

AS I SEE IT

Remaining on stage in the planetary theater¹

John Cairns, Jr.*

Department of Biology, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061, USA

A culture of poverty is one in which the future is discounted—both implicitly and explicitly—at a very high rate.
Garrett Hardin

If humankind wishes to leave a habitable planet to posterity, the high rate at which the future is discounted must be markedly reduced. To accomplish this reduction, a planetary perspective over large spatial and temporal spans is essential. The health and integrity of the planet's ecological life support system (i.e. natural capital and the ecosystem services it provides) are the keys to continued use of the planet by *Homo sapiens*.

Although a planetary perspective is essential to achieving sustainable use of the planet, Lovelock (1988, p. xvi) believes that this need occurs 'at a time when biology has divided itself into some thirty or more specialties proud of their ignorance of other sciences, even of other biological disciplines, it needed someone of Lynn's (Margulis) rare breadth of vision to establish a biological context for Gaia.' The ancient Greeks visualized Earth as a living goddess named Gaia. The Gaia hypothesis supposes Earth to be alive. Even though a metaphor, this vision is a useful way to communicate about a very complex, multivariate system. As related to this discussion, the key assertion of the Gaia hypothesis is that the atmosphere, the oceans, the climate, and the crust of Earth are regulated at a state comfortable for life because of the behavior of living organisms. This assertion concerns the state that is comfortable for life—not necessarily in an indefinite time frame for *Homo sapiens*.

Paleontologist RL Kaesler (pers. comm.) estimates that individual species have a range from 2 to 4 million years, which can vary widely. Some freshwater ostracods may exist for 20 million or so years, which is far short of the time for a Paleozoic marine ostracod that is

supposed to range through 40 million years. Even these large numbers are dwarfed by the 4.55 billion years Earth has taken to evolve into the planet that humans can inhabit. Living organisms may have appeared 3.8 billion years ago. Earth may last another 15 billion years. In contrast, modern *Homo sapiens* has been on the planet about 130 000 years, archaic *H. sapiens* about 200 000, and 600 000 years ago the last common ancestor of modern humans and Neanderthals existed.² Humankind has been 'on stage' a relatively short time; however, if intelligence has marked survival value, humans may endure as long as an ostracod.

Over evolutionary time, many unexpected events could force humans off the stage if their response to the events is too late or inappropriate. Human minds efficiently store past information amazingly well. In the US, baseball fans can recite an amazing amount of information on the batting averages, home runs, etc. of their favorite players. However, in terms of human survival potential, most of this information is inconsequential. For example, most sports fans (and a huge number of other people) were surprised by the political collapse of the USSR. Of course, recognition of conceivable risks markedly reduces the probability that they will occur because some precautionary measures to reduce the risk will be in place.

Considerable protection and lowered risk is commonly the result of monitoring to determine if previously established quality control conditions are being met, along with a well established group to take immediate remedial action if conditions vary outside the norm. However, detailed knowledge to construct robust, verified predictive models based on reliable

¹Both 'theater' and 'theory' have the same Greek root — both are concerned with putting on a show

²See <http://calvin.linfield.edu/~mrobert/originsfigure17.html>

information is sparse. It would be naïve to assume there would be no negligence, complacency, and system flaws, all or any of which would increase risk. Danger is also present in focusing too narrowly on specific attributes while ignoring others that are more difficult to interpret. In addition, all monitoring systems generate both false negative and false positive signals. As a consequence, neither zero risk nor infinite vigilance in monitoring is a realistic goal.

In order for humankind to have a modest likelihood of living sustainably for even a few million of the billions of years Earth may have before the sun dies, three major adjustments must occur: (1) more attention must be given to nature's laws, and a more harmonious relationship with natural systems must be in place, (2) modern society must have a better understanding of risk, and (3) adequate financial resources must be available to cope with unexpected events. As Rubin (2004) remarks, 'Enormous and never ending deficits greatly reduce our flexibility in responding to future emergencies—geopolitical or economic.'

A worst possible case scenario is lack of financial resources to respond to a cascade of interactive tipping points that could destabilize human society and alter basic evolutionary processes. Anthropogenic greenhouse gases that would trigger major global climate change are, arguably, both the most probable and the most threatening factor likely to cause such a cascade. For example, significant sea level rise could produce millions, even billions, of environmental refugees. Sea level rise would also reduce land availability for supporting an even more densely packed humanity and would strain the infrastructure of most societies. Even at current city densities, Folke et al. (1997) note that the increasingly limited capacity of ecosystems to sustain urban areas deserves high priority attention.

The Environmental News Service summarized an article in the British newspaper *The Observer* which analyzes a Pentagon report asserting that a sudden global climate warming is a much greater threat to societal stability than terrorism.³ The rapid depletion of fossil water (i.e. underground aquifers) will probably lead to the loss of many irrigated agricultural lands. Underground aquifers are just a few of the many systems that will probably fail if current unsustainable practices are not replaced with sustainable practices. No robust information is available for predicting how close most of these critical systems are to a 'tipping point', beyond which they are unlikely to return to their present state so favorable to humankind.

³Environmental News Service (2004) 'Leaked Pentagon report warns of coming climate wars.' Summary available online at www.ens-newswire.com/ens/feb2004/2004-02-23-09.asp#anchor1. News service requires subscription

Worse yet, Saenz-Arroyo et al. provide persuasive evidence that 'people's perceptions of what is natural change even to the extent that they no longer believe historical anecdotes of past abundance or size of species.'⁴ This lack of perception increases the probability that some tipping points will be exceeded, resulting in a cascade of tipping point situations. Current human society was built on a one-time-only bonanza of natural capital, which, if damaged, may take centuries or more for recovery or to reach some new dynamic equilibrium.

Metaphors are useful in communicating complex ideas in simple terms. However, they also have weaknesses. In the theater metaphor used here, visualizing the audience—posterity; *Homo sapiens*, for as long as it survives; humans now alive, especially the young—is difficult. The 30+ million other species are not an audience, at least in the common definition of the word (a group of spectators at a public event). In fact, humankind is both actors and audiences in the 'planetary theater.' Moreover, the audience will be eliminated if the human species disappears. If a less habitable planet is left for posterity, these descendants are not likely to applaud the performance.

Although humans have only recently appeared 'on stage'; the evolutionary 'play' was in progress for billions of years without humankind. To carry the metaphor a bit further, the evolutionary play has had a long 'run' in the planetary theater. As individuals, no one will see more than a tiny fraction of the play. Science can report, ex post facto, only on fragments of the play. Even science cannot reveal the plot for the entire play. The ethical question becomes: Is humankind willing to do whatever is necessary for posterity to experience the play on a habitable planet?

I believe that *Homo sapiens* can adapt to sustainable use of the planet for hundreds of thousands, even millions, of years into the future. To do so, the human species must take precautionary measures to preserve both the ecological stage and the planetary theater so that *H. sapiens* continues as a major actor. Sustainable use of the planet (and remaining on the ecological stage) requires that humankind neither exceeds Earth's carrying capacity nor engages in any practices that would diminish carrying capacity. Surely, this requirement is not too much to ask of the self-named species *H. sapiens*.

⁴Saenz-Arroyo A, Roberts CM, Torre J, Carino-Olvera M, Enriquez-Andrade RR (pre-print) 'Rapidly shifting baselines among fishers of the Sea of Cortez', to be presented at the 2004 Society for Conservation Biology symposium, New York. Paper sponsored by The Ocean Conservancy, Scripps Institution of Oceanography, and The Surffindes Foundation. See additionally 'The Shifting Baseline Syndrome', *Marine Pollution Bulletin* 30(12):766–767, and http://shiftingbaselines.org/blog/archives/2004_03.html

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