LEVELS. A CENTURY AGO, ANNUAL GROWTH IN THE WORLD ECONOMY WAS MEASURED IN THE BILLIONS OF DOLLARS. TODAY, IT IS MEASURED IN THE TRILLIONS. IN THE EYES OF MAINSTREAM ECONOMISTS, OUR PRESENT ECONOMIC SYSTEM HAS NOT ONLY AN ILLUSTRIOUS PAST BUT ALSO A PROMISING FUTURE.”¹⁴**

 Continued economic “progress” that is based on perpetual, resource-dependent growth is simply not possible on a finite planet with finite resources.

 ***“BUT NATURAL SCIENTISTS SEE THAT AS THE WORLD ECONOMY EXPANDED SOME 20-FOLD OVER THE LAST CENTURY, IT HAS REVEALED A FLAW — A FLAW SO SERIOUS THAT IF IT IS NOT CORRECTED IT WILL SPELL THE END OF CIVILIZATION AS WE KNOW IT. AT SOME POINT, WHAT HAD BEEN EXCESSIVE LOCAL DEMANDS ON ENVIRONMENTAL SYSTEMS WHEN THE ECONOMY WAS SMALL BECAME GLOBAL IN SCOPE.”¹⁴***






-  In short, growth is limited, and carrying capacity for any species is finite because resources are finite.
-  The era of abundance ended about 1987 when ecological overshoot began and humanity began using natural capital to sustain economic growth instead of living on the renewable resources generated by natural capital.
-  Earth's Biosphere is finite and thus has limits to the generation of renewable resources.
-  The universal laws of physics, chemistry, and biology, plus common sense, dictate that perpetual, resources-dependent growth is not possible on a finite planet.



HUMANITY NOW HAS TWO MEANS OF MUTUALLY ASSURED DESTRUCTION — EACH APPALLING IN ITS OWN WAY. HOWEVER, GLOBAL CLIMATE CHANGE IS A PROBLEM SOMETHING EACH INDIVIDUAL CONTRIBUTES TO ON A DAILY BASIS.

- 🌍 To reduce the risks of a nuclear war, reducing the number of nuclear bombs is a good first step.
- 🌍 To reduce the rate of climate change, reducing anthropogenic emissions of greenhouse gases is an essential first step.
- 🌍 *“How serious is the threat to the environment? Here is one measure of the problem: all we have to do to destroy the planet’s climate and biota and leave a ruined world to our children and grandchildren is to keep doing exactly what we are doing today, with no growth in human population or the world economy. Just continue to release greenhouse gases at current rates, just continue to impoverish ecosystems and releases of toxic chemicals at current rates, and the world in the latter part of this century won’t be fit to live in.”¹⁵*

MANY “SIGNPOSTS” ARE OBVIOUS ON THE PATH TO GLOBALLY ASSURED DESTRUCTION (GAD). A FEW ILLUSTRATIONS FOLLOW.

-  **The global human population is growing exponentially — global resources are not and may be diminished by global climate change.**
-  **Humanity’s reluctance to cease using fossil fuels is reducing renewable resource regeneration.**
-  **If business as usual continues the collapse of the present Biosphere becomes increasingly probable.**
-  **The war on science will not affect the function of the universal laws — scientists merely report on them.**
-  **When civilization developed after the agricultural and industrial revolutions, resources were plentiful and easily obtained for a comparatively small population. Now they are more difficult to obtain for a huge human population. If the global civilization collapses, restoring it in an era of scarce resources will be difficult (if not impossible).**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich and Paula Kullberg for calling useful references to my attention.

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CHAPTER 36

EVOLVING TOWARD AN EVIDENCE-BASED/ETHICAL VALUE-BASED SOCIETY TO NURTURE EARTH'S BIOSPHERE





 ***“OUR BRETHREN ARE ALREADY IN THE FIELD! WHY STAND WE IDLE?”***


Patrick Henry

 ***“THE ULTIMATE ISSUE IN ENVIRONMENTAL ETHICS IS WHAT CONSTITUTES EACH INDIVIDUAL’S RESPONSIBILITY FOR MAINTAINING THE CRUCIAL NATURAL SERVICES THAT THOSE ECOSYSTEMS SUPPLY TO HUMANITY.”***

Paul and Anne Ehrlich

HUMANITY'S IRRESPONSIBILITY — THE USE OF NATURAL RESOURCES TO STIMULATE ECONOMIC GROWTH — HAS ENDANGERED BOTH CIVILIZATION AND THE SPECIES.

-  **Interest in the common good of all life forms (i.e., the Biosphere) is uncommon.**
-  **Human population growth together with increasing per capita consumption, if continued, will result in collapse of the present Biosphere.**
-  **Climate change and other anthropogenic disasters (e.g., Fukushima nuclear power stations) should persuade humanity to become more aware of scientific evidence and reflect on ethical/moral values, especially the intergenerational ones.**
-  **If humanity intends to nurture the Biosphere, it must begin at once, i.e., before more damage to the integrity of the Biosphere occurs.**



THE CENTRAL GOAL IN NURTURING THE BIOSPHERE SHOULD BE THE COMMON GOOD OF ALL LIFE ON EARTH (I.E., THE BIOSPHERE) OF WHICH *HOMO SAPIENS* IS A PART.

- 🌍 **Humanity is dependent upon the Biosphere both as a life support system and for renewable resources that are essential to the human economy.**
- 🌍 **At present, humanity is badly damaging the Biosphere, which will collapse if present, unsustainable practices continue.**
- 🌍 **Humanity evolved in the present Biosphere and is unlikely to survive in the Biosphere that replaces it.**
- 🌍 **Time is growing very short to make the transition to nurturing instead of exploiting the present Biosphere.**


DURING WAR WORLD II, PEOPLE OF MANY NATIONS UNITED VOLUNTARILY FOR THE COMMON GOOD BECAUSE WAR THREATENED THE COMMON GOOD IN AN EASILY UNDERSTOOD WAY.

- 🌐 Even in the United States, the “. . . *defense industry was suffering an acute shortage of animal fats. . .*” to produce smokeless gunpowder during World War II. The First Lady, Eleanor Roosevelt, as spouse of then U.S. President Franklin Roosevelt, had an appeal in her daily newspaper column, “My Day,” for housewives to save kitchen fat to support the war effort.¹
- 🌐 The U. S. military for World War II was financed by war bonds purchased by the general public, often at rallies with movie stars as “salespersons.” Although the bonds paid interest, this endeavor was a remarkable effort for the common good.
- 🌐 In the United States, a draft procured individuals for the war effort in World War II, so the military represented U.S. families in protecting the nations for the common good.
- 🌐 Mobilization for the common good was swift and nearly universal in the United States in World War II — why not use such a mobilization in peacetime?



IN CONTRAST TO THE UNIFIED EFFORT OF WORLD WAR II, THE DANGER RESULTING FROM DAMAGE OF NATURAL SYSTEMS (I.E., THE BIOSPHERE) HAS NOT ELICITED AN EFFECTIVE RESPONSE.

- 🌍 “. . . U.S. consumers rank last of 17 countries . . . in sustainable behavior, . . . U.S. consumers are among the least likely to feel ‘guilty about the impact’ they have on the environment . . . yet they are near the top in believing their individual choices could make a difference . . .”²
- 🌍 If individuals in the developing world had a per capita consumption-of-resources behavior similar to the per capita consumption of the developed world, biospheric collapse would be highly probable. *Homo sapiens* may still have time to actually live sustainably on a finite planet with finite resources. May it be so!




EVOLVING TO SUSTAINABLE CONSUMPTION AND RECYCLING BEHAVIORS THAT WILL ENABLE HUMANITY TO LIVE SUSTAINABLY WILL REQUIRE ENDING HUMAN POPULATION GROWTH AND COMPASSIONATE REDUCTION IN POPULATION SIZE AND CONSUMPTION OF RESOURCES TO MATCH OR BE BELOW BIOSPHERIC REGENERATION OF RESOURCES.





- ④ **Addressing resource / population issues is long overdue.³**
- ④ ***“ . . . some of the religious and political opposition to family planning that too often is based on narrow, no-evidence-based biases that ignore the incontrovertible evidence of the positive health and family benefits of child spacing” must be addressed.³***
- ④ **However, family planning must be based on scientific, evidence-based data on the Biosphere’s long-term carrying capacity for humans at the global level.**




A FAREWELL TO THE THROW-AWAY CULTURE AND FOSSIL FUEL USE IS TAKING TOO LONG.

- 🌐 *“The current oil and gas boom in continental North America poses a difficult policy question: How are we to reduce climate emissions in an era of continuing, and even increasing, oil and gas supplies?”⁴*
- 🌐 Whenever a new technology appears (e.g., solar panels), lamentations are heard about the jobs that will be lost in the old technology (e.g., coal-fired power plants). However, no mention is made of the jobs created by the new technology. When automobiles replaced horse-drawn carriages and wagons, manufacture of horse whips declined and those jobs were lost — but automobiles provided many new jobs. No one now mourns the loss of makers of horse whips — they probably opened gas stations.

 **EARTH'S DOMINANT SPECIES *HOMO SAPIENS* MUST EXHIBIT MORE SELF CONTROL AND NOT APPROPRIATE RESOURCES, INCLUDING SPACE, FROM OTHER SPECIES FOR A PERCEIVED “NEED” FOR ECONOMIC GROWTH.**



-  **Humanity cannot continue to add 1 billion additional people to Earth every 12 years.**
-  **Exponential human population growth requires appropriation of resources from the 30+ million other life forms with which *Homo sapiens* shares the planet.**
-  **Anthropogenic greenhouse gas emissions are causing rapid, often irreversible, climate change that is threatening the Biosphere.**
-  **Lack of human self control involving reckless use of resources is an unethical behavior threatening the quality of life of future generations.**

 **“ I’M NOT SURE THAT TREATIES ARE PASSÉ, BUT THE 21ST CENTURY HAS PRODUCED NOTHING TO HELP ME WITH A COUNTER ARGUMENT.”⁵**

- 🌍 *“What will not work is to surrender our initiative to a kind of consumerist green chic, in which we choose to ‘live sustainable lives’ by buying greener products and doing nothing else.”⁵*
- 🌍 *“Normatively, the upside of the Anthropocene is that we’re no longer able to sustain the conceit that nature and humanity are separate. Maybe that will cause us to behave more respectfully toward our planet, but it is pretty hit or miss right now.”⁵*
- 🌍 Little robust evidence exists that shows humanity is progressing toward an evidence-based/ethical value-based society to nurture the Biosphere. However, this transition must be completed before the present Biosphere collapses and makes survival of *Homo sapiens* difficult, if not impossible.



AN EVOLVING RELATIONSHIP WITH A COMPLEX, DYNAMIC SYSTEM, SUCH AS THE BIOSPHERE, REQUIRES A KNOWLEDGE OF THE EXISTING SCIENTIFIC LITERATURE, AN AWARENESS OF THE PREPONDERANCE OF SCIENTIFIC EVIDENCE, CRITICAL THINKING TO SELECT THE HIGHEST QUALITY EVIDENCE, JUDGMENT OF THE MOST APPROPRIATE SCIENTIFIC EVIDENCE SUITABLE FOR POLICY DEVELOPMENT, REALIZATION THAT UNCERTAINTY WILL ALWAYS EXIST IN LIFE, RECOGNITION THAT CIVILITY IS ESSENTIAL IN BOTH SCIENTIFIC AND PUBLIC DISCOURSE AS IS AN UNBIASED VIEW OF SCIENTIFIC EVIDENCE.

-  Policy making involving scientific evidence requires public literacy about the scientific process.
-  The news media would benefit, as would the general public, when scientific evidence is reported in a synthesis rather than as isolated evidence.⁶


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
CHAPTER 37

CRITICAL THINKING, THE COMMON GOOD, AND THE NEW NORMAL GLOBAL CLIMATE

 ***“CRITICAL THINKING IS A SYSTEMATIC PROCESS FOR SEPARATING TRUTH FROM FICTION. IT PROVIDES TOOLS OF THOUGHT FOR CARVING YOUR WAY THROUGH THE FLOOD OF INFORMATION THAT YOU FACE EACH AND EVERY DAY. IT DOES BEAR MANY RESEMBLANCES TO THE SCIENTIFIC METHOD, BUT IT IS MORE APPLICABLE TO THE VAGUE AND INCOMPLETE INFORMATION ONE FACES IN DAILY LIFE.”¹***


 **“THE GREAT CRISIS AMONG US IS THE CRISIS OF THE ‘COMMON GOOD,’ THE SENSE OF COMMUNITY SOLIDARITY THAT BINDS ALL IN A COMMON DESTINY — HAVES AND HAVE-NOTS, THE RICH AND THE POOR. WE FACE A CRISIS ABOUT THE COMMON GOOD BECAUSE THERE ARE POWERFUL FORCES AT WORK AMONG US TO RESIST THE COMMON GOOD, TO VIOLATE COMMUNITY SOLIDARITY, AND TO DENY A COMMON DESTINY.”²**


-  Discussion of the common good is usually centered on one species — *Homo sapiens*.
-  All life on Earth is intimately associated with the present Biosphere and dependent upon it.
-  Therefore, nurturing the present Biosphere serves the common good for the millions of species with which *Homo sapiens* shares the planet.




BRACE YOURSELF — THAT WEIRD WEATHER YOU HAVE BEEN EXPERIENCING, READING ABOUT, OR VIEWING ON TELEVISION “... WILL BECOME THE ‘NEW NORMAL’ FOR MOST OF THE COMING CENTURY.”³

- 🌍 If anthropogenic greenhouse gas emissions continue to increase at present rates (or even if they stabilize at present rates), climate change will almost certainly continue.
- 🌍 Even at present levels, serious damage is being done to the US infrastructure. *“From highways in Texas to nuclear power plants in Illinois, the concrete, steel sophisticated engineering that undergird[s] the nation’s infrastructure are being taxed to worrisome degrees by heat, drought and vicious storms.”⁴*
- 🌍 How will this damage be repaired on a continuing basis?

 **“THOMAS PAINE ACTUALLY DESCRIBED TODAY’S SITUATION [CLIMATE CHANGE CRISIS] VERY WELL. AS AMERICA FOUGHT FOR ITS INDEPENDENCE, HE SAID: ‘IT IS AN AFFRONT TO TREAT FALSEHOOD WITH COMPLAISANCE.’ YET WHEN IT COMES TO THE CHALLENGE OF CLIMATE CHANGE, THE FALSEHOOD OF TODAY’S NAYSAYERS IS ONLY MATCHED BY THE COMPLACENCY OF OUR POLITICAL SYSTEM.”⁵**


 ***“Yet today, the naysayers escape all accountability to the truth. The media hardly murmurs when a candidate for President of the United States in 2012 can walk away from previously held positions to announce that the evidence is not yet there about the impact of greenhouse gases on climate.”⁵***

 **Such action is not even a gesture toward critical thinking or the common good.**





**“...TRULY, SCIENCE IS THE
THREAD THAT WEAVES US ALL
INTO THE FABRIC OF REALITY.”⁶**

- The rejection of science is a major factor in the denial of climate change and the attacks on scientists and their evidence — humans are, because of anthropogenic greenhouse gas emissions, causing Earth’s climate to change.
- *“The consequence of this inattention [to climate change] is an irreversible commitment to dangerous climate change.”⁷*
- *“... even if greenhouse gas concentrations in the atmosphere could be held steady at 2005 levels, scientists . . . have calculated that global temperature would rise by 2.4 degrees Celsius.”⁷*
- A 2.0 degree Celsius increase in global mean surface temperature is *“the threshold between ‘dangerous’ and ‘extremely dangerous’ climate change.”⁸*

 **NO HUMAN LAWS CAN NEGATE OR REPLACE THE UNIVERSAL LAWS OF PHYSICS, CHEMISTRY, AND BIOLOGY. NOR IS IT POSSIBLE TO SUPPRESS SCIENTIFIC EVIDENCE IN A FREE SOCIETY, ESPECIALLY ONE WITH FREE AND OPEN NEWS MEDIA.**

- 🌐 *“A new law in North Carolina will ban the state from basing coastal policies on the latest scientific predictions of how much sea level will rise, prompting environmentalists to accuse the state of disrespecting climate science.”⁹*
- 🌐 *“If your science gives you a result you don’t like, pass a law saying the result is illegal. Problem solved.”¹⁰*
- 🌐 *“. . . a plank from the 2012 platform of the Republican Party of Texas . . . reads as follows: ‘We oppose the teaching of Higher Order Thinking Skills (HOTS) (values clarification), critical thinking skills and similar programs that are simply a relabeling of Outcome-Based Education (OBE) (mastery learning) which focus on behavior modification and have the purpose of challenging the student’s fixed beliefs and undermining parental authority.’”¹¹*




 **“CLIMATE CHANGE IS STARING US IN THE FACE. THE SCIENCE IS CLEAR, AND THE NEED TO REDUCE PLANET-WARMING EMISSIONS HAS GROWN URGENT. SO WHY, COLLECTIVELY, ARE WE DOING SO LITTLE ABOUT IT?”¹²**

 ***“We have trouble imagining a future drastically different from the present. We block out complex problems that lack simple solutions. We dislike delayed benefits and so are reluctant to sacrifice today for future gains. And we find it harder to confront problems that creep upon us than emergencies that hit quickly.”¹²***




 **Worst of all, humanity acts as if it were immune to nature’s universal laws.**


 **Even catastrophes (e.g., Fukushima) do not produce a wake-up call.**



THE FATE OF THE EVER INCREASING NUMBERS OF HUMANS WILL BE MISERY UNTIL MORE CRITICAL THINKING ARISES ON POPULATION/CONSUMPTION/RESOURCE REGENERATION.

-  **A free, open, and civil discussion of these critical, interrelated issues is, at present, almost impossible to achieve.**
-  **Non-critical thinkers take an egotistical view of the world: (1) they take their facts as the only relevant ones, (2) they take their own perspective as the only sensible one, (3) they take their goal as the only valid one (http://www.criticalreading.com/critical_thinking.htm).**
-  **Exponential human population growth cannot continue on a finite planet with finite resources. Critical thinking requires that this fact be acknowledged.**

INACTION ON THE POPULATION/CONSUMPTION/ RESOURCES PROBLEM ENSURES MORE MISERY, STARVATION, DISEASE, AND DEATH.

-  **Inaction does not serve the common good.**
-  **Inaction means natural laws will reduce the human population to or below Earth's carrying capacity.**
-  **Climate change and exponential human population growth are interactive crises.**

 **FOR ANYONE WHO DECIDES TO
BECOME INVOLVED IN THE
POPULATION/CONSUMPTION/RESOURCES
CRISIS, TWO RECENT PUBLICATIONS
ARE STRONGLY RECOMMENDED.**

-  Paul and Anne Ehrlich¹³ provide a concise, readable overview of the complex population/consumption/resources problem. Both ecologists have been involved in global population issues since Paul Ehrlich authored *The Population Bomb* in 1968.
-  The article “Climate Change and Moral Judgment”¹⁴ discusses the six psychological challenges posed by climate change to the human, moral judgment system.


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CHAPTER 38

THE CATASTROPHIC RISKS OF IGNORING THE “NEW NORMAL” CLIMATE






 **“WHEN YOU FIRST HEAR OF THE NEW LAW ABOUT GLOBAL WARMING AND SEA-LEVEL RISE THAT JUST WENT INTO EFFECT IN NORTH CAROLINA, IT’S HARD NOT TO JUST LAUGH AT THE LUNACY. BUT IT IS QUITE SERIOUS.”¹**

 *“... the proposed bill is ‘exactly like saying, do not predict tomorrow’s weather based on radar images of a hurricane swirling offshore, moving west towards us with 60-mph winds and ten inches of rain. Predict the weather based on the last two weeks of fair weather with gentle breezes towards the east. Don’t use radar and barometers; use the Farmer’s Almanac and what grandpa remembers.’”²*

 The North Carolina law will have no effect upon the universal laws of physics, chemistry, and biology: glaciers will melt, water will expand when heated, and storms will increase in intensity and frequency.

EXCLUDING SCIENTIFIC EVIDENCE ON SEA LEVEL RISE CAN ADVERSELY AFFECT HUMAN SECURITY AS WELL AS AFFECTING ECONOMIC RISKS.

Sea level rise

-  **will result in refugees from areas inundated by sea level rise.**
-  **will have long-term adverse effects upon coastal housing prices.**
-  **will have immediate adverse effects upon coastal ecosystems.**
-  **will increase the probability of flooding in large coastal cities as well as smaller municipalities.**
-  **will affect that part of the human economy based on recreation.**



HUMANITY'S PRESENT PRACTICES ARE UNSUSTAINABLE AT BOTH NATIONAL AND GLOBAL LEVELS.

- 🌍 **Most humans have been conditioned to think in terms of national security.**
- 🌍 **However, climate change is clearly a matter of global security.**
- 🌍 **Global security requires nurturing the present Biosphere.**
- 🌍 **Intergenerational ethics requires a strong focus on global security over long periods of time.**

TWO EXAMPLES FOLLOW OF ISSUES AFFECTING BOTH NATIONAL AND GLOBAL SECURITY.

 ***“A reactor at the Millstone nuclear plant in Waterford, Conn., has shut down because of something that its 1960s designers never anticipated: the water in Long Island Sound was too warm to cool it.”³***

“Under the reactor’s safety rules, the cooling water can be no higher than 75 degrees [F] . . . the water’s temperature soared to 76.7 degrees [F], prompting the operator, Dominion Power, to order the shutdown of the 880-megawatt reactor.”³

A warming world with increased water shortages is the “new normal.”

In some cases, cooler water may be available in deeper water but, in a warming world, this water will get warmer eventually.

 ***“At least 117 boys were being born for every 100 girls at the beginning of this century in China.”⁴***

“The country’s last population census in 2000 revealed an increase of 750 million over half a century — more than a doubling.”⁴

These “new normals” are not sustainable and will probably result in antisocial behaviors, including violence.

“The imbalances [male-female] are greatest in poorer, rural areas, and because women from this background will be able to ‘marry up,’ it is mostly the poorest men who will find themselves with no marriage prospects.”⁴

“The Chinese government has expressed explicit concerns about the dangers for society and security.”⁴

However, if action fails to follow concerns, China and the rest of humanity will suffer grievously.







THE PRESENT BIOSPHERE INCLUDES ALL LIFE ON EARTH — IT IS SERIOUSLY ENDANGERED BY HUMAN ACTIVITIES AND WILL COLLAPSE IF “BUSINESS AS USUAL” CONTINUES, INCLUDING WILDLIFE TRAFFICKING.

- 🌍 The present Biosphere constitutes both Earth’s life support system and the source of renewable resources, so endangering it by greed for short-term profit for a few individuals is beyond belief.
- 🌍 “. . . *unlike the past, traffickers are no longer guaranteed safe passage, . . . undercover officers [are] monitoring corrupt ones [officials] and smugglers trying to outwit them all.*”⁵
- 🌍 “. . . *well over 300 elephants are thought to have been killed*” in Cameroon early in 2012, “. . . *wiping out a significant portion of the country’s elephant population.*”⁶
- 🌍 Many of the species being wiped out took millions of years to evolve. Protecting the common good requires that this destruction be stopped.






 ***“THERE IS SOMETHING FUNDAMENTALLY WRONG IN TREATING THE EARTH AS IF IT WERE A BUSINESS IN LIQUIDATION.”⁷***

- 🌍 **Commodification of the Biosphere as presently practiced is unsustainable.**
- 🌍 **Financial globalization has ensured increased access to all ecological and species components of the Biosphere and increased the destruction of natural systems.**
- 🌍 **Both commodification of natural systems and financial globalization have adversely affected the remnants of intergenerational ethics.**
- 🌍 **How ironic that the human economic system, which is a subset of the Biosphere, will cause, if business as usual continues, the present Biosphere to collapse.**
- 🌍 **The present economic system is unsustainable.**

 **THE OCEANS ARE THE LARGEST (ABOUT 71%) COMPONENT OF THE PRESENT BIOSPHERE, AND HUMANITY'S RELATIONSHIP WITH THE OCEANS IS AN INDICATOR OF THE PROSPECTS FOR SURVIVAL OF CIVILIZATION AND *HOMO SAPIENS*.**


-  *“ . . . the Ocean Health Index . . . Is the first broad, quantitative assessment of the critical relationships between the ocean and people, framed in terms of the many benefits we derive from the ocean, instead of simply assuming any human presence is negative, it asks what our impacts mean for the things we care about.”⁸*
-  **Humanity has not even begun to develop a sustainable relationship with the largest global commons, the ocean(s). This connection must be made in the early part of the 21st century.**
-  **This sustainable relationship should begin with restoration to the ocean's previous mildly alkaline condition. Major reduction at once of anthropogenic carbon dioxide emissions will probably be essential to this goal.**




UNTIL HUMANITY ACCEPTS MORE HUMANE WAYS TO CONTROL HUMAN POPULATION GROWTH THAN MISERY, STARVATION, DISEASE, AND DEATH, A QUALITY LIFE WILL NOT BE ATTAINABLE FOR ALL HUMANS.

-  Improving technology is only a temporary “solution” if exponential growth continues on a finite planet.
-  *“To a large extent, refusal to recognize that continued population growth is a serious threat to the future of civilization can be blamed on the failure of educational systems to bridge key parts of the culture gap, the growing chasm between what we each know as individuals and all of the knowledge society possesses corporately.”⁹*
-  Population growth and per capita resource consumption are major factors in biospheric degradation.
-  Humanity must accept that resources are increasingly scarce and more expensive to acquire.
-  Exponential population growth on a finite planet is already a major crisis.

THE “NEW NORMAL” CLIMATE HAS ALREADY ARRIVED AND IS FAR LESS BENIGN THAN THE “OLD NORMAL” DESPITE TWO WORLD WARS AND A GLOBAL DEPRESSION IN THE OLD NORMAL.

- 🌐 Clugston¹⁰ suggests that austerity will be the “new normal.”
- 🌐 *Austerity* is defined as “*harsh, strict, severe, without luxury.*” (Webster’s Dictionary – Harper Collins)
- 🌐 At present, at least 1 billion people would embrace austerity as an improvement.
- 🌐 Failure to take actions on greenhouse gas emissions, exponential human population growth, and ecological overshoot suggests that present generations will probably experience a “new abnormal.”
- 🌐 However, the World Bank’s Compound Annual Growth Rate in Global Material Living Standard (per capita GDP) Improvement has decreased from 2.01% (1960-2000) to 1.66% (2000-2008) to 0.40% (2008-2011).¹⁰
- 🌐 Failure to take actions on greenhouse gas emissions, exponential human population growth, and ecological overshoot suggests that present generations will probably experience a “new abnormal.”

 **“RECENT RESEARCH INDICATES THAT THE CLIMATE IN COMING DECADES AND CENTURIES WILL BE LARGELY DETERMINED BY HUMAN ACTIVITIES.”¹¹**

-  **“Failure to take meaningful actions to reduce global emissions [greenhouse gases] is a particularly serious decision.”¹¹**
-  **Since global changes are likely to be irreversible, a series of “new normals” will almost certainly be in place unless forcing factors (e.g., greenhouse gas emissions, exponential population growth) are eliminated or markedly reduced.**
-  **If humanity fails to accept the present “new normal,” how will it fare with the series of “new normals” that are inevitable if the nine interactive global crises^{12,13} continue to worsen?**


Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich, Paula Kullberg, and Karen Cairns for calling useful references to my attention.


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CHAPTER 39

ASSISTED BIOTIC COLONIZATION TO PRESERVE THE PRESENT BIOSPHERE

 ***“MANKIND PERCEIVES THAT IT HAS EVOLVED WITHIN A CERTAIN MOSAIC OF ECOSYSTEMS UPON WHICH IT HAS SLOWLY COME TO REALIZE THAT IT IS DEPENDENT. BUT IT ALSO SHOWS A BIOLOGICALLY IMPERATIVE PRAGMATISM WHEREIN WE, ALBEIT ANTHROPOCENTRICALLY, BELIEVE THAT THE EARTH’S PRESENT LIFE-SUPPORTING CAPABILITIES PROVIDE THE BEST OPPORTUNITIES FOR THAT COMPONENT OF ORGANISMS AND THAT MOSAIC OF ECOSYSTEMS WITH WHICH WE MOST WANT TO SHARE OUR LIVES DURING OUR REMARKABLY SHORT PERIOD OF TENURE-SHIP ON EARTH.”¹***



SEA LEVEL RISE AND OTHER CONSEQUENCES OF GLOBAL CLIMATE CHANGE MAY NEGATE MANY ECOLOGICAL RESTORATION PROJECTS TO A PREDISTURBANCE OR ECOLOGICALLY IMPROVED CONDITION.





- 🌐 For example: *“Salt water chewed away at thousands of acres of cypress swamp”* in Louisiana, USA.²
- 🌐 *“The restoration project — divided into three tiers — aims to restore or protect 57,000 acres of habitat . . .”*²
- 🌐 *“. . . ‘as sea level rises, benefits of the federally identified plan diminish and would cease’ under the worst case scenario.”*²



MUST ANY COMPONENT OF THE PRESENT BIOSPHERE BE LOST BECAUSE ECOLOGICAL RESTORATION WILL BE NEGATED BY SEA LEVEL RISE?

- ① **No! As the sea level rises, potentially comparable habitat sites will become available inland and, if properly prepared and colonized by appropriate species, could replace all or most of the damaged habitat.**
- ① **Because the present Biosphere is hospitable to *Homo sapiens*, the primary goal of assisted biotic colonization is to keep present ecosystems and their species functional and alive for the longest possible span of time.**
- ① **If the present Biosphere collapses because of unsustainable anthropogenic practices, another Biosphere will replace it in evolutionary time if past events are repeated.**
- ① **Since the species and ecosystems are likely to be markedly different, they are not as likely to be as hospitable to *Homo sapiens* as the present ones are.**


SOME PREVIOUS RESEARCH ON CREATED WETLANDS INVOLVED ASSISTED COLONIZATION, AND SOME OF THE WETLANDS HAVE PERSISTED FOR 20 YEARS, WHICH SUGGESTS THE POTENTIAL FOR SELF MAINTENANCE.^{3,4,5}



-  **Assisted biotic colonization requires: (1) a statement of justification, (2) an explanation of the ecological concepts, (3) a detailed description of the goals and conditions, and (4) an explanation of the risks and uncertainties.**
-  **Assisted biotic colonization should be both goal and process oriented.**
-  **All ecosystems have successional processes that require continual colonization of species, so assisted biotic colonization may need to be a long-term management responsibility if no natural sources of colonizing species are within an appropriate range.**
-  **The expected ecosystem services (e.g., biomass production, assimilation of pollutants) should be identified before construction/assisted biotic colonization and verified once the ecosystem has been completed.**









BIOLOGICAL/CHEMICAL/PHYSICAL MONITORING SHOULD BE A MANDATORY COMPONENT OF ALL ASSISTED BIOTIC COLONIZATION UNDERTAKINGS. MONITORING IN THIS CONTEXT IS “SURVEILLANCE” UNDERTAKEN TO ENSURE THAT PREVIOUSLY ESTABLISHED QUALITY CONTROL METRICS ARE BEING MET (SIMILAR IN PRINCIPLE TO HOSPITAL INTENSIVE CARE AND INDUSTRIAL PRODUCTION MONITORING).

- 🌐 **A monitoring system is useless unless a rapid response team is available and empowered to initiate immediate corrective action when the previously established quality control conditions are not being met.**
- 🌐 **In the initial stages of monitoring complex systems, both false positive (indication that conditions are deviating from established norms, when they are not) and false negative (indication that conditions are not deviating from established norms, when they are) signals should be viewed as opportunities to improve the monitoring system**
- 🌐 **Monitoring should be regarded as an essential safeguard to ensure that a critical system (e.g., the Biosphere) is not at risk.**




 ***“IF ONE ACCEPTS THE HYPOTHESIS THAT HUMAN SOCIETY’S LIFE SUPPORT SYSTEM REQUIRES BOTH TECHNOLOGICAL AND ECOSYSTEM COMPONENTS, THEN IT IS DIFFICULT TO VISUALIZE SUSTAINABLE USE OF THE PLANET AT THE PROJECTED POPULATION DENSITIES AND EXPECTATION OF AFFLUENCE WITHOUT ROBUST DELIVERY OF BOTH TYPES OF SERVICES.”⁶***

-  Even if assisted biotic colonization replaces lost coastal ecosystems, sustainable use of the planet will not be possible until the nine interactive global crises are eliminated.
-  For example, assisted biotic colonization requires suitable colonizing species, and they will not be available at necessary levels if biodiversity loss and biotic impoverishment continue at present rates.







 **“TO COMPENSATE FOR THE RATE OF GLOBAL BIOSPHERIC DESTRUCTION,” BOTH ASSISTED BIOTIC COLONIZATION AND ECOSYSTEM CONSTRUCTION “MUST BE CARRIED OUT IN A LANDSCAPE CONTEXT WHENEVER POSSIBLE.”⁶**

-  **“Large systems are more likely to be self maintaining” than smaller systems.⁶**
-  **“Economies of scale” are generally available in large systems.⁶**
-  **Large undertakings are more likely than small undertakings to generate public interest, which may offer a degree of protection less likely to occur in small systems.⁶**
-  **Patch dynamics (e.g., shift from a species sink to a species source) is more likely to function in a large system.⁶**
-  **Species dispersion is more likely to be effective in large systems, thus enhancing the colonization rate.⁶**

HUMANITY'S RELATIONSHIP TO THE BIOSPHERE MAY BE IMPROVED BY ASSISTED BIOTIC COLONIZATION AND ECOSYSTEM CONSTRUCTION IN AN INTERACTIVE URBAN CONTEXT.

-  **Ecological restoration case studies should have significant citizen and environmental organization involvement.**
-  **The process of ecological restoration shares much with assisted biotic colonization, and ecological construction involves a variety of professions and interest groups.**
-  **Considerations in restoration programs include (1) a landscape perspective, (2) adaptive planning and management (analysis of alternative strategies, review of new scientific data, reanalyzing management decisions), (3) evaluation and ranking of alternatives based on an assessment of opportunity-cost rather than on traditional benefit-cost analysis, (4) the objective of returning an ecosystem to a close approximation of its condition prior to disturbance, (5) agencies to coordinate restoration programs in local areas, and (6) a unified strategy for all involved.⁷**

SCIENTISTS, RESOURCE MANAGERS, POLICY ANALYSTS, AND DECISION MAKERS MUST BE INVOLVED INTERACTIVELY IN DESIGNING RESOURCE MANAGEMENT PROGRAMS.^{8,9}

-  **Humanity should be using both a landscape and global perspective for all biospheric issues, but is poorly prepared to do either.**
-  **Academe is divided into “*zealously defended specialized tribal units*” (disciplines).¹⁰**
-  **The financial component of human society is divided into tribal units with a strong focus on economic growth and profit.**
-  **Political subdivisions (e.g., townships, nations) have a strong motive to optimize the well being of a particular region as opposed to the common good.**
-  **Other special interest groups usually have a single major focus.**
-  **All the above serve a useful purpose or they would not exist, but consilience is rarely one of the strong points.**

AS LONG AS DAMAGE TO THE BIOSPHERE EXCEEDS REPAIR, HUMANKIND IS IN GRAVE DANGER.

- 🌍 The Biosphere is a large, interactive system, and repairing only parts of it is not enough.
- 🌍 The basic units of the Biosphere are species and ecosystems, and the extinction of species initiates irreversible damage to an ecosystem.
- 🌍 The Biosphere is the source of renewable resources, without which the human economy will crash.
- 🌍 *Homo sapiens* evolved in the present Biosphere and is a part of it — not apart from it.


Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich, Paula Kullberg, and Karen Cairns for calling useful references to my attention.


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CHAPTER 40

**TO SURVIVE, HUMANITY MUST
LEARN MORE ABOUT THE
LARGER SYSTEM OF WHICH IT
IS A PART: THE PRESENT
BIOSPHERE**

 ***“NO, THOUGH A MAN BE WISE, ‘TIS NO SHAME FOR HIM TO LEARN MANY THINGS, AND TO BEND IN SEASON.”¹***

 **“TODAY THE NETWORK OF RELATIONSHIPS LINKING THE HUMAN RACE TO ITSELF AND TO THE REST OF THE BIOSPHERE IS SO COMPLEX THAT ALL ASPECTS AFFECT ALL OTHERS TO AN EXTRAORDINARY DEGREE. SOMEONE SHOULD BE STUDYING THE WHOLE SYSTEM, HOWEVER CRUDELY THAT HAS TO BE DONE, BECAUSE NO GLUING TOGETHER OF PARTIAL STUDIES OF A COMPLEX NONLINEAR SYSTEM CAN GIVE A GOOD IDEA OF THE BEHAVIOR OF THE WHOLE.”** Murray Gell-Mann


 ***“WE CAN’T IMPOSE OUR WILL ON A SYSTEM. WE CAN LISTEN TO WHAT THE SYSTEM TELLS US, AND DISCOVER HOW ITS PROPERTIES AND OUR VALUES CAN WORK TOGETHER TO BRING FORTH SOMETHING MUCH BETTER THAN COULD EVER BE PRODUCED BY OUR WILL ALONE.”²***




 **THE EFFECTS OF HUMAN BEHAVIOR HAS PHYSICALLY ALTERED EARTH. THE CENTRAL QUESTION IS: HOW MUCH LONGER CAN DESTRUCTIVE EFFECTS STRONGLY OUTWEIGH CONSTRUCTIVE EFFECTS?**








WHEN PHYSICAL AND CHEMICAL CONDITIONS ARE APPROPRIATE, THE TWO BASIC NEEDS OF ALL LIFE FORMS ARE ENERGY AND RESOURCES.


- Humans discovered that the use of fossil fuel provided them with far more energy per capital than available to any other species.
- This abundance of energy per capita made it possible for humans to appropriate resources from other species.
- The abundance of energy also made the Industrial Revolution possible.
- Wastes from the Industrial Revolution were hazardous to most species, including *Homo sapiens*.
- Wastes (output) from non-human species serve as resources (input) for other species in the Biosphere.




 **ECONOMIC GROWTH, HUMANITY'S
PRESENT ADDICTION, IS NOT
SUSTAINABLE BECAUSE IT IS RESOURCE
DEPENDENT AND RESOURCES ARE
FINITE ON A FINITE PLANET.**

-  **Worse yet, economic growth is presently based on fossil fuels that produce the greenhouse gas carbon dioxide and global warming.**
-  **Global warming is adversely affecting food production — “. . . *global food prices soared by 10% in July [2012], with staples such as maize and soybean increasing by 25% to an all-time high.*”³**
-  **World food prices are a major factor in civil unrest, which is not good for the global economy.**




RECYCLING, RATHER THAN “THROW-AWAY LIVING,” SHOULD BECOME THE CULTURAL NORM.


-  **Recycling would markedly reduce ecological overshoot.**
-  **Exponential human population growth is dramatically increasing resource consumption.**
-  **Exponential human population growth on a finite planet means less resources per capita.**
-  **The extremely wealthy 1% of the population will probably not be markedly affected by resource scarcity, but about 30% of the population, the very poor, will be.**
-  **As long as the population / resource use / consumption problem remains essentially ignored, misery for many will be the norm.**



 **THE OCEANS REPRESENT 71 PERCENT OF THE AREA OF THE BIOSPHERIC SYSTEM, BUT “... FORESTS COVER 31 PERCENT OF THE WORLD’S LAND SURFACE ...”⁴**

-  Forests provide both renewable resources (such as timber) and ecosystem services (“*they filter water, control water runoff, protect soil, regulate climate, cycle and store nutrients, and provide habitat for countless animal species . . .*”).⁴
-  Planted forests (monoculture) have a much lower biodiversity than old growth (mixed species) forests. “*The spread of planted forests has been accelerating, rising from an expansion of 3.7 million hectares annually in the 1990s to 4.9 million hectares annually the following decade.*”⁴
-  This biotic impoverishment at a mega-systems level for tree species and an even greater total loss of biodiversity has serious, often irreversible, effects upon the present Biosphere.

THE HUMAN POPULATION IS GROWING EXPONENTIALLY — THE HUMAN FOOD SUPPLY IS NOT. WHY IS THERE SO LITTLE PUBLIC ATTENTION BEING GIVEN TO THIS ISSUE?⁵

-  *“The world is in transition from an era of food abundance to one of scarcity. Over the last decade, world grain reserves have fallen by one third. World food prices have more than doubled, triggering a worldwide land rush and ushering in a new geopolitics of food. Food is the new oil. Land is the new gold.”⁵*
-  *“When this period of food abundance began, the world had 2.5 billion people. Today [2012] it has 7 billion.”⁵*
-  **Critical thinking at the systems level on this crisis is long overdue.**

 **PERPETUAL HUMAN POPULATION AND ECONOMIC GROWTH ON A FINITE PLANET WITH FINITE RESOURCES IS UNSUSTAINABLE MADNESS, AND YET, HUMANITY EXTOLS ECONOMIC GROWTH WHILE DISCUSSIONS OF POPULATION GROWTH ARE TABOO OR HIGHLY EMOTIONAL IF THEY DO OCCUR.**

-  Rarely is humanity's life support system, the present Biosphere, mentioned in public policy statements or political campaigns.
-  Establishing limits to growth and nurturing the planet's life support system benefit the common good and should be the basis of intergenerational ethics if humanity wishes to leave a habitable planet for its descendants.

THE NINE GLOBAL CRISES^{6,7} REMAIN UNADDRESSED, AND MOST, PROBABLY ALL, ARE WORSENING.

- 🌍 **Water stress is common for many humans; anthropogenic greenhouse gas emissions continue to rise; and biodiversity loss and biotic impoverishment continue, as does exponential human population growth, oceanic acidity that may reach corrosive levels in the polar regions, and disparity in wealth.**
- 🌍 **If the present Biosphere collapses, even the wealthiest one percent of the population will have no defense against the consequences.**
- 🌍 ***Homo sapiens* evolved in the present Biosphere and is the result of conditions that maintain it and the other species that evolved within them.**
- 🌍 **None of the past five biospheres were as suitable as the present Biosphere for *Homo sapiens*, and probably none of the future biospheres will be either.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication.

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CHAPTER 41



FACING REALITY TO PRESERVE THE PRESENT BIOSPHERE







***“REALITY IS THAT WHICH,
WHEN YOU STOP BELIEVING
IN IT, DOESN'T GO AWAY.”***

Philip K. Dick¹

 **NINE INTERACTIVE CRISES^{2,3} THREATEN THE PRESENT BIOSPHERE, WHICH SERVES AS A LIFE SUPPORT SYSTEM FOR THE MILLIONS OF SPECIES THAT EVOLVED IN IT, INCLUDING HUMANS, AND ALSO PROVIDES RENEWABLE RESOURCES ESSENTIAL TO THE HUMAN ECONOMY.**

-  **Despite the importance of these crises, little or no attention has been given to them.**
-  **However, global crises require facing reality, however unpleasant.**

 ***“WE ARE THE HEALTHIEST, WEALTHIEST, AND LONGEST-LIVED PEOPLE IN HISTORY. AND WE ARE INCREASINGLY AFRAID. THIS IS ONE OF THE GREAT PARADOXES OF OUR TIME.”⁴***

-  ***“Some of the more common fears are: (1) fear of the unknown, (2) fear of failure and rejection, (3) fear of loss (losing what you have), (4) fear of facing reality, and (5) fear of disapproval.”⁵***
-  **Facing reality is facilitated if new information is framed in the context of the preponderance of evidence.**
-  **Special interest groups rarely have the common good as a high priority.**









THE MERCHANTS OF DOUBT⁶ AND THE MERCHANTS OF FEAR⁷ SPEND HUGE AMOUNTS OF MONEY TO OBSCURE REALITY.


- 🌍 Humankind is creating an alien planet (a reality), and it fears the changes necessary in lifestyle and worldview to eliminate or minimize existing threats to the present Biosphere.
- 🌍 However, *“Pushing through fear is less frightening than living with the underlying fear that comes from the feeling of helplessness.”*⁸
- 🌍 *“Public opinion about climate change . . . can be compared to waves ‘in a shallow pan,’ easily tipped with ‘a lot of sloshing but not a lot of depth.’”*⁹



🗣️ “POLITICIANS AND BUSINESS PEOPLE LOOK FORWARD EAGERLY TO THE ANNOUNCEMENT OF THE NUMBER OF NEW JOBS CREATED IN THE US EACH MONTH. . . . AROUND 125,000 NEW JOBS EACH MONTH [MUST BE CREATED] JUST TO TAKE CARE OF THE POPULATION GROWTH IN THE US!”¹⁰

- 🌐 Population grows exponentially — jobs rarely grow for any substantial amount of time.
- 🌐 Most jobs are based on resources that rarely grow exponentially on a finite planet.
- 🌐 The news media should be responsible for quality control to ensure that verifiable evidence (reality) is provided in letters, commentaries, and news articles.

 **“ONE OFTEN READS AND HEARS STATEMENTS: ‘THE UNITED STATES HAS 250 YEARS SUPPLY OF COAL,’ ‘THE UNITED STATES OIL INDEPENDENCE IS NO LONGER A JOKE’ AND ‘SHALE GAS COULD SUPPLY 100 YEARS OF CONSUMPTION FOR THE UNITED STATES.’”¹¹**

-  Careful analysis (reality) *“clearly shows that those optimistic statements are false.”¹¹*
-  *“To be accurate about the extraction of a fossil fuel from the Earth in the future, one must use a mathematical function that rises quickly, usually exponentially, then levels off to a peak and then falls, usually exponentially, either slower or faster than it rose.”¹¹*
-  *“... coal extraction in the United States is peaking about now at about 80 percent extracted . . .”¹¹*
-  *“... crude oil is about 78 percent extracted in the United States . . .”¹¹*
-  *“It appears that natural gas is about 71 percent extracted in the United States.”¹¹*

 ***“NEVERTHELESS, THE GENERAL PICTURE [ABOUT RESOURCES] IS INESCAPABLE: IT IS ONE OF MUTUALLY INTERACTING INSTANCES OF OVERCONSUMPTION AND EMERGING SCARCITY.”¹²***

-  ***“If the increased availability of cheap energy has historically enabled unprecedented growth in the extraction rates of other resources, then the coincidence of Peak Oil with the peaking and decline of many other resources is entirely predictable.”¹²***
-  ***The generation of Americans born after World War II has “. . . stolen much from the future generations; the main question remaining is, can we now give them back at least the possibility that they might build the world we once dreamed of?”¹²***

HUMANITY HAS LEFT THE BRIEF CORNUCOPIAN ERA AND IS ENTERING A LONG-TERM ERA OF SCARCITY.

- 🌍 Inhabitants of developed countries must learn to live in an age of scarcity (reality) so that the lives of those living in misery are not worsened.
- 🌍 Regulations protecting the present Biosphere must be enforced so that no resources are impaired. In short, the “. . . *largely successful war on federal regulatory agencies . . .*”¹³ must cease.
- 🌍 Disasters such as Fukushima, whose operators knew “*safety improvements were needed before the disaster but had failed to implement them,*”¹⁴ should never happen again.
- 🌍 Economic growth should never be given a higher priority than compassion.


Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Kullberg, Paul Ehrlich, and Richard Rusk for calling useful references to my attention..





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CHAPTER 42


FUTURE AVAILABILITY OF BIOSPHERIC RESOURCES: HOW WILL HUMANS FRAME THEIR WORLD VIEWS?

 **TO UNDERSTAND THE EVENTS OF THE NEXT 50 YEARS, ONE MUST FIRST AND FOREMOST UNDERSTAND ENVIRONMENTAL SCARCITY OR “DIMINISHING NATURAL RESOURCES.”¹**

-  **Biospheric resources, such as grain, are at record breaking high prices, which also increase livestock prices.²**
-  **Global climate change (e.g., global warming, altered rainfall, droughts) already adversely affects regeneration of renewable resources.**
-  **Human population is growing exponentially while renewable resource regeneration is declining.**
-  **No political infrastructure exists that has the authority to address global resource crises.**

 ***“NATURE IS TRYING VERY HARD TO MAKE US SUCCEED, BUT NATURE DOES NOT DEPEND ON US. WE ARE NOT THE ONLY EXPERIMENT.”³***


 ***“THE GREEKS RIOTED IN RESPONSE TO ‘AUSTERITY MEASURES’ — BUT TO NO AVAIL. THE EARTH RUNS THE SHOW.”⁴***






***“TO BE UNCERTAIN IS TO
BE UNCOMFORTABLE, BUT
TO BE CERTAIN IS TO BE
RIDICULOUS.”*** Chinese Proverb








***“YOU CANNOT DEVALUE THE BODY
AND VALUE THE SOUL — OR
ANYTHING ELSE . . . CONTEMPT FOR
THE BODY IS INVARIABLY
MANIFESTED IN CONTEMPT FOR
OTHER BODIES — THE BODIES OF
SLAVES, LABOURERS, WOMEN,
ANIMALS, PLANTS, THE EARTH
ITSELF.”⁵***



 **“DINOSAURS DOMINATED THE EARTH WELL BEFORE HUMANITY AND SURVIVED OVER 150 MILLION YEARS. HUMANS, ON THE OTHER HAND, HAVE BEEN AROUND FOR ABOUT 3 MILLION YEARS. NATURE DESTROYED THEM [the dinosaurs], ARE WE NEXT? SOMETHING MUST BE DONE SOON BECAUSE ‘NATURE BATS LAST!’”⁶**


-  **“The technical term for understanding within the cognitive sciences is ‘framing.’ [Humans] think, mostly unconsciously, in terms of systems of structure called ‘frames’ . . . the frame circuitry in our brains doesn’t change overnight.”⁷**
-  **The way humanity frames its present circumstances, climate change, and scientific evidence of the probability of future changes will strongly affect the survival of *Homo sapiens*.**
-  **Realistic framing was less important when resources were abundant relative to human population size. However, in an era of resource scarcity, realistic framing is essential.**




IF ECOLOGICAL OVERSHOOT IS NOT ELIMINATED, THE PRESENT BIOSPHERE WILL COLLAPSE, AS DID FIVE PREVIOUS BIOSPHERES, AND HUMAN CIVILIZATION WILL PROBABLY NOT SURVIVE.

-  **Option #1 — Continue business as usual and hope someone or something (technology) will save humanity.**
-  **Option #2 — Humanity could try living frugally within the resources available in each nation and share limited resources with compassion until the human population is at or below carrying capacity.**
-  **Option #3 — Forget the common good and let the “winners” take all.**
-  **Option #4 — When on the Titanic, one might as well go first class — not very good news for posterity.**

 **THE HUMAN PREDICAMENT CAN BE DESCRIBED IN A FEW WORDS: “*TOO SMART FOR OUR OWN GOOD . . . AND TOO DUMB TO CHANGE.*”⁸**

-  For example: “*. . . climate change causes 400,000 deaths on average each year, primarily due to hunger and communicable diseases. Separately, fossil fuels and the activities that support such a carbon-intensive energy system cause an estimated 4.5 million deaths each year linked to air pollution, hazardous occupations and cancer.*”⁹
-  “*Economic losses in 2030 of China, India and the United States alone will collectively total \$2.5 trillion and more than 3 million death[s] per year, or half of all mortality . . .*”⁹

 **UNTIL THE NINE INTERACTIVE THREATS^{10,11}
TO THE PRESENT BIOSPHERE ARE
ELIMINATED, HUMANITY WILL REMAIN AT
HIGH RISK, AS WILL THE MILLIONS OF OTHER
SPECIES THAT EVOLVED IN THE PRESENT
BIOSPHERE.**


-  **How much scientific evidence will it take to counter the effective news activities of the “merchants of doubt”?¹²**
-  **How much additional human misery will it take to awaken reason and compassion?**
-  **Must the present Biosphere collapse before humanity realizes that the human economy is a subset of the present Biosphere?**


HUMANITY'S ANCIENT TRIBAL ANCESTORS PAID CLOSE ATTENTION TO THE HABITATS FROM WHICH THEY OBTAINED THE RESOURCES NECESSARY FOR THEIR SURVIVAL — IF THEY HAD NOT, THEY WOULD NOT HAVE SURVIVED.

- 🌐 Tribal ancestors were far from perfect since they drove some megafauna to extinction by over hunting.
- 🌐 However, *Homo sapiens* managed to live sustainably for approximately 200,000 years.
- 🌐 The six other species in the genus *Homo* lived sustainably for approximately 4 million years.
- 🌐 Living sustainably was accomplished in the Edo (now Tokyo) period in Japan from 1603 to about 1847.
- 🌐 *Homo sapiens* may still live sustainably if strong actions are taken immediately.

 ***“MORE THAN 99 PERCENT OF ALL SPECIES THAT HAVE LIVED ON EARTH ARE NOW EXTINCT.”***

(<http://dsc.discovery.com>)

 **If humanity's world view is not congruent with the universal laws of physics, chemistry, and biology, catastrophic consequences will follow.**

 A SPECIES WITH A GLOBAL DISTRIBUTION (I.E., *HOMO SAPIENS*) MUST DEVELOP A WORLD VIEW BASED ON THE HEALTH AND INTEGRITY OF THE PRESENT BIOSPHERE — THE SOURCE OF RENEWABLE RESOURCES AND ECOSYSTEM SERVICES.

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg and Paul Ehrlich for calling useful references to my attention.

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CHAPTER 43

CATASTROPHIC CLIMATE CHANGE AND THE BIOSPHERE


THE CATASTROPHIC EFFECTS OF “BUSINESS AS USUAL” HAVE ALREADY BECOME APPARENT.



Some effects are

-  **increasingly probable collapse of the present Biosphere,**
-  **catastrophic storms, droughts, and floods,**
-  **increased probability of pandemic diseases,**
-  **diminished productivity of renewable resources, including food,**
-  **catastrophic release of hazardous materials (e.g., Fukushima nuclear power plant destruction),**
-  **destruction of humanity’s infrastructure, such as transportation, power, and food delivery systems,**
-  **increased climate variability (e.g., temperature),**
-  **episodic storm release of hazardous materials.**

DURING AND AFTER SUPER STORM SANDY (IN THE UNITED STATES), DISCUSSIONS CENTERED ON REBUILDING CITIES AND TOWNS IN STORM DAMAGED AREAS.




- 🌐 However, insurance costs may shatter most of these dreams. For example, *“North America incurred \$510 billion in insured losses from weather catastrophes over the last three decades, and climate change is emerging as one of the reasons why, . . .”*¹
- 🌐 *“ . . . a nearly quintupled number of weather-related loss events [occurred] in North America for the past three decades, compared with an increase factor of 4 in Asia, 2.5 in Africa, 2 in Europe and 1.5 in South America, . . . ”*¹
- 🌐 *“Up to now, however, the increasing losses caused by weather related natural catastrophes have been primarily driven by socio-economic factors, such as population growth, urban sprawl, and increasing wealth.”*¹

 **“THE HEDGE EXPRESSED BY JOURNALISTS IS THAT MANY VARIABLES GO INTO CREATING A BIG STORM, SO THE SIZE OF HURRICANE SANDY, OR ANY SPECIFIC STORM, CANNOT BE ATTRIBUTED TO CLIMATE CHANGE. THAT’S TRUE AND IT’S BASED ON GOOD SCIENCE. HOWEVER, THAT STATEMENT DOES NOT MEAN THAT WE CANNOT SAY THAT CLIMATE CHANGE IS MAKING STORMS BIGGER. IT IS DOING JUST THAT — A STATEMENT ALSO BASED ON GOOD SCIENCE, AND ONE THAT THE INSURANCE INDUSTRY IS EMBRACING, . . .”²**

-  ***“Insurers, scientists and journalist[s] are beginning to drop the caveats and simply say that climate change is causing big storms.”²***
-  ***Still, the merchants of doubt state: “. . . they can’t even tell the weather three days ahead of time — how can they predict the climate? But in fact ‘they’ can tell the weather, and in the process they saved thousands upon thousands of lives.”²***






***“CLIMATE DENIERS EXPLOIT
SCIENTIFIC COMPLEXITY TO AVOID
ANY DISCUSSION AT ALL.”³***


-  ***“Clarity, however, is not beyond reach. Hurricane Sandy demands it: At least 40 U. S. deaths. Economic losses expected to climb as high as \$50 billion. Eight million homes without power. Hundreds of thousands of people evacuated. More than 15,000 flights grounded. Factories, stores, and hospitals shut. Lower Manhattan dark, silent, and underwater.”³***
-  ***“While nearly 200 nations at the 2009 United Nations Framework Convention on Climate Change agreed to limit the average global temperature increase to 3.6 degree[s] Fahrenheit (2 degrees Celsius) by 2050, too few nations have taken measurable steps to hitting that mark . . .”⁴***
-  **Humanity can, and must, do far, far better than this attempt!**

✚ CATASTROPHIC CONDITIONS ALREADY EXIST. “WITH FALLING WATER TABLES, ERODING SOILS, AND RISING TEMPERATURES MAKING IT DIFFICULT TO FEED GROWING POPULATIONS, CONTROL OF ARABLE LAND AND WATER RESOURCES IS MOVING TO CENTER STAGE IN THE GLOBAL STRUGGLE FOR FOOD SECURITY. WHAT WILL THE GEOPOLITICS OF FOOD LOOK LIKE IN A NEW ERA DOMINATED BY FOOD SCARCITY AND FOOD NATIONALISM?”⁵


- 🌍 Instead of action on the basic problem, climate change, the “solution” has become fighting over dwindling resources, which, at best, is a temporary, inadequate solution.**
- 🌍 A more effective, long-term solution is immediate rapid transition from fossil fuels to non-carbon energy sources (e.g., solar, wind, geothermal).**
- 🌍 Increasing energy use efficiency (e.g., insulate building more effectively) is a necessary additional action.**





 **OTHER REASONS EXIST FOR IMMEDIATE, PROTECTIVE ACTION. FOR EXAMPLE, “NO SERIOUS CLIMATE SCIENTIST BELIEVES THAT THE SEA WILL RISE LESS THAN A METER THIS CENTURY, UNLESS WE GET OFF FOSSIL FUEL WITH GREAT SPEED; MANY ANTICIPATE IT WILL RISE FAR MORE. THINK ABOUT WHAT THAT MEANS — . . . ANY AVERAGE STORM WILL BECOME AN INSIDIOUS THREAT.”⁶**


-  In the United States, updating floodplain mapping “. . . *will likely incorporate area[s] now considered at risk because of climate change effects like rising sea levels. That will raise federal flood insurance premiums to reflect risk realities, in turn stunting migration to vulnerable regions.*”⁷
-  How sad that human misery and suffering are required to give credence to warnings that scientists have been stating for at least three decades.

 **PERPETUAL GROWTH, INCLUDING ECONOMIC AND POPULATION, ON A FINITE PLANET IS DAMAGING THE PRESENT BIOSPHERE AND, IF CONTINUED, WILL RESULT IN COLLAPSE OF THE PRESENT BIOSPHERE.**

- 🌍 Continuation of “business as usual” is the disease — living sustainably by eliminating the nine interactive threats to the present Biosphere^{8,9} is the cure.
- 🌍 “. . . *the urgent crisis of climate change was never meaningfully discussed in the debates or on the campaign [United States in 2012] trail.*”¹⁰
- 🌍 However, super storm Sandy affected both the end of the political campaign and the voting process that followed it in many states disrupted by Sandy. ¹¹

 **HUMANITY WILL ALMOST CERTAINLY NOT
HAVE THE KIND OF WORLD IT WANTS
UNLESS IMMEDIATE, EFFECTIVE ACTION IS
TAKEN TO NURTURE THE PRESENT
BIOSPHERE.**

-  ***“What kind of world is likely if we take no deliberate action? What kind of world do we want? What kind of world is possible if we act effectively?”¹²***
-  **Surely humankind wishes to leave a habitable planet for posterity.**
-  **Surely humankind wants to limit population size with something other than misery, starvation, and death.**
-  ***Homo sapiens* evolved and flourished in the present Biosphere and probably could not have survived in the five previous biospheres. Surely the present Biosphere is worth preserving.**

 **“... GOVERNMENTS HAVE NOT RESPONDED TO THE CHANGE WITH ANY GREATER URGENCY ABOUT LIMITING GREENHOUSE GAS EMISSIONS. TO THE CONTRARY, THEIR MAIN RESPONSE HAS BEEN TO PLAN FOR EXPLOITATION OF NEWLY ACCESSIBLE MINERALS IN THE ARCTIC, INCLUDING DRILLING FOR MORE OIL. THAT IS, TO ACCELERATE THE CATASTROPHE. IT IS QUITE INTERESTING. IT DEMONSTRATES AN EXTRAORDINARY WILLINGNESS TO SACRIFICE THE LIVES OF OUR CHILDREN AND GRANDCHILDREN FOR SHORT-TERM GAIN, OR PERHAPS AN EQUALLY REMARKABLE WILLINGNESS TO SHUT OUR EYES SO AS NOT TO SEE IMPENDING PERIL. THESE THINGS YOU SOMETIMES FIND WITH YOUNG INFANTS: SOMETHING LOOKS DANGEROUS, CLOSE MY EYES AND WON'T LOOK AT IT.”¹³**



Surely humanity deserves better leadership than this!

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg and Paul Ehrlich for calling useful references to my attention.

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CHAPTER 44

**DELIBERATELY
CREATING AN ALIEN
PLANET**

ALIEN — BELONGING OR RELATING TO ANOTHER PERSON, PLACE, OR THING (www.merriam-webster.com)

-  **alien — wholly different in nature; foreign; adverse; inconsistent (with); incongruous** (thinkexist.com>Dictionary>Ain-All)
-  **alien — differing in nature or character typically to the point of incompatibility** (www.merriam-webster.com)
-  **alien — (to somebody/something) strange and frightening; different from what you are used to** (<http://oald8.oxfordlearnersdictionaries.com>)





 **INDIVIDUALS OF THE SPECIES *HOMO SAPIENS* OFTEN IDENTIFY THOSE INDIVIDUALS OF THE SPECIES AS ALIENS IF THEY ARE FROM A DIFFERENT CULTURE —A “THEM” VERSUS “US” ATTITUDE. INDIVIDUALS ALSO OFTEN IDENTIFY WITH ECOSYSTEMS IN WHICH THEY LIVE AND THEIR GEOLOGICAL/CLIMATIC ENVIRONMENT (E.G., MOUNTAINS OR PLAINS).**

-  ***Homo sapiens* evolved as a small group (tribal), widely dispersed species and is most secure in small, ideologically uniform groups.**
-  **Although *Homo sapiens* is primarily in large cities, it has not adjusted to this comparatively new condition; ethnic differences are still a major source of contention.**
-  ***Homo sapiens* occupies most of the planet and has partially achieved financial globalization.**
-  **However, *Homo sapiens* has not displayed competence in addressing global problems such as climate change and overpopulation.**

✚ THE GENUS *HOMO* AND THE LAST SPECIES, *HOMO SAPIENS*, HAVE LIVED IN A WORLD OF CONSTANT CHANGE FOR APPROXIMATELY 4 MILLION AND 200,000 YEARS, RESPECTIVELY. HOWEVER, NOW THE WORLD HAS BEEN CHANGING MORE RAPIDLY THAN EVER, ESPECIALLY SINCE THE END OF WORLD WAR II.

- 🌍 **How did *Homo sapiens* become so powerful that it is capable of seriously damaging Earth's life support system, the present Biosphere?**
- 🌍 ***“Humanity's rise to dominance is a result of both genetic and cultural evolution***
. . .”¹ However, fossil fuels provided more energy per capita than any large species has ever had.
- 🌍 **However, present emissions from burning fossil fuels is changing Earth's climate and humanity is feverishly searching for more, which, if burnt, will almost certainly push the present Biosphere past the tipping points that result in collapse.**


HUMANITY'S ADDICTION TO DANGEROUS FOSSIL FUELS AS A SOURCE OF ENERGY RESULTS IN DRILLING IN ECOLOGICALLY SENSITIVE AREAS THAT ARE IMPORTANT COMPONENTS OF THE PRESENT BIOSPHERE.


-  Both tar sands processing and coal burning release hazardous chemicals into the water supply and the entire environment.
-  The sun is the primary source of energy — why not use it directly (e.g., solar panels) or indirectly (e.g., wind turbines)?
-  Fossil fuels are only cheap if one ignores the costs in human health and damage to the present Biosphere.
-  The profits from fossil fuels are acquired by a relatively small number of people, but the health and environmental costs are paid by society.





THE PRESENT CONTROVERSY OVER CLIMATE CHANGE PITS IDEOLOGY AGAINST SCIENCE, WHICH IS EVIDENCE BASED.





- 🌍 **The preponderance of evidence confirms that Earth’s climate is changing and anthropogenic greenhouse gas emissions are the cause.**
- 🌍 **Time is insufficient for markedly increasing literacy on a complex subject such as climate change.**
- 🌍 **However, the news media can make a major contribution by requiring that climate change denial must be supported by confirmed/verifiable evidence.**
- 🌍 **To further confuse, two new terms have appeared — “climate conflict” and “global warring.”²**


 **“GIVEN THE AVAILABLE SCIENTIFIC KNOWLEDGE OF THE CLIMATE SYSTEM, IT IS PRUDENT FOR SECURITY ANALYSTS TO EXPECT CLIMATE SURPRISES IN THE COMING DECADE, INCLUDING UNEXPECTED AND POTENTIALLY DISRUPTIVE SINGLE EVENTS AS WELL AS CONJUNCTIONS OF EVENTS OCCURRING SIMULTANEOUSLY OR IN SEQUENCE, AND FOR THEM TO BECOME PROGRESSIVELY MORE SERIOUS AND MORE FREQUENT THEREAFTER, MOST LIKELY AT AN ACCELERATING RATE. THE CLIMATE SURPRISES MAY AFFECT PARTICULAR REGIONS OR GLOBALLY INTEGRATED SYSTEMS, SUCH AS GRAIN MARKETS, THAT PROVIDE FOR HUMAN WELL-BEING. . .”²**



 ***“Unabated emissions of greenhouse gases are bound to cause trouble in an era of peak human population and appetites, so efforts to shift from energy menus dominated by fossil fuels are a very good idea.”²***

 **For the record — anthropogenic greenhouse gas emissions are still increasing substantially as vigorous searches continue for new sources of fossil fuel. Clean coal remains an aspiration, not a reality.**

 **FOR MANY YEARS, THE MERCHANTS OF DOUBT³
HAVE USED UNCERTAINTY IN SCIENCE TO DELAY
ACTION ON SCIENTIFIC INFORMATION WHILE
TURNING A BLIND EYE TO THE UNCERTAINTIES IN
POLITICAL ELECTIONS, SPORTS, AND LIFE IN
GENERAL.**

-  ***“There’s been a lot of uncertainty and quite a range of this quantity called climate sensitivity in the climate models . . . If you take our results at face value, it certainly indicates that the climate change will be at the higher side of what’s been put forth previously, and that’s not good news.”⁴***
-  ***“Clouds significantly influence the earth’s temperatures, but predicting how those ever-shifting masses will change is notoriously difficult.”⁴***
-  **The “new normal” climate will increase uncertainty until additional scientific evidence is available.**
-  **The war on science will impede gathering additional evidence.**

 **EARTH WILL BECOME INCREASINGLY ALIEN UNTIL HUMANITY ACCEPTS THE UNIVERSAL LAWS OF PHYSICS, CHEMISTRY, AND BIOLOGY AND LIVES ACCORDINGLY.**

-  ***“In the end, a pell-mell, decades-long rush to throw up housing and businesses along fragile and vulnerable coastlines trumped commonsense concerns about the wisdom of placing hundreds of thousands of closely huddled people in the path of potential cataclysms.”⁵***
-  ***“It’s just horrendous that there’s been all this research and all this analysis and so little action. . . It’s a shame that we seem never to take the kind of action we need to until something really awful happens.”⁶***



***“INSANITY: DOING THE
SAME THING OVER AND
OVER AGAIN AND
EXPECTING DIFFERENT
RESULTS.”*** Albert Einstein


- 🌍 **Is humanity confident it can live forever on an increasingly alien planet?**
- 🌍 **Humankind has no planet B to escape to and cannot “secede” from the universal laws.**



“WHAT ME WORRY?”

Alfred E. Neuman

fictional mascot
and cover boy
of *Mad Magazine*

 **THE CRUCIAL QUESTION OF THE 21ST CENTURY IS
“WILL HUMANITY FRAME A REALISTIC EVIDENCE
BASED WORLD VIEW OR BE PERSUADED BY THE
“MERCHANTS OF DOUBT”³ THAT CLIMATE CHANGE IS
A HOAX PERPETUATED BY SCIENTISTS IN ORDER TO
ACQUIRE RESEARCH FUNDING?”**




A related question is “Will the news media continue to give the “merchants of doubt” considerable coverage despite the lack of robust evidence to support the world view of the doubters?”



Hope is still justified! *“All nations will suffer the effects of a warmer world, but it is the world’s poorest countries that will be hit hardest by food shortages, rising sea levels, cyclones, and drought . . .”*⁷



***“A resource crisis exacerbated by global warming is looming, . . . More scientists must speak out.”*⁸**

 **HUMANITY WILL SUFFER
CATASTROPHES FROM PREVIOUSLY
EMITTED GREENHOUSE GASES, BUT
NOW HOPE IS EMERGING THAT
RISKS CAN BE REDUCED.**

-  ***“A coalition of the world’s largest investors called on governments . . . to ramp up action on climate change and boost clean-energy investment or risk trillions of dollars in investments and disruption to economies.”⁹***
-  **A current high probability is that a planetary tipping point will be passed if “business as usual” continues on greenhouse gas emissions.**
-  **Then the planet and the present Biosphere will become unmistakably alien.**



HUMANITY HAS SIMULTANEOUSLY GLOBALIZED ITS FATE AND AN INDUSTRY WHOSE PRIMARY GOAL IS TO CAST DOUBT ON THE SCIENTIFIC EVIDENCE BEARING ON THAT FATE (E.G., CLIMATE CHANGE).

- 🌍 **Humankind's ancestors lived in a dangerous world and they knew it.**
- 🌍 **An error in judgment could be fatal and they knew it.**
- 🌍 **Mother Nature (i.e., the universal laws) eliminates those species whose life styles are not congruent with the universal laws.**
- 🌍 **Conferences do not impress Mother Nature — action does.**

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paula Kullberg and Paul Ehrlich for calling useful references to my attention.

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CHAPTER 45

FOSSIL SUNLIGHT* VS RENEWABLE SUNLIGHT





*Fossil sunlight is sunlight captured by organisms and then turned into fossil fuel.



ANCIENT SUNLIGHT WAS CAPTURED BY EARTH'S PLANTS AND, AFTER MILLIONS OF YEARS, WAS TRANSFORMED INTO FOSSIL FUELS (i.e., COAL, PETROLEUM, METHANE).


- 🌐 **These fossil fuels were the energy source for the Industrial Revolution.**
- 🌐 **At present, the remaining fossil fuels are tough to acquire and are hazardous to use (i.e., resulting in greenhouse gases and toxic chemicals).**
- 🌐 **Why not use the abundant renewable sunlight that reaches Earth daily as an energy source?**

THE PRIMARY PROBLEM FOR THE BIOSPHERE IS THE INCREASING BUILD UP OF CARBON DIOXIDE FROM BURNING FOSSIL FUELS (COAL, PETROLEUM, NATURAL GAS).


-  Fossil fuels are finite on a finite planet, despite statements that they will last.
-  *“... in order to limit global warming to 2°C above pre-industrial levels — the generally accepted target to stabilize carbon emissions and avoid dangerous climate change — no more than one-third of the world’s remaining proven fossil fuel reserves can be burned, and massive global investments in energy efficiency and low-carbon energy technologies will be needed.”¹*
-  Humanity acquired temporary dominance over most other species because of cheap, abundant fossil fuel, which had hidden costs (e.g., climate change) that are just now beginning to be appreciated.²
-  The era of cheap, abundant energy is over.




“GLOBAL GREENHOUSE-GAS EMISSIONS FROM FOSSIL FUELS HAVE REACHED NEW RECORD LEVELS, YET THERE WILL BE NO NEW, GLOBALLY BINDING CLIMATE-PROTECTION AGREEMENT FOR ALL STATES BEFORE 2020.”³

 ***“The more serious the future climate changes turn out to be, the more expensive adjustment measures will become. It is not enough for politicians to set themselves targets. They must now also tackle implementation.”⁴***

 ***Because of the suicidal nature of humankind’s reckless use of fossil fuels, “Top International Energy Agency officials offered a bleak assessment . . . of the prospects for global progress on preventing big temperature increases.”⁵***

 ***“THE EXTREME WEATHER EVENTS
OF 2012 ARE WHAT WE [CLIMATE
SCIENTISTS] HAVE BEEN WARNING OF
FOR 25 YEARS, . . . ”⁶***


 ***“WILL OUR SHORT ATTENTION SPAN BE THE END OF US? JUST A MONTH AFTER THE SECOND “STORM OF A CENTURY” IN TWO YEARS, THE MEDIA MOVES ON TO THE LATEST SCANDAL WITH BARELY A RETROSPECTIVE GLANCE AT THE IMPLICATIONS OF THE EXTREME CLIMATE ANOMALIES WE HAVE SEEN.”⁶***




***“WE [HUMANS] LOADED THE
DICE. WE CHANGED OUR
CLIMATE.”⁶***



✚ THE COST OF THE TRANSITION TO ALTERNATIVE ENERGY SOURCES HAS RECEIVED MUCH DISCUSSION.⁷ HOWEVER, OMITTED FROM MOST OF THESE DISCUSSIONS IS A BASIC ETHICAL/MORAL QUESTION: HOW MUCH IS HUMANITY PREPARED TO PAY TO INCREASE THE PROBABILITY OF LEAVING A HABITABLE PLANET TO POSTERITY?

- 🌐 Twelve US government agencies decided in 2010 to “*use the same baseline of [US] \$21 per ton as the standard in monetizing the social costs of the seven-plus billion tons of carbon generated by American power plants, vehicles, and factories each year.*”⁷
- 🌐 If humankind does not act soon, runaway climate change could make the debate on costs of transition to non-carbon energy obsolete.
- 🌐 Extinction of *Homo sapiens* probably will move from possible to probable if “business as usual” continues with anthropogenic greenhouse gas emissions .

 **DESPITE LOOMING CLIMATE CHANGE CATASTROPHES, HUMANKIND'S CIRCUMSTANCES MAY WORSEN. FOR EXAMPLE, "THE HEARTLAND INSTITUTE, A LIBERTARIAN THINK TANK SKEPTICAL OF CLIMATE CHANGE SCIENCE, HAS JOINED WITH THE CONSERVATIVE AMERICAN LEGISLATIVE EXCHANGE COUNCIL TO WRITE MODEL LEGISLATION AIMED AT REVERSING STATE RENEWABLE ENERGY MANDATES ACROSS THE COUNTRY."**⁸

 ***"But, Gabe Elsner, co-director of the public watchdog group Checks and Balances Project, said the legislation and economic reports amount to a one-two punch against clean energy laws across the country by fossil-fuel interests."***⁸

SOME PRELIMINARY ESTIMATES OF THE COST OF A SLUGGISH TRANSITION TO NON-CARBON ENERGY SOURCES CAN BE DERIVED FROM THE DISASTER-PREPAREDNESS ECONOMY.

-  *“Driven of late by freakish storms, this [disaster preparedness] industry is growing fast, well beyond the fringe groups that first embraced it. And by some measures, it’s bigger than ever.”⁹*
-  Superstorm Sandy *“was a stark illustration of the power that climate change can deliver — today — to our doorsteps. Ask the homeowners along the New Jersey and New York shores still homeless. Ask the local governments struggling weeks later to turn on power to their cold, darkened towns and cities. Ask the entire [US] north-east coast, reeling from a catastrophe whose cost is estimated at \$50bn and rising.”⁶*



AN APOCALYPSE WILL BE CREATED BY DENIGRATING SCIENTIFIC EVIDENCE AND IGNORING REASON AND ETHICS.

- 🌍 **The collapse of the present Biosphere will result from passing a global tipping point, which will result in irreversible change.**
- 🌍 **Collapse of the present Biosphere will include a precipitous loss of renewable resources, including food.**
- 🌍 **Super storms, drought, spread of diseases, and other catastrophes will cause widespread generation of refugees, causing additional stress to “host” countries.**
- 🌍 **Social systems will collapse, resulting in a markedly ineffective social infrastructure for such needs as health care, electric service, and water and energy supplies.**
- 🌍 **Adaptation to new, alien conditions is problematic.**



**“THOSE WHO CAN MAKE YOU BELIEVE
ABSURDITIES, CAN MAKE YOU COMMIT
ATROCITIES.”**

Voltaire



**“INJUSTICE
ANYWHERE IS A
THREAT TO JUSTICE
EVERYWHERE.”**

MARTIN LUTHER KING, JR.



**“SOME THINGS YOU MUST
ALWAYS BE UNABLE TO BEAR.
SOME THINGS YOU MUST NEVER
STOP REFUSING TO BEAR.
INJUSTICE AND OUTRAGE AND
DISHONOR AND SHAME. NO
MATTER HOW YOUNG YOU ARE
OR HOW OLD YOU HAVE GOT.
NOT FOR KUDOS AND NOT FOR
CASH: YOUR PICTURE IN THE
PAPER NOR MONEY IN THE BANK
EITHER. JUST REFUSE TO BEAR
THEM.”**

William Faulkner


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CHAPTER 46


PROTECT THE WORLD'S CHILDREN: LEAVE A HABITABLE PLANET FOR POSTERITY


 **“THIS IS OUR FIRST TASK, CARING FOR OUR CHILDREN. IT’S OUR FIRST JOB. IF WE DON’T GET THAT RIGHT, WE DON’T GET ANYTHING RIGHT. THAT’S HOW, AS A SOCIETY, WE WILL BE JUDGED.”¹**

 *“We know we’re always doing right when we’re taking care of them [our children], when we’re teaching them well, when we’re showing acts of kindness. We don’t go wrong when we do that.”¹*

 And what of the future generations of children not yet born that are called posterity?

 Isn’t leaving a habitable planet for them to live on the ultimate act of kindness?

 Climate change is already adversely affecting food and water security and expanding the range of tropical diseases.

 The world’s children are now at increased risk.



HUMANITY CANNOT PROTECT THE WORLD'S CHILDREN IF RUNAWAY CLIMATE CHANGE OCCURS.

- 🌍 **Continuing anthropogenic greenhouse gas emissions at present rates ensures that runaway climate change will occur — probably in the 21st century.**
- 🌍 **One estimation is that humans have altered more than 50% of Earth's land surface and that the current rate of land transformation is unsustainable.²**
- 🌍 **The pH of the planet's oceans has been changed from mildly alkaline to mildly acidic, in addition to other changes.**
- 🌍 **The human population continues to grow exponentially, but food production does not.**
- 🌍 **The cost of combating climate change is surging,³ but policymakers still lack a sense of urgency for action.**




“THE ‘LAW’ OF DIMINISHING MARGINAL RETURNS APPLIES TO SUCCESSIVE INVESTMENTS IN NONRENEWABLE NATURAL RESOURCE (NNR) EXPLORATION; I.E., INVESTMENTS IN THE EXPLORATION FOR, THE EXTRACTION OF, AND THE PROVISIONING OF FOSSIL FUELS, METALS, AND NONMETALLIC MINERALS OVER TIME.”⁴







The reckless use of fossil fuels is rapid and causes damaging climate change, which is a threat to civilization.




The reckless use of nonrenewable resources leaves little for the present generation’s children , and the remaining, proven reserves are difficult to obtain and, in many cases, are in politically unstable regions.

 ***“THERE WAS A MAN WHO HAD A GOOSE THAT ALWAYS LAID GOLDEN EGGS, ONE EVERY DAY IN THE YEAR. NOW , HE THOUGHT THERE MUST BE GOLD INSIDE OF HER. SO HE WRUNG HER NECK AND LAID HER OPEN. HE FOUND THAT SHE WAS EXACTLY LIKE ALL OTHER GEESE. HE THOUGHT TO FIND RICHES, AND LOST THE LITTLE HE HAD.”⁵***


-  Humanity should be content to live with the services and the finite renewable resources the finite present Biosphere provides annually and not be greedy.
-  However, humanity is attempting to maintain a high consumption lifestyle for approximately half the world's population while the other half lives in conditions the wealthier half would find unacceptable.
-  Humanity must do more for its children and grandchildren than keep their pictures in a wallet or purse. It should do everything possible to leave a habitable planet for them to live on.


 **“THE SURVIVAL OF THE HUMAN SPECIES IS NOT A PREORDAINED EVOLUTIONARY PROGRAM. ABUNDANT SOURCES OF GENETIC VARIATION EXIST FOR VIRUSES TO LEARN NEW TRICKS, NOT NECESSARILY CONFINED TO WHAT HAPPENS ROUTINELY, OR EVEN FREQUENTLY.”⁶**

 **Many factors, if not addressed rapidly, could lead to a collapse of global civilization.⁷**

 **Major drivers of a global collapse are “*overpopulation, overconsumption by the rich and poor choices of technologies . . .*”⁷**

 **“*Dramatic cultural change provides the main hope of averting calamity.*”⁷**






 **“*But whether we or more optimistic observers are correct, our own ethical values compel us to think the benefits to those future generations are worth struggling for, to increase at least slightly the chances of avoiding a dissolution of today’s global civilization as we know it.*”⁷**







**“MAN IS THE ONLY ANIMAL
FOR WHO HIS OWN EXISTENCE
IS A PROBLEM WHICH HE HAS
TO SOLVE.”** *Erich Fromm*

- 🌍 **Humanity must accept that its lifestyle and practices must be congruent with the universal laws of physics, chemistry, and biology.**
- 🌍 ***“Unlike any creature that lived before, we have become a geophysical force, swiftly changing the atmosphere and the climate as well as the composition of the world’s fauna and flora.”⁸***
- 🌍 **In 2013, humanity is finding out that these changes are far from benign.**
- 🌍 **In fact, if business as usual continues, the probable consequence is the collapse of western civilization.⁹**

***HOMO SAPIENS* EVOLVED IN THE PRESENT BIOSPHERE, THE SIXTH, AS DID ALL OTHER SPECIES WITH WHICH HUMANS SHARE THE PLANET.**

-  **Humans and the 30+ million other species are both part of the present Biosphere and will share its fate if it collapses.**
-  **Humanity is now altering Earth's climate and human hereditary traits. The product of natural selection is a major factor that results in destructive behavior.**
-  **Cooperation in protecting the present Biosphere is virtually absent.**
-  **Restriction of anthropogenic greenhouse gas emissions, which are irreversibly altering Earth's climate, is fiercely opposed by both individuals and powerful fossil fuel corporations.**
-  **Humans have a suicidal priority list – the economy first and the environment last. Humanity's genetic heritage favors a short-range perspective and ignores posterity.**

 **FOR MILLIONS OF YEARS, THE GENUS *HOMO*, INCLUDING *HOMO SAPIENS*, WAS TRIBAL AND SPREAD IN LOW NUMBERS OVER MOST OF THE PLANET. NOW IT IS GLOBALIZED.**

-  This situation raises an interesting question: “*Can individual intelligence have selective (i.e., survival) value for a globalized species?*”¹⁰
-  Another question also arises: “*Can Homo sapiens survive drastic, irreversible climate changes that affect food and water supplies, plus the probable disequilibrium of the biospheric life support system?*”¹⁰
-  Natural selection has not prepared *Homo sapiens* for addressing global problems, but it is at least possible, if not probable, that social evolution might provide this capacity.

A MAJOR OBSTACLE TO DEVELOPING A GLOBAL PERSPECTIVE ON CLIMATE CHANGE IS THAT DIFFERENT ECO-REGIONS WILL RESPOND DIFFERENTLY TO INCREASED TEMPERATURE.


- 🌐 For example, *“Large parts of the continent [Australia] will be uninhabitable [wild fire, climate change], not just by humans but by Australia’s spectacular biodiversity as well.”*¹¹
- 🌐 Attitudes on climate change are changing in Australia where climate change impacts are severe and readily observable, but must catastrophes at the level of severity occur everywhere before a global perspective on climate change is achieved?
- 🌐 Brush fires and unusual heat waves are probably the “new normal” for Australia,¹² but the evolutionary changes are, at present, difficult to predict.
- 🌐 *“Physics doesn’t understand that rapid action on climate change threatens the most lucrative business on Earth, the fossil fuel industry. It’s implacable. It takes the carbon dioxide we produce and translates it into heat, which means into melting ice and rising oceans and gathering storms.”*¹³


🚧 TWO VIEWS ARE BLOCKING GLOBALIZATION ON CLIMATE CHANGE: (1) IT (MAJOR CHANGE) WON'T HAPPEN IN MY LIFE TIME. (2) IT'S (MAJOR CHANGE) FAR AWAY (IN TIME OR SPACE) AND HAS NOTHING TO DO WITH ME.


- 🌍 **What about the present generation's children , grandchildren, and their children — isn't it humanity's responsibility to leave them a habitable planet?**
- 🌍 **What about the 30+ million other species with which humans share the present Biosphere — shouldn't the present generation try to leave as many species as possible for future generations and not sacrifice these species in the name of economic growth?**
- 🌍 **Spaceship Earth could be regarded as a global version of Noah's Ark, transporting the biota of the present Biosphere into the future.**
- 🌍 **The fable of the man who killed the goose that laid the golden eggs is a metaphor for humanity's relationship with the present Biosphere.⁵**

PERSISTENCE IN CLIMATE CHANGE DENIAL AND THE RESULTING INACTION IN REDUCING ANTHROPOGENIC GREENHOUSE GAS EMISSIONS ARE STEALING THE FUTURE FROM EARTH'S CHILDREN.

 *“Everybody’s got a plan until they get punched in the mouth.”* Mike Tyson

 *“The episode in human history that I named in my 2005 book *The Long Emergency* is off to a good start.”*¹⁴

 *“Whenever I venture out to the campuses and professional conferences people ask me *What’s your time frame for this long emergency? I tell them we’ve entered the zone.*”*¹⁴

 *“The most conspicuous feature of these times is our inability to construct a coherent consensus about what is happening to us and what we’re going to do about it.”*¹⁴

✚ ***“THE DAMAGE THAT CLIMATE CHANGE IS CAUSING AND THAT WILL GET WORSE IF WE FAIL TO ACT GOES BEYOND HUNDREDS OF THOUSANDS OF LIVES, HOMES AND BUSINESSES LOST, ECOSYSTEMS DESTROYED, SPECIES DRIVEN TO EXTINCTION, INFRASTRUCTURE SMASHED AND PEOPLE INCONVENIENCED.”*** DAVID SUZUKI

✚ **THERE ARE PLENTY OF PROBLEMS IN THE WORLD, MANY OF THEM INTERCONNECTED. BUT THERE IS NO PROBLEM WHICH COMPARES WITH THIS CENTRAL, UNIVERSAL PROBLEM OF SAVING THE HUMAN RACE FROM EXTINCTION.**

JOHN FOSTER DULLES


✚ ***“MOST EVOLVING LINEAGES, HUMAN OR OTHERWISE, WHEN THREATENED WITH EXTINCTION, DON’T DO ANYTHING SPECIAL TO AVOID IT.”*** GEORGE C. WILLIAMS

✚ ***“EXTINCTION IS THE RULE. SURVIVAL IS THE EXCEPTION.”***

CARL SAGAN

 **“WE ARE CONFRONTED WITH THE
FIERCE URGENCY OF NOW . . .”**

Rev. Dr. Martin Luther King, Jr.

 **“WE HAVE A DREAM — THAT OUR
PRESIDENT WILL UNDERSTAND THE
INTERGENERATIONAL INJUSTICE OF
HUMAN-MADE CLIMATE CHANGE —
THAT HE WILL RECOGNIZE OUR DUTY
TO BE CARETAKERS OF CREATION, OF
THE LAND, OF THE LIFE ON OUR PLANET
— AND THAT HE WILL GIVE THESE
MATTERS THE PRIORITY OUR YOUNG
PEOPLE DESERVE.”** *James Hansen*¹⁵

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich, Paula Kullberg, and James Hansen for calling useful references to my attention.

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CHAPTER 47

OIKOS, ECONOMICS, ECOLOGY, AND THE FUTURE OF THE SIXTH BIOSPHERE



“WHILE SO-CALLED EMERGING COUNTRIES, SUCH AS CHINA AND INDIA, ARE NOW RESPONSIBLE FOR MOST OF THE GREENHOUSE GASES THAT ARE CAUSING CLIMATE CHANGE, THE ESTABLISHED (POST) INDUSTRIAL COUNTRIES IN THE WEST HAVE LED THE WAY OVER THE LAST CENTURY. THIS DICHOTOMY HAS LED TO AN UNHEALTHY AND SILLY DEBATE OVER WHO IS MOST AT FAULT AND WHO SHOULD CHANGE MOST. THE EMERGING COUNTRIES WANT THEIR PLACE IN THE ECONOMIC SUN, AND THE OLDER ECONOMIC COUNTRIES WANT TO PRESERVE THEIR POSITION. THE TRUTH OF THE MATTER IS THAT NO ONE IS GOING TO BE ABLE TO PRESERVE THE CURRENT TRAJECTORY. IT IS THAT SERIOUS.”¹

 This is no time for political games — this is the time to do everything possible to leave a habitable world for posterity!



“OIKOS IS THE GREEK WORD FOR HOUSEHOLD, WHICH MEANS THE WORDS ECONOMY (OIKOS-NOMOS, THE PROPER MANAGEMENT OF THE HOUSEHOLD), ECOLOGY (OIKOS-LOGOS, THE STUDIED KNOWLEDGE OF OUR PLANETARY HOUSEHOLD), AND ECUMENICITY (OIKOUMENIKOS, AN OPENNESS TO THE WORLDWIDE HOUSEHOLD) ALL SHARE A BASIC ORIENTATION TO HOME. IN AN AGE OF CLIMATE CHANGE, FINANCIAL CRISIS, AND GLOBAL PROTEST, THERE IS A GROWING RECOGNITION THAT THE PRESENT WAYS OF ORDERING OUR HOUSEHOLD LIFE TOGETHER CANNOT BE SUSTAINED. THE TIME IS RIPE FOR A NEW ECONOMY.”
(<http://www.garrett.edu/index.php/the-oikos-of-god>)




Humanity has decoupled economics, ecology, and ethics/morality with disastrous consequences.




Economics must become congruent with the other two legs of a three-legged stool.


HUMANITY IS FACING ITS MOST SEVERE CRISIS IN 200,000 YEARS, CAUSED BY THE ILLUSION THAT IT IS NOT COUPLED TO THE UNIVERSAL LAWS OF PHYSICS, CHEMISTRY, AND BIOLOGY.


- 🌍 However, *Homo sapiens* evolved and flourished in the sixth Biosphere and its fate is strongly coupled to the fate of this present Biosphere.
- 🌍 Since humanity is strongly coupled to the present Biosphere, it seems reasonable to assume that humanity would be urgently trying to eliminate the nine interactive threats to the Biosphere. ^{2,3}
- 🌍 Recoupling efforts (i.e., humanity to Biosphere) are at present far from adequate, so *Homo sapiens* is a species threatened with a simultaneous collapse of civilization and the present Biosphere.
- 🌍 *Homo sapiens* is an exceptional species in many ways, but is not exempt from the universal laws that have produced many millions of other species and resulted in their extinction.


 **“A GREAT CIVILIZATION IS NOT CONQUERED FROM WITHOUT UNTIL IT HAS DESTROYED ITSELF FROM WITHIN.”⁴**

- ① **The costs of doing nothing about climate change are becoming clearer after Hurricane Sandy devastated New York state and the state of New Jersey.**
- ① ***“For years, the city and the state of New York commissioned reports about the dangers of rising sea levels combined with a powerful hurricane. And for years, dissuaded by the costs of doing something, New York put in place few new preparations for a massive storm surge.”⁵***
- ① ***“Following Hurricane Sandy, estimated recovery costs have skyrocketed.”⁵***
- ① ***“... we haven’t even begun to figure out what a dream protection system would look like, much less what it would cost . . .”⁵***


 **ONE WOULD EXPECT SENIOR EXECUTIVES TO PAY CLOSE ATTENTION TO REGENERATION OF NATURAL RESOURCES BECAUSE THEY ARE THE BASES OF THE HUMAN ECONOMY. WRONG, WRONG, WRONG – THEY ARE NOT!**




 *“The survey, of 475 senior executives in Brazil, China, South Korea, the UK and the US, shows that many are not prepared to look at the issue of resource shortages now and believe they will not need to make significant changes in their business operations to combat resource scarcity until 2018.”⁶*


 However, renewable resources are an output of the sixth Biosphere, which is already badly damaged by ecological overshoot.





 *“. . . research shows that many organizations are ‘asleep at the wheel’ when it comes to addressing sustainability and resource scarcity, doing nothing to address a problem they indicate could hit their operations by 2018.”⁶*

 No mention was made of collapse of the sixth Biosphere.




 **THE RESPONSE TO THE DAMAGE CAUSED BY SUPERSTORM SANDY IS A SUPERB EXAMPLE OF COGNITIVE DISSONANCE: HUMANKIND IS BUILDING BARRIERS TO SEA LEVEL RISE BUT NOT DOING ENOUGH ABOUT THE CAUSE OF SEA LEVEL RISE – ANTHROPOGENIC GREENHOUSE GAS EMISSIONS.**


-  Climate change is affecting biological evolutionary processes in species with short life cycles, but social evolution should be the primary response in *Homo sapiens* .
-  The preponderance of scientific evidence confirms that there is a close connection between anthropogenic greenhouse gas emissions and climate change.
-  A carbon tax on all fossil fuels would have immediate short-term benefits as well as on long-term benefits.⁷




 ***AFTER SUPERSTORM SANDY, THERE HAS BEEN MUCH DISCUSSION ABOUT REBUILDING THE STORM DAMAGED AREAS (E.G., SUBWAYS, RESIDENTIAL HOUSING) BUT WILL THE REBUILDING BE FOR THE OLD CLIMATE NORM, WHICH NO LONGER EXISTS, OR THE NEW CLIMATE NORM THAT REQUIRES MUCH EFFORT AND EXPENSE?***

-  For example, 2012 was the hottest year on record in the contiguous United States.⁸
-  Almost everyone will wish to return to the climate of the 20th century once the new normal 21st century climate affects their lives adversely. However, passing climate tipping points produces irreversible change to which humanity may not be able to adapt.
-  However, action to eliminate further damage to the climate system (e.g., reduction of anthropogenic greenhouse gas emissions) and damage to the present Biosphere is essentially nonexistent.
-  It is essential to eliminate economic practices that result in climate change and damage the present Biosphere.

THE TRANSITION TO A SUSTAINABLE WORLD⁹ WILL NOT BE EASY. IT WILL MEAN A NEW PERSPECTIVE ON RESOURCE AVAILABILITY AND DISTRIBUTION.

-  Neither biological nor social evolution has prepared *Homo sapiens* for the rapid climate changes that greenhouse gas emissions from over 7 billion people has caused.
-  Greene¹⁰ states “*Although Einstein refused to take his own theory at face value and accept that the universe is neither eternal nor static, Alexander Friedmann did.*”
-  It is indeed a dangerous world but humankind can make it less dangerous by reducing greenhouse gas emissions.

 **EXAMINING THE WORST CASE
SCENARIO CAN BE USEFUL,
ESPECIALLY WHEN HUMAN DENIAL IS
INVOLVED. SOME WORST CASE
SCENARIOS FOLLOW.**

-  ***“This is the way the world ends. Not with a bang but a whimper.”***
T. S. Eliot, *The Hollow Men* (1925)
-  ***“To be Irish is to know that in the end the world will break your heart.”***
Daniel Patrick Moynihan (1963)
-  ***“I sat in the dark and thought. There’s no big apocalypse. Just an endless procession of little ones.”*** ¹¹

✚ “THE POINT IS THAT WE’RE LOADING THE DICE AGAINST OURSELVES. WE’RE ALTERING ALL THE BIOPHYSICAL CONDITIONS AROUND THE ENTIRETY OF THE PLANET THAT WE’VE BEEN ADAPTED TO FOR HUNDREDS OF THOUSANDS OF YEARS AS A SPECIES. WHAT’S MORE, WE’RE ALTERING THOSE CONDITIONS EXTREMELY RAPIDLY, AND WE DON’T FULLY UNDERSTAND THE CONSEQUENCES. WE’RE PLAYING WITH A LOT OF PARAMETERS SIMULTANEOUSLY – RISING TEMPERATURES, CHANGING WEATHER PATTERNS, SEA LEVEL RISE, OCEAN ACIDIFICATION, CHANGES IN THE DISTRIBUTION OF INFECTIOUS DISEASES – WITHOUT A FULL OR EVEN PARTIAL UNDERSTANDING OF WHAT ALL THE IMPLICATIONS OF THESE CHANGES MIGHT BE.”¹²

Acknowledgments. I am indebted to Darla Donald for transcribing the handwritten draft and for editorial assistance in preparation for publication and to Paul Ehrlich and Paula Kullberg for calling useful references to my attention.

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