

## THE FATE OF AN ACTOR ON THE ECOLOGICAL STAGE OF THE EVOLUTIONARY THEATER

John Cairns, Jr.

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

*The love of wilderness is more than a hunger for what is always beyond reach; it is also an expression of loyalty to the earth ... the only home we shall ever know, the only paradise we ever need – if only we had the eyes to see.*  
Edward Abbey

*As action is right when it tends to preserve the integrity, stability, and beauty of a living community, and wrong when it tends otherwise. Rightness is reckoned in terms of safeguarding the present and preserving future options – not just for people, but for the living world that forms humanity's crucible, context and endowment.*

Aldo Leopold

This humble observer/stagehand/actor has previously used the metaphor of a stage in the evolutionary theater to attempt a planetary perspective on sustainable use of the planet (Cairns 2004). This combination seems appropriate since the words *theater* and *theory* have Greek roots — both are concerned with putting on a show. The metaphor has a number of useful features: (1) humankind should be an actor, stagehand, and observer (audience), (2) *Homo sapiens* is just one of over 30 million species now “on stage,” (3) a majority of actors (i.e., species) that were once on stage will not return – each has become extinct, (4) the “play” has been “running” for over 4 billion years and has an estimated 15 billion more to go, (5) humans can extend their 160,000 years on stage by living sustainably.

Humans are markedly different from other actors that are now or have been on stage. Individuals of other species differ from each other, but the range of differences between individuals that affect the health and well being of the planet is dramatically greater in humans. Global warming is a disturbing illustration of this point (e.g., per capita energy use). Both the theory and the evidence for global warming have been accepted by mainstream science for many years, e.g., six ex-chiefs of the US Environmental Protection Agency (USEPA) urge more action on greenhouse gases (Janofsky 2006). This number includes five (serving under Republican presidents) who feel that the administration of the present President Bush needs to act more aggressively to limit the emission of greenhouse gases linked to climate change. The ex-chiefs comments were a reminder that, since President Bush took office in 2001, neither the President nor the US Congress has proposed any comprehensive plan to limit carbon emissions from vehicles, utilities, and other sources. Even President Bush's Department of Energy chief predicts that the production of greenhouse gases will worsen. Former USEPA Chief Russell E. Train (1973-1977) has noted that sitting back and ignoring this problem and dealing with it sometime down the road is both dishonest and self destructive.

Responses I received to the previous brief article (which used the stage metaphor) and other discussions on the subject indicate that this topic warrants further discussion. However, some people felt that: (1) *Homo sapiens* would be on Earth as long as it is habitable and then would colonize other planets, (2) social evolution would replace biological evolution for the human species, (3) technology

would provide all the resources humans need and would shield them from climate changes, and (4) biological evolution would not produce any species that could compete with *Homo sapiens*. A new, short article seems advisable since world opinion on some major issues (e.g., global warming) has shifted significantly since the last article in 2004.

Some illustrative examples related to the fate of the human species follow.

- (1) The biospheric life support system fared quite well without *Homo sapiens*, but humankind depends on it in its present form for survival.
- (2) The five great extinctions that life on Earth has survived were initiated by natural causes. The magnitude of these catastrophes dwarf the calamities that newly arrived humankind has experienced, even though humankind was not well prepared to cope with the less severe events it has experienced during its existence.
- (3) Continental drift has dramatically altered the geography of the planet over its 4½ billion years.
- (4) Species and ecosystems come and go, but evolutionary processes persist and even flourish.
- (5) Evolutionary processes have shaped life on Earth for billions of years, yet a majority of people in the United States deny that the processes exist. Denying the validity of the scientific evidence on both evolution and global warming accumulated and accepted by mainstream science is not a good foundation for aspiring to sustainable use of the planet.

Humankind must make the transition to a sustainable economy in the 21<sup>st</sup> century or the probability of environmental catastrophes will increase dramatically. The probability that humankind is approaching a number of ecological and societal tipping points is increasing. Sustainable use of the planet is a multidimensional issue, but progress on such components as global warming is miniscule and export of greenhouse gases from thawed permafrost might offset the gains of the Kyoto Protocol, even if it is implemented.

The elements of a worst case scenario are already evident: global warming, alteration of the hydrologic cycle, floods and drought, increased severity of storms, and the failure of government agencies to anticipate, prepare for, and quickly respond to emergencies. The additional 3 billion people on a finite planet estimated to arrive by 2050 will further stretch the food supply and social services. Under these circumstances, resource wars will both intensify and become more ubiquitous, diverting badly needed resources from social needs to social conflict. Anarchy is almost certainly a major component of a worst case scenario. If the planet's biospheric life support system is severely impaired or sufficiently stressed to cause disequilibrium and alter the conditions that have so long favored *Homo sapiens*, a major loss of life will occur, and even the survival of the human species may be in doubt. Like most people, including most world leaders, I have avoided exploring my innermost feelings as deeply as the circumstances warranted. Diamond's (2005) superb book has both examples of past civilizations that would not alter unsustainable practices and those that made social choices that would enhance the quest for sustainable use of the planet. Science is now under assault by people who deny scientific evidence and attempt to substitute faith based viewpoints for viewpoints based on verifiable evidence. Ethical and moral values are crucial, but so are the results of carefully structured scientific studies.

### The Homocentric Viewpoint

With few exceptions, humankind has value to each individual — companionship, family, music, books, sports, security, help in troubled times, and the like. Individuals think that existence is their play, their stage, their theater, even their universe. Some people deny the fossil evidence and assert that humans have been onstage the entire time. A concomitant, but less fervently stated, belief is that humans will be center stage for the entire remainder of the play.

Humankind's lack of concern for posterity defies understanding. Humans are reluctant to abandon unsustainable practices and do something effective about global warming and other types of climate change that are strongly influenced by anthropogenic greenhouse gases.

The prospect of *Homo sapiens* becoming extinct is depressing. All the attractive things associated with humans will be gone. A former graduate student gave me a striking photograph of a rhinoceros standing alone on a plain. Few other members of the species remained. How sad I thought, until I realized the rhinoceros was probably just being a rhinoceros and oblivious to or accepting of whatever nature had in store. I can accept my own mortality, but the prospect of *Homo sapiens* becoming extinct is troubling. However, humans cannot just continue being themselves if

their unsustainable practices are adversely affecting the biospheric life support system and the future of posterity.

### The Ecocentric Viewpoint

The fossil record provides evidence that species and ecosystems come and go, but evolutionary processes persist. These processes produced a diverse array of new species that appeared over evolutionary time. The sixth great extinction, which now appears to be underway, is unique in that anthropogenic environmental stresses are a major factor. A prime example is the increased anthropogenic greenhouse gases that play a major role in global warming and many other types of climate change.

Humankind had a sustainable, mutualistic relationship with the biospheric life support system until about 10,000 years ago when the Agricultural Revolution began. It, together with the Industrial Revolution, led to an unprecedented exponential growth of the human population. In the 20<sup>th</sup> century, the human population more than doubled within a single human life span. This growth and the concomitant destruction of natural systems cannot continue without catastrophic consequences for both humans and other life forms. Considering what humankind must do to remain on the planet (i.e., the ecological stage) for an extended period of time is long overdue.

The most important challenge for humankind is to develop a more realistic perspective of its role in the larger system of which it is a part. In evolutionary time, humans have only been “on stage” very briefly. Moreover, *Homo sapiens* has both severely damaged and overused the planet’s resource base by 20%. Especially in the last 200 years, intelligence has not proven to enhance ecological fitness. Instead of using intelligence to stay within resource limits of a finite planet, intelligence is increasingly being used to develop sophisticated weaponry for resource wars.

In a world that is changing at a speed unprecedented in human history, science could provide much useful information for societal decisions. Shockingly, the verifiable evidence provided by science is being ignored, denigrated, and even attacked (e.g., Lubchenco 2005, Ericson 2005, Revkin 2005). One possible explanation for this attack on science is the suggestion of Nobel Laureate Paul Crutzen of The Netherlands that the planet is now entering a new global epoch, The Anthropocene, which began about 1780 when industrialization began to change the planet’s geochemical history (May 2005). The “play” has a new “scene” that humankind has not realized or has denied. Another possibility is an irrational exuberance about using technology as a primary solution for all the problems of human society.

In the United States, dramatic differences are obvious between societal actions and personal beliefs, which appear to be irrational. As a society, Americans profess a concern for future generations, but, as former USEPA Chief William D. Ruckelshaus stated: “We need to fashion policies with proper incentives to reduce the amount of carbon we are putting into the atmosphere. There are all kinds of things we can do right now, and we ought to be taking those steps.” In contrast, the USEPA’s Annual Energy Report, 2006, projects that carbon emissions from inside the United States will increase by 37% by 2030 (Janofsky 2006). Americans profess a respect for education in mathematics and science, yet more than 60% of public school students in some areas of mathematics and science learn from teachers who have not majored in the subject taught or who have no certification in that subject (Editorial 2006a). How does one account for the curious reluctance to address this crucial sustainability issue? Britain has 2.3 million cubic meters of nuclear waste stored around that small, heavily populated country (Connor and Brown 2006). The estimated cost of an “adequate burial” of this waste is 85 billion pounds. A very small amount of the most lethal components is estimated to remain lethal for 1 million years. To assume that a species that has only inhabited the planet for 160,000 years can handle this problem properly is arrogant at best and suicidal at worst. Despite this formidable risk, the British government has taken the first steps toward building ten new nuclear reactors (Connor and Brown 2006) in the context of the energy crisis.

Most other societal issues are not amenable to “solution” by biological evolution without further extinction of species and major threats to the human condition. However, as Ehrlich and Levin (2005) note, human beings are a product of biological evolution and are – more than any other organisms – also products of “cultural evolution.” Ehrlich and Levin (2005) define cultural evolution as “changes in the nongenetic information stored in brains, stories, songs, books, computer discs, and the like.” Ideally, cultural evolution would be strongly influenced by mainstream science since the pace of

cultural evolution is so rapid that genetic changes are irrelevant (e.g., Ehrlich and Feldman 2003). Mainstream scientists agree that anthropogenic activity is a major cause of global warming. At present, the debate has shifted to whether climate change (including global warming) is occurring so rapidly that humans may be unable to slow or reverse this dangerous trend (Eilperin 2006). In contrast, NASA's top climate scientist, James E. Hansen, has said that officials at NASA headquarters had ordered the public affairs staff to review his coming lectures, papers, and postings on the Goddard website and requests for interviews from journalists (Revkin 2006). In short, suppress unfavorable evidence. Perhaps a sea level rise of 34 centimeters (11 inches) by the end of the century, with consequent increased flooding and coastal erosion, will produce the necessary paradigm shift (Casey 2006). Opposition to scientific evidence is formidable and well funded. The outcome is in doubt.

Ironically, a perfect test case of the adequacy of cultural evolution is just emerging. Most ecosystems are at or near a tipping point. If nothing effective is done in this century, a collapse from which ecosystems will not recover is highly probable (Editorial 2006b). Damage to the world's oceans has been well documented in the scientific literature and the news media. The most interesting aspect of the damage in terms of cultural evolution is acidification due to increasing atmospheric carbon dioxide (e.g., Royal Society 2006). Here is an opportunity to reduce, at one stroke, the two major problems of this era – global warming and ocean acidification. What an opportunity for a “scene stealer”!

Why is humankind behaving in such a self destructive way? Zimmer (2005) reports on some studies that suggest that children are more likely (80%) to continue a series of behaviors even when some serve no useful purposes. Of course, mass marketers have known this fact for years. However, this explanation seems too simple for both humankind's self destructive behavior and its assault on science. Furthermore, how does one explain the inaction at the Montreal Climate Summit on global warming (e.g., McKibben 2005)? At one time, I believed that a catastrophe would cause a major paradigm shift, but the Hurricane Katrina catastrophe in 2005 did not bring the response I anticipated. One urgent question following a catastrophe is “Who's in charge?” (Editorial 2005). The July 2004 report card of the 9/11 Commission gave a “C” to emergency response agencies nationwide for not adopting a chain of command that works with multiple departments and layers of government (Editorial 2005). The lesson from Hurricane Katrina is that society and its leaders did not pay adequate attention to readily available, verified, scientific evidence to either anticipate the problem or to correct the damage done.

A number of colleagues who have thought about a major environmental crisis are confident that, whatever happens, a remnant of *Homo sapiens* will survive. Even if this conjecture is true, major human mortality will occur. This result alone would constitute a major catastrophe. How prepared would a surviving, small group of humans be to live in a world quite different from the world it had inhabited? Survival after a catastrophe will require much more ingenuity than learning to live sustainably under present conditions. In a worst case scenario, *Homo sapiens* would become extinct. Surely, learning to live sustainably is more attractive than these alternatives, which become increasingly probable the longer present unsustainable trends continue. Yet, humankind persists in continuing a life style and individual behavior that make these unpleasant outcomes increasingly probable.

#### Concluding Statement

Individuals see only a tiny fraction of the play on the ecological stage of the evolutionary theater. The human species may not see much more of the play if present unsustainable trends continue. Humankind is driving other species off the stage, which, in turn, makes it less hospitable to humans. The basic problem is humankind's relationship with the biospheric life support system, consisting of 30+ million other life forms. Humans are capable of altering evolutionary processes, but not of directing them. Since these processes have produced a biospheric life support system so favorable to humans, the best management practice is to preserve it in its present form as long as possible. If damage to the biospheric life support system continues, evolutionary processes will probably not produce a new life support system that is as favorable to humans as the present one.

Similarly, humankind can affect the health and integrity of the biospheric life support system, but cannot stress it severely, as it is now doing, and expect it to continue functioning as it now does.

If the life support system is put into disequilibrium, the play will go on, but many of the actors, probably including *Homo sapiens*, will exit “stage left” and new ones will appear. This exit and appearance will probably be similar to the previous five great extinctions, so it seems reasonable to expect a large number of new actors to appear that are quite different than those that preceded them.

Humans are unique in that they have attributes not thought to exist in other species. However, thus far, this uniqueness has not assured that humans will abandon unsustainable practices and replace them with sustainable ones. If this trend continues, the 21<sup>st</sup> century may be the last one in which *Homo sapiens* has a major role in the play and a significant amount of time on stage. Only a few years ago, I thought that I would not live long enough (I am 82) to experience a major ecological tipping point. However, now it seems increasingly probable. I am most concerned about posterity, so I will keep writing in the hope that cultural evolution will save the biospheric life support system and the species (including humans) that benefit from it.

#### Acknowledgments

I am indebted to Darla Donald for transferring the handwritten draft to the computer and for her editorial assistance and to Elizabeth Spenser and Duncan Cairns for useful comments on early drafts.

#### LITERATURE CITED

- Cairns, J., Jr. 2004. Remaining on stage in the planetary theater. *Ethics in Science and Environmental Politics* <http://www.int-res.com/articles/esep/2004/E51.pdf>
- Casey, M. 2006. Global warming may cause sea levels to rise 34 centimeters by 2100. *Associated Press* 27Jan <http://www.enn.com/today.html?id=9762>
- Connor, S. and J. Brown. 2005. Tackle nuclear waste disposal first, warn advisers. *The Independent* 24 Jan <http://www.news.independent.co.uk/environment/article340630.ece>
- Diamond, J. 2005. *Collapse*. Viking Press, New York.
- Editorial. 2005. First question in a disaster. *Christian Science Monitor* 13 Dec <http://www.csmonitor.com/2005/1213/p08s01-comv.html>
- Editorial. 2006a. Rising above the gathering storm. *New York Times* 24Jan:Late edition-final, Section A, p. 20, col. 1.
- Editorial. 2006b. Oceans in peril. *Washington Post* 23Jan:A14.
- Ehrlich, P. R. and M. W. Feldman. 2003. Genes and cultures: What creates our behavioral phenome? *Current Anthropology* 44:87-107.
- Ehrlich, P. R. and S. A. Levin. 2005. The evolution of norms. *PLoS Biology* 3(6):e194.
- Eilperin, J. 2006. Debate on climate shifts to issue of irreparable change: Some experts on global warming foresee ‘tipping point’ when it is too late to act. *Washington Post* 29Jan:A01.
- Ericson, B. 2005. U.S. Nobel winners fret over Bush research policies. *USA Today* 8 Dec [http://www.usatoday.com/tech/science/2005-12-08-nobellaureates\\_x.htm](http://www.usatoday.com/tech/science/2005-12-08-nobellaureates_x.htm)
- Janofsky, M. 2006. 6 ex-chiefs of E.P.A. urge action on greenhouse gases. *New York Times* 19Jan:Late edition-final, Section A, p. 19, col. 1.
- Lubchenco, J. 2005. Earth’s unruly tenant. *Open Spaces Quarterly* 29 Nov <http://www.open-spaces.com/article-v2n1-lubchenco.php>
- May, R. 2005. Annual Anniversary Address: Climate change undoubtedly real, caused by human activities. *Royal Society* 30 Nov <http://www.royalsoc.ac.uk/publication.asp?id=3866>
- McKibben, B. 2005. No talk and no action: why the Montreal climate summit was too painful to watch. *Grist Magazine* 12 Dec <http://www.grist.org/comments/soapbox/2005/12/12/mckibben>
- Revkina, A. C. 2005. U.S., under fire, eases its stance on climate talks. *New York Times* 10 Dec Late edition-final, Section A, p. 1. col. 6.
- Revkina, A. C. 2006. Climate expert says NASA tried to silence him. *New York Times* 29Jan:Late edition-final, Section 1, p. 1. col. 6.
- Royal Society. 2006. Ocean acidification due to increasing carbon dioxide. <http://www.royalsoc.ac.uk/displaypagedoc.asp?id=13314>
- Zimmer, C. 2005. Children learn by monkey see, monkey do. Chimps don’t. *New York Times* 13 Dec Late edition-final, Section F, p. 2, col. 2.