

Co-evolving with the Present Biosphere



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Abstract : Lovelock (2009) hopes that a few million *Homo sapiens* will survive the climate changes and will find some “ecological lifeboats” to preserve civilization: “As part of Gaia, our presence begins to make the planet sentient. We should be proud that we could be part of this huge step, one that may help Gaia survive as the sun continues its slow but ineluctable increase of heat output, making the solar system an increasingly hostile future environment.” Lovelock (2009) is clearly aware of the difficulties of developing a mutualistic relationship between humans and Gaia: “There is no set of rules or prescription for living with Gaia, there are only consequences.” Gaia is a unifying concept in a sea of highly specialized information. Specialized information is essential, but is most effectively integrated within a particular context.

Key words : Gaia, Biosphere, Co-evolving, Climate engineering, Life support system, “Hail Mary” technologies, Feedback loops.

If we fail to take our planet seriously, we will be like children who take their homes for granted and never doubt that breakfast starts the day; we will not notice as we enjoy our daily lives that the cost of our neglect could soon cause the greatest tragedy in the memory of humankind.

James Lovelock, 2009

But what is interesting is that in a number of respects the universe is very fine-tuned, so that if things were a little different, if the laws of nature were a little different, if the constants that determine the action of these laws of nature were a little different, then the universe might be so different as to be incompatible with life.

Carl Sagan, 2006

My Personal Perspective

One’s perspective is always influenced, but should not be dominated, by life experiences. My professional career began as a member (protozoologist) of a river survey team studying the effects of pollution upon aquatic communities. I then added laboratory studies of the effects of chemical substances on aquatic organisms. Then the study of colonization processes in both stressed and unstressed ecosystems was added. Then came natural capital and the ecosystem services it provides. An important part of this mixture was biological monitoring to provide an information feedback loop on the health and condition of natural systems. In short, my primary source of information was nature.

Not until late in my career did I see humankind and natural systems (Gaia) as co-evolving (Cairns, 1994). Instead of using the term *Gaia*, although I was aware

of and respected the concept, I used the term *biospheric life support system* because it associates humankind’s life support system with its survival. I was wrong! Economic growth has always been the concept that humankind associates with its survival.

Humankind’s Self-Inflicted Harm

In the 21st century, a substantial number of books has sounded the alarm of severe damage to the biosphere and the endangerment of posterity (Ehrlich and Ehrlich, 2004; Diamond, 2005; Speth 2008). Exponential human population growth, rampant consumerism, and an addiction to perpetual economic growth are the primary, but not the only, threats to the biosphere. If the biosphere is changed into something other than its present form, what will be the climate and atmospheric gas composition?

Events in global climate change are generally moving faster than predictions have estimated. The lesson from this acceleration is clear – humankind better do something big now and not wait until 2050, 2025, or even 2015. Nurturing the biospheric life support system should be given the highest priority in all global circumstances because, if it fails, the planet will not be hospitable for humans and the human economy will disappear if humans do. Economic growth is damaging the biospheric life support system, and, if humankind continues “business as usual,” the biospheric life support system will evolve into another state, probably not favorable to humans since the present state has produced conditions favorable to the genus *Homo* for approximately 2 million years. Any threat to the present biospheric life support system should be given a higher priority than the human economy since it is a wholly dependent subset of the biospheric life support system.

Biodiversity

All species on Earth make up the biospheric life support system. Biodiversity loss or species impoverishment have a negative effect on the biospheric life support system by reducing functional redundancy and impairing both ecological succession and colonization processes. Unfortunately, the biosphere is so large (after all it is global) that obtaining information about it would take years and require a huge number of people. However, immediate steps could be taken that would reduce risk and restore biodiversity.

(1) Reduce anthropogenic carbon dioxide emissions so that they do not exceed Earth's assimilative capacity

With this approach, atmospheric carbon dioxide concentration will first decrease, then stabilize, which may even prevent further increases in oceanic acidity. However, to protect biodiversity fully, further reductions in anthropogenic carbon dioxide emissions may be necessary. The goal is to reverse ocean acidification and return to the normal, slightly alkaline state. Keeping within Earth's assimilative capacity for carbon dioxide should reduce rate of climate change and perhaps return Earth to the comparatively stable climate of the last 10-12,000 years.

(2) Stop overconsumption/ecological overshoot

Overconsumption is, from an ecological viewpoint, using resources more rapidly than Earth can regenerate them. This situation is termed *ecological overshoot*, which reduces natural capital (and, thus, biodiversity) and the ecosystem services it delivers. When ecological overshoot is eliminated, the biosphere will not be at severe risk. However, many ecological changes caused by present climate conditions have yet to occur. Humans have no choice but to adapt to climate changes that have already occurred and to prepare for those that are already developing.

Political Obstacles

The urgency felt by scientists (*e.g.*, Intergovernmental Panel on Climate Change [IPCC], James Lovelock, James Hansen) is not shared by most political leaders or the general public. This contrast may be due to well funded lobbyists, the denial industry, poor coverage of the scientific process and conclusions by the news media, and focus on the global financial meltdown. Most likely, the situation has developed from all of the above. In addition, at present, the very poor are suffering most from the current crises, but they lack the political clout of the affluent. In order to co-

evolve with the biosphere to both protect and nurture it (humankind's job), humankind must be more aware of the consequences of its actions.

The moderate "centrist" position has been much touted in the US Congress and the US press. However, no "centrist" position exists on the global crises that humankind faces. Either humankind controls anthropogenic greenhouse gas emission to match Earth's assimilative capacity for them or it suffers the consequences. The same is true for overpopulation – either the population is still experiencing exponential growth or it is declining, eventually perhaps to Earth's carrying capacity for humans. Overpopulation/ecological overshoot "merely" requires reducing consumption so that it does not exceed Earth's ability to regenerate the resources. The final challenge is to reduce wastes in the environment to stay within Earth's assimilative capacity for them and to stop producing the very damaging ones (*e.g.*, endocrine disrupters) altogether. Of course, a nuclear war, if large enough, could solve the global heating problem by causing a nuclear winter.

The Me-First Crowd

The recent "town hall" meetings on reforming the US health care system have finally brought "The Me-First, Forget-Everyone-Else Crowd" into the open (Sirota, 2009). The same attitude, masked as rugged individualism, is an obstacle in resolving all the crises mentioned earlier. ". . . the Me-First, Forget-Everyone-Else Crowd isn't interested in fairness, empiricism or morality" (Sirota, 2009). However, resolving the crises facing humankind at present requires all three attributes, plus a healthy dose of compassion.

"Hail Mary" Climate Change Technologies

Just a few years ago, outlandish proposals for reducing global heating were regarded as "science fiction" by the most charitable people and as madness by the skeptics. Later, they were referred to by the respectable title of "geoengineering" and, more recently, as "climate engineering." At present, even US President Obama and the Group of 8 leaders have decreed that the planet's average temperature shall not rise more than 2°C, which follows IPCC's advice. Tierney (2009) lists two options: "Plan A. Keep talking about the weather. . . . Plan B. Do something about the weather [using geoengineering]." However, another plan, Plan C – Develop a mutualistic relationship with the biospheric life support system by controlling anthropogenic waste discharges (in this case, greenhouse gases) to fit Earth's assimilative capacity for them – is a better approach. A mutualistic relationship

(e.g., Cairns 1994) would require co-evolution since humankind would have to adjust its practices to conform to the needs of the biospheric life support system.

One goal of ecological restoration has been to produce self-maintaining ecosystems. The goal of climate engineering is to avoid a particular temperature, not to produce a self-maintaining ecosystem. Ecology is not mentioned nor is it part of the goal. Since Earth is the “laboratory,” the first global test of climate engineering will almost certainly be based on computer models and much smaller scale field tests. Humankind cannot even name all of the species that will be affected. Tierney (2009) notes: “The skeptics understandably fear the unintended consequences of tampering with the planet’s thermostat, but they also fear the possibility – which I’d call a near certainty – that the political leaders will not seriously reduce carbon emissions anytime soon.” This situation is very weird – individuals elect politicians to provide security from the types of risks sovereign nations should be able to address, and, when the politicians fail to do so, people are willing to place Earth at risk with unproven technologies to avoid asking politicians to perform.

Tierney (2009) states: “By contrast, climate engineering does not require unanimous agreement or steadfast enforcement throughout the world. Instead of relying on politicians’ promises, we might find it simpler to deal directly with Mother Earth’s hot air.” This statement is incredible in its naiveté – changing Earth’s climate without quality control, without effective assumption of responsibility, without a rigorous check on the qualifications of those carrying out the climate engineering, and without assignment of costs of a global climate experiment if (when) things go badly wrong. The present stated goal of climate engineering is to prevent a global temperature increase of more than 2°C, but what will the untested climate engineering do to the biosphere, agricultural productivity, rainfall patterns, and so on? The climate engineers will benefit financially.

The basic issue is very simply stated – should the biosphere be ignored because humans refuse to stay within the assimilative capacity of natural systems for human wastes (e.g., carbon dioxide) and have turned to technology to avoid natural limits? If humankind takes over management of one natural system metric (i.e., temperature), it will soon be required to “manage” other metrics such as rainfall and hurricanes.

This time is a defining moment for civilization. Will humankind reduce anthropogenic carbon dioxide emissions to match Earth’s assimilative capacity for them or will humankind base its future on technology? Of

course, the technological approach will treat only the symptoms of climate change (i.e., increased temperature), not the cause (increase of atmospheric greenhouse gases because Earth’s assimilative capacity for them has been exceeded).

The “Hail Mary” technologies sound too good to be true, and probably are. Humankind should realize by now a technological solution is not available for every problem, and, even with one, unexpected secondary effects dispel the illusion of simplicity. Humankind must learn to co-evolve with the biospheric life support system and abandon “technological fixes” – either humankind learns to live harmoniously with the biosphere or it will be forced to depend on technology. No viable centrist position exists.

Over a decade ago, the article “Places to Intervene in a System” (Meadows, 1997) appeared, but it did not receive the attention it deserved. Some of the points in the article illustrate using technology to avoid doing what needs to be done to nurture the biospheric life support system.

(1) (Taken from #6 in Meadows, 1997) – Driving positive feedback loops

Meadows notes: “A positive feedback loop is self-reinforcing. The more it works, the more it gains power to work some more.” Eilperin (2009) describes an interesting situation in which “human-generated greenhouse gas emissions have helped reverse a 2,000-year trend of cooling in the Arctic.” The ice and snow reflected incoming radiation back into space (negative feedback). However, increased atmospheric greenhouse gases melted the reflective surfaces and exposed more absorptive surfaces – ocean and permafrost. The additional heat caused release of frozen hydrated methane from the ocean and both carbon dioxide and methane from the permafrost (positive feedback).

(2) (Taken from #3 in Meadows, 1997) – The power of self-organization

Meadows notes: “The most stunning thing living systems can do is to change themselves utterly by creating whole new structures and behaviors.” This problem is one of the least understood ones that confront humankind at present. If humankind does not nurture the biospheric life support system, the present, favorable conditions for life on the planet may not continue.

(3) (Taken from #5 in Meadows, 1997) – Information flows

Meadows states: “There was this subdivision of identical houses, the story goes, except that the electric meter in some of the houses was installed in the basement

and in others it was installed in the front hall, where the residents could see it constantly, going around faster or slower as they used more or less electricity. Electricity consumption was 30 percent lower in the houses where the meter was in the front hall.” Arguably, inadequate information about the condition of the biospheric life support system and poor public literacy on ecological matters are the biggest obstacles to a co-evolutionary relationship between humans and their life support system.

Two issues not mentioned in the Meadows’ (1997) article are getting some recognition today. The first one is ecological redundancy, i.e., how many species are carrying out the same function? With over 30 million species in the biosphere, functional redundancy must be substantial or the biosphere would not have been able to absorb the beating it has taken (e.g., high rate of species loss + loss of habitat) and still provide the ecosystem services as it has done. However, loss of redundancy means reducing the safety factor and risking collapse of the biospheric life support system.

The second issue is biospheric resilience, which indicates how rapidly a system can recover from damage. Of course, passing a tipping point means exceeding system resilience and no recovery. Nurturing the biosphere requires both maintaining redundancy and not depending on resilience to keep the system functioning optimally. Monbiot (2009) comments on the loss of resilience: “In other words, governments’ hopes about the trajectory of temperature change are ill-founded. Most . . . are working on the assumption that we can overshoot the desired targets for temperature and atmospheric concentrations of CO₂, then watch them settle back later. . . . wherever temperatures peak, that is more or less where they will stay.”

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