

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.

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References

- ¹ Wilson, E. O. 2012. *The Social Conquest of Earth*. W. W. Norton, New York, NY, p. 287.
- ² Cairns, J., Jr. 2012. The ninth threat to the biosphere: human thought processes. Supercourse Legacy Lecture: National Academy of Sciences Members' Lectures. <http://www.pitt.edu/~super1/lecture/lec45641/001.htm>.
- ³ Coulter, J. 2012. Evidence behind Queensland's cost of living fears. Canberra Times 10Apr <http://www.canberratimes.com.au/opinion/evidence-behind-queenslands-cost-of-living-fears-20120409-1wl8d.html>.
- ⁴ Revkin, A. C. 2012. Scientists call for practical steps to smooth humanity's journey. New York Times, DOT Earth Blogs 29Mar <http://dotearth.blogs.nytimes.com/2012/03/29/scientists-call-for-practical-steps-to-smooth-humanitys-journey/>.
- ⁵ Energy Bulletin, JFS Staff. 2012. Japan's sustainable society in the Edo period (1603-1867), Part 1: Reuse and recycling practices. 3Mar <http://www.energybulletin.net/node/5140>.
- ⁶ Natural Resources Defense Council. 2012. Ready or not: an evaluation of state climate change and water preparedness planning. <http://www.nrdc.org/water/readiness/water-readiness-report.asp>.
- ⁷ Oreskes, N. and E. M. Conway. 2010. *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*. Bloombury Press, New York, NY.
- ⁸ Shakun, J. D., Clark, P. U., He F., Marcott, S. A., Mix, A. C., Liu, Z., Otto-Bliesner, B., Schmittner, A. and Bard, E. 2012. Global warming preceded by increasing carbon dioxide concentrations during the last deglaciation. *Nature* 484:49-54.
- ⁹ DeConto, R. M., S. Galeotti, M. Pagani, D. Tacy, K. Schaefer, T. Zhang, D. Pollard and D. J. Beerling. 2012. Past extreme warming events linked to massive carbon release from thawing permafrost. *Nature* 284:87-91.
- ¹⁰ ScienceDaily. 2012. Global warming skepticism climbs during tough economic times. 13Mar <http://www.sciencedaily.com/releases/2012/03/120313122456.htm>.
- ¹¹ Abel, D. 2012. Big shifts in summer heat tied to death risk. Bostonglobe.com 10Apr http://www.boston.com/news/local/massachusetts/articles/2012/04/10/large_summer_temperature_swings_can_be_deadly_harvard_study_finds/?camp=bnb.
- ¹² Brown, L. 2012. Getting the market to tell the truth. Earth Policy News 10Apr http://www.earth-policy.org/book_bytes/2012/wotech13_ss1.
- ¹³ Cairns, J., Jr. 2007. Sustainable coevolution. *International Journal of Sustainable Development and World Ecology* 14(1):103-108.
- ¹⁴ Barry, E. and W. Rees. 2012. The use and misuse of the concept of sustainability: including population and resource macro-balancing in the sustainability dialog. 8th International Conference on Environmental, Cultural, Economic, and Social Sustainability, Vancouver, Canada.

- ¹⁵ msnbc.comstaff and news services. 2012. Damage to world's oceans could hit \$2 trillion a year, experts say. World News 21Mar http://worldnews.msnbc.msn.com/_news/2012/03/21/10789273-damage-to-worlds-oceans-could-hit-2-trillion-a-year-experts-say.
- ¹⁶ Hardin, G. 1968. The tragedy of the commons. *Science* 162:1243-1248.
- ¹⁷ Kahneman, D. 2011. *Thinking, Fast and Slow*. Farrar, Straus and Giroux, New York, NY, p. 8.
- ¹⁸ Ehrlich, P. R. 2000. *Human Natures*. Island Press, Shearwater Books, Washington, DC.
- ¹⁹ Kahneman, D. 1980. Human engineering of decisions. Pages 190-192 in M. Kranzberg, ed., *Ethics in an Age of Persuasive Technology*. Westview Press, Boulder, CO.
- ²⁰ Dillworth, C. 2010. *Too Smart for Our Own Good*. Cambridge University Press, Cambridge, UK.