

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 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 alga. 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.

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