Asian J. Exp. Sci., Vol. 23, No. 1, 2009; 321-328

Some Consequences of the Inability to Halt Global Climate Change

John Cairns, Jr.
Department of Biological Sciences,
Virginia Polytechnic Institute and State University,
Blacksburg, Virginia 24061, USA

Abstract : What kind of a world does humankind want? If it is one that closely resembles the one we have it is essential to avoid the consequences of "business as usual." The biological diversity now present constitutes the biospheric life support system that has maintained conditions favorable to the genus *Homo* for approximately two million years. The precise location of both ecological and societal tipping points is not discernable until they have been passed. In short, the consequences, once tipping points have been passed, are not reversible in time frames of interest to humans. Taking precautions to avoid passing tipping points and thus avoiding the consequences that might well make the planet less habitable for humans seems prudent. All the consequences are interrelated and there are usually interactions between them, which means coping with the problems at a system level. When a tipping point is passed, some consequences are predictable; others are not. However, the consequences already seen are dangerous to humankind, and the dangers lurking beyond the next global, climatic tipping point are likely to be catastrophic.

Key words : Financial crisis, Tipping points, Ecological debt, Ignorance, Life support system, Extinction.

Anything in history or nature that can be described as changing steadily can be seen as heading toward catastrophe.

Susan Sontag

In constraining carbon through rationing, we might soon find that we are building a different sort of society, one emphasizing quality of life before the raw statistics of economic growth and relentless consumerism.

Mark Lynas
***Six Degrees*, p. 302**

We have a rendezvous with destiny. **Former US President**

Franklin D. Roosevelt

The paleoclimate record shouts out to us that, far from being self-stabilizing, the Earth's climate system is an ornery beast which overacts even to small nudges.

Wallace Broecker
Climate Scientist, 1995

Great biological diversity takes long stretches of geologic time . . . The richest ecosystems build slowly over millions of years. It is further true that by chance alone only a few species are poised to move into novel adaptive zones, to create something spectacular and diversity. A panda or sequoia represents a magnitude of evolution that comes along only rarely. It takes a stroke of luck and a long period of probing, experimentation, and failure. Such a creation is part of deep history, and the planet does not have the means nor we the time to see it repeated.

E. O. Wilson, *The Diversity of Life*

More than any other time in history, mankind faces a crossroads. One path leads to despair and utter hopelessness. The other, to total extinction. Let us hope we have the wisdom to choose correctly.

Woody Allen

The global financial crisis of 2008 "is just one consequence of a system that demands that governments sacrifice long-term survival for short- term gains. . . . For similar reasons we are likely to be ambushed by other nasty surprises: runaway climate change, resource depletion, foreign policy blowback, new surveillance and genetic technologies, skills shortages, demographic change, a declining tax base, private and public debt. Politics is the art of shifting trouble from the living to the unborn" (Monbiot, 2008a).

The ignorance of politicians and the general public is frightening, especially when "global climate change is happening much faster than the world's best scientists predicted and will wreak havoc unless action is taken on a global scale" (Eccleston, 2008). A "bleak report from WWF – formerly the World Wildlife Fund – also predicts crops failures and the collapse of" both water and land ecosystems (Eccleston, 2008). Humans often dismiss changes of 1°C as trivial and not worth attention, especially if preventing temperature increase involves expenditure of tax dollars. However, Lynas (2008, pp. 25-70) gives extensive documentation of the ecological changes from a 1°C rise in global temperature. Many of these changes (e.g., melting glaciers) are easily discerned by laypersons.

Tipping Points

Most, arguably all, complex systems have one or more tipping points, which, if exceeded, cause disequilibrium from which return to the predisturbance condition is unlikely. Cairns (2004) discusses ecological tipping points. The five great global extinctions show the biotic chaos (i.e., biotic impoverishment – species extinctions) that occurred after which the process of evolution restored biotic diversity but the new array of species was markedly different from the pre-tipping point array. Millions of additional (millions already have) species will become extinct if "business as usual" results in the continuation of the sixth great extinction. Is it reasonable to assume that *Homo sapiens* will be one of the survivors? If humans lose the ability to maintain global climate within a range that favors their species, a favorable answer to this question is problematic at best.

The tunnel vision approach to economic growth has resulted in living far in excess of Earth's ability to regenerate natural resources. The day that marks exhaustion of Earth's regenerative capacity is regularly occurring earlier each year. Humankind maintains its present lifestyle by using natural capital and the ecosystem services it would have provided. However, the ecosystem services constitute the biospheric life support system upon which human survival depends. The real danger exists of passing a tipping point beyond which conditions on Earth may no longer be favorable to humans and many other species. The 2008 Living Planet Report (2008) states: "(the possibility of a) financial recession pales in comparison to the looming ecological credit crunch." Hood (2008) quotes a European Union study that calculated the loss of between two and five trillion dollars in natural capital each year due to the degradation of Earth's ecosystems.

Humankind's Ecological Debt

In the near future, society will be facing multiple crises that will make the current financial meltdown look like a picnic by comparison. "At the current rate that humanity is using natural resources and producing

waste," two planet Earths will be required by the mid-2030s to supply the resources to meet demands (Global Footprint Network, 2008). A "bailout" for the debt of the financial crisis of 2008 has been authorized by the US Congress and signed by US President Bush. Legitimate concerns have already surfaced that the bailout will not work as expected. In addition, requests (demands?) have already been voiced for further bailout funds which, if honored, will further increase the massive US national debt. Both the United States and global economies are artificial constructs that, as recently displayed, have tipping points which, when exceeded, make return to the predisturbance condition unlikely.

No "bailout" exists for ecological debt. Lost natural capital and the ecosystem services it provides may possibly be restored, but such a feat must be done by ensuring that human demands upon natural systems are kept within nature's regenerative capacity. Further loss of biodiversity, perhaps even the present level of loss, may preclude return to previous ecological states. This life threatening situation, which is rapidly worsening, is almost ignored by politicians, the news media, and the general public. Such neglect is almost beyond belief since humanity will reach the two-planet level of resource consumption by the 2030s. Of course, humanity will not live to 2030 before nature culls the surplus people (i.e., exceeding Earth's carrying capacity) in the usual ways – starvation, disease, and death. Would avoiding such a situation be worth at least a few hours of attention?

Could the Answer Possibly be due to the Triumph of Ignorance?

Monbiot (2008b) observes the activities in North America from the United Kingdom. In his latest posting, he asks: "How did politics in the US come to be dominated by people who make a virtue out of ignorance? . . . How could Republican rallies in 2008 be drowned out by screaming ignoramuses insisting that Barack Obama is a Muslim and a terrorist?" He asks why, "uniquely among the developed nations (with the possible exception of Australia), learning is a grave political disadvantage" (Monbiot, 2008b). Clearly, the founding fathers of the United States, such as Thomas Jefferson, Benjamin Franklin, James Madison, John Adams, and Alexander Hamilton, made no secret of learning and remained both popular and among the great thinkers of their age (Monbiot, 2008b). Monbiot (2008b) remarks that "ignorant politicians are elected by ignorant people." He notes that US education "is notorious for its failures: . . . one adult in five believes the sun revolves around the earth; only 26% accept that evolution takes place by means of natural selection; two-thirds of young adults are unable to find Iraq on a map; two-thirds of US voters cannot name the three branches of government; the math skills of 15 year-olds in the US are ranked 24th out of 29 countries of the OECD" (Monbiot, 2008b). However, Monbiot (2008b) states that "this merely extends the mystery: how did so many US citizens become so dumb, and so suspicious of intelligence?" He notes that "Susan Jacoby's book *The Age of American Unreason* provides the fullest explanation I have read so far" (Monbiot, 2008b). Jacoby shows that "one theme is both familiar and clear: religion – in particular fundamentalist religion – makes you stupid. The US is the only rich country in which Christian fundamentalism is vast and growing" (Monbiot, 2008b). If this explanation is not correct, what is? If it is correct, what can be done about it? Is it a good thing to be so suspicious of intelligence and wisdom?

As a final note, a vice presidential candidate denigrated "fruit fly research" in an October 24th speech on special-needs children (Palmer and Pringle, 2008): "Where does a lot

of that earmarked money go anyway? [. . .] You've heard about, um, these – some of those pet projects they really don't make a whole lot of sense, and sometimes these dollars they go to projects having little or nothing to do with the public good. Things like fruit fly research in Paris, France. I kid you not!" Palmer and Pringle (2008) remark: "Fruit flies are more than just the occasional vehicles for research relevant to human disabilities. They are literally the foundation of modern genetics, the original model organism that has enabled us to discover so much of what we know about heredity, genome structure, congenital disorders, and (yes) evolution. So for Palin to state that 'fruit fly research' has 'little or nothing to do with the public good' is not just wrong – it's mind boggling." Palmer and Pringle (2008) found "it odd that, of all the examples of dubious expenditures of public funds, the speechwriters alighted on this one." I agree, especially since biological research, although sometimes expensive, is only a tiny fraction of expenditure of public funds.

No politician can be expected to keep up with the vast number of scientific publications that literally appear weekly. However, speechwriters could call qualified scientists directly. This omission shows a dangerous lack of organization and/or a very low opinion of science, both of which, if absent in a political leader in a time of crisis, can result in very dangerous decisions. How else can one explain the powerful, single-minded focus on economic growth that, as presently implemented, is rapidly destroying humankind's biospheric life support system?

Driving Humankind to Extinction

A common response to the discussion of the human condition with people who are blissfully unaware of present problems is: "Let me know when some good news happens." However, "good news" will not surface until humankind looks at the catastrophically deep ecological hole that it has dug in the last 200 years. If the hole gets much deeper, it will collapse, and the survivors, if any, will have endless discussions on why humankind could not stop digging. Paul Ehrlich (e-mail, 5 November 2008) lists seven monumental needs that, if ignored, either collectively or individually, will result in severe deleterious consequences for humans. Although his e-mail inspired this component, the perspective for (1) and (2) is mostly mine.

(1) Put births on a par with deaths

Thomas Malthus wrote "An Essay on the Principle of Population as it Affects the Future Improvement of Society" in 1809. The Malthusian perspective has been denigrated ever since and virtually nothing has been done to keep the human population within Earth's carrying capacity. A graphic series of human population distributions and numbers, starting at 1AD and ending at 2020 is given at http://desip.igc.org/mapanim.html. One can literally watch the population growth at http://math.berkeley.eud/~galen/popclk.htm/ or http://opr.princeton.edu/popclock/. A particularly good site is "World Clocks: World Population and Productive Land Clocks" at http://www.tranquileye.com/clock where one can see the population increasing and productive land decreasing. Another very useful site it "Worldometers – Real Time World Statistics" at http://www.worldometers.info/ where one can see: (1) current world population, (2) births this year, (3) births today, (4) deaths this year, (5) deaths today, and (6) absolute population growth for today (births minus deaths).

Mother Earth can be nurturing and lovely, but violate natural laws and the consequences are deadly. She can be "tough as nails." For species that violate her laws, the default position is starvation, disease, death, and extinction.

(2) Do humans want the world they are getting?

If other intelligent beings had control of the universe, would they rent a planet to *Homo sapiens*? The species is not a good steward of the planet since it is using natural resources far in excess of the rate at which they are being regenerated and is rapidly changing the climate from one favorable to the species to one far less favorable. Massive evidence indicates that anthropogenic greenhouse gas emissions are a major part of the problem. Worse yet, much of the carbon and methane stored in the oceans and land masses is being released as the global temperature rises.

The remaining list is directly from the Ehrlich e-mail.

(3) Put conserving on a par with consuming

(4) Judge technologies not just on what they do for people but also to people and their life-support systems

(5) Education is what economists call a "non-rival good" – something that can be consumed without reducing the amount available to others and as such it is an ideal consumption good for a sustainable society

(6) Rapidly expand humankind's empathy

(7) Determine the institutions and arrangement best suited to govern a planetary society with a maximum of freedom within the constraints of sustainability

All seven items in this section represent complex systems, but the ultimate complex system is planet Earth (Tainter, 1990; Diamond, 1994). The important characteristics of complex systems are that (a) they appear, to the uninformed observer, to function normally until they reach a tipping point and collapse and (b) the collapse is sudden, as was the case of the global financial system, and irreversible.

Former US Vice-President Al Gore, world class climate scientist James Hansen, author Bill McKibben, and other deeply concerned people are literally begging that humankind "begin an emergency rescue of human civilization from the imminent and rapidly growing threat posed by the climate crisis" (e.g., Gore, 2008). "Here is the good news, the bold steps needed to solve the climate crisis are exactly the same steps that ought to be taken in order to solve the economic crisis and the energy security crisis . . . Of course, the best – indeed the only way – to secure a global agreement to safeguard our future is by re-establishing the United States as the country with the moral and political authority to lead the world toward a solution" (Gore, 2008).

However, Lakoff (2008) believes that stiff resistance to political and social change exists because society lacks an appropriate frame of reference. After all, the developed countries have lived in a cornucopian world for the last 4-5 decades of the 20th century – at least until the global financial meltdown occurred in 2008. Suddenly, citizens of the Untied States are ready for change, but the desired change does not include living sustainably with greatly reduced greenhouse gas emissions.

Gore (2008) provides "a five-part plan to re-power America with a commitment to producing 100% of our electricity from carbon-free sources within 10 years."

(a) Offer large-scale investment in incentives for the construction of solar thermal plants, wind farms, and geothermal plants.

(b) Begin planning and constructing a national smart grid for the transport of renewable electricity.

(c) Help America's automobiles convert quickly to plug-in hybrids that can run on renewable electricity.

(d) Embark on a nationwide effort to retrofit buildings with better insulation and energy-efficient windows and lighting.

(e) Lead the way by putting a price on carbon in the United States.

Tipping Point Shock

Humankind has been "ambushed" by "surprises" that should have been anticipated – for example, population and global warming. Human population growth is a core issue, and all other issues are affected by exponential population growth. Global climate change has massive scientific evidence that a major factor is anthropogenic greenhouse gas emissions. Yet no effective, substantive efforts have been made to reduce them. In fact, they continue to rise. Much of the world is suffering from the effects of rising global temperatures, yet "business as usual" remains the norm. The recent global financial meltdown provides a good lesson to public reaction after passing a tipping point, although the consequences were almost certainly more benign than the global climatic tipping point will be.

Iceland has previously been regarded by the United Nations as the world's best country in which to live. Although it is isolated, its population of 300,000 was modern and sophisticated. It had enjoyed the fourth highest gross domestic product per capita in the world, superb life expectancy, unemployment between 0 and 1%, and high per capita income and educational levels identified by the United Nations. When the economic news was extremely good, "once-frugal Icelanders took regular shopping weekends in Europe, bought fancy cars, and built bigger houses paid for with low-interest loans in foreign currencies" (Lyall, 2008).

Suddenly, with no apparent observable warning, the collapse occurred and the citizens of Iceland felt they were inhabiting an unreal country. People lost much, perhaps all, of their savings. Prices soared. No breadlines and no immediate major increases in the number of homeless people have occurred. However, people who had been gainfully employed suddenly lost their jobs. Inflation is reported to be 16% (Lyall, 2008). Jon Danielsson, an economist with the London School of Economics, remarked about the events in Iceland: "No country has ever crashed as quickly and as badly in peacetime" (as quoted in Lyall, 2008).

The effects of passing a financial tipping point for Iceland were sudden and unexpected. However, this situation was a picnic compared to the probable consequences of passing the next global climate tipping point. Despite a huge number of books (e.g., Lynas, 2008), very persuasive evidence provided by the Intergovernmental Panel on Climate Change, and a huge array of papers in professional journals, humankind does not appear to be interested in reducing greenhouse gas emissions to 350 ppm atmospheric carbon dioxide, which has been recommended by James Hansen and others to avoid another global climate tipping point.

How can this inattention occur when the scientific evidence is so strong? In the United States, such activities as strong anti-science political resistance and massive attempts to discredit science by emphasizing uncertainty, which is a factor in all human activities, are occurring daily. Finally, the news media uses the concept of "balance" as an excuse to ignore the preponderance of evidence to give the impression that a major difference exists among scientists concerning the effects of anthropogenic greenhouse gas emissions. None of this activity would have mattered if most people were willing to change their lifestyles to prevent climate change catastrophes. However, the world's oceans are less of a carbon dioxide sink than they were a century ago and terrestrial carbon sinks (e.g., peat bogs, old growth forests) are less effective than they were a century ago. Anthropogenic greenhouse gas emissions are still increasing markedly.

Finally, the positive greenhouse gas emissions feedback loops are likely to demonstrate increased activity far beyond their present levels if global temperature continues to increase by as little as 1 or 2°C.

Conclusions

Cousteau (2008) calls attention to already observable effects of sea level rise. "The Pacific Ocean is greedily licking up the last islands of Tuvalu. The country is disappearing, leaving its people condemned to permanent exile. Today, on planet Earth, there are 30 million people who have been forced to move and abandon forever their history, their memories, their burial grounds. By the year 2050, they will number 250 million" (Cousteau, 2008).

Agricultural productivity is increasingly problematic, as is the global freshwater supply. The human population is still growing exponentially, despite threats to the biospheric life support system and the species that, collectively, comprise it. The fossil fuel of last resort is coal, which is far more polluting per unit of energy obtained than petroleum and natural gas. Clean coal (i.e., carbon capture and sequestering of the carbon) is far from an economic reality, although much advertising suggests that it is. Neither humankind nor its political leaders have faced reality to the degree necessary to avoid the severe consequences of continuing "business as usual."

There is still hope! Political change in the United States indicates that over half the eligible voters favor change. The financial meltdown of 2008 was almost certainly the primary impetus for this dramatic shift in perspective. However, nothing indicates that the general public is literate on the dangers to the biospheric life support system. Some species will probably survive catastrophic climate change, and one hopes *Homo sapiens* will be one of the survivors. Reducing emphasis on short-term financial gains and increasing humankind's long-term perspective would increase species fitness and probability of survival.

Acknowledgements

My editorial assistant Darla Donald transcribed the handwritten draft of this manuscript and provided assistance in the publication process. Stefan Cairns provided useful comments on a draft of this manuscript. I am indebted to Karen Cairns, Paul Ehrlich, Paula Kullberg, Peter Leigh, and Alvin Lucier for calling useful references to my attention.

References

Cairns J. Jr. (2004) : Ecological tipping points: a major challenge for experimental sciences. *Asian J. Exper. Sci*., **18(1,2)**, 1-16.

Cousteau F. (2008) : Their undersea world. *Calypso Log*, September:3.

Diamond J. (1994) : *Collapse: How Societies Choose to Fail or Succeed*. (New York, NY: Viking Press).

Eccleston P. (2008) : Climate change is "faster and more extreme" than feared. The Telegraph 20Oct www.telegraph.co.uk/news/worldnews/3226747/Climate-change-is-faster-and-more-extreme-than-feared.html.

Global Footprint Network. (2008) : New data show ecological debt compounding. 29Oct http://www.footprintnetwork.org/de/index.php/blog/af/ab_new_data_shows_humanitys_ecological_debt_compounding.

Gore A. (2008) : The climate for change. New York Times 9Nov http://www.nytimes.com/2008/11/09/opinion/09gore.html.

Hood M. (2008) : World threatened by ecological credit crunch. World Wildlife Fund http://www.wwf.org.uk/news_feed.cfm?uNewsID=2294.

Lakoff G. (2008) : *The Political Mind*. (New York, NY: Penguin Group).

Living Planet Report. (2008) : Humanity's demands exceed our planet's capacity to sustain us. http://www.wwfint.org/news_facts/publications/living_planet_report/index.cfm.

Lyall S. (2008) : Stunned Islanders struggle after economy's fall. New York Times 8Nov http://www.nytimes.com/2008/11/09/world/europe/09iceland.html?_r=3&hp=&pagewanted=all

Lynas M. (2008) : *Six Degrees*. (Washington, DC: National Geographic Society, by arrangement with HarperCollins Publishers, Ltd).

Monbiot G. (2008a) : Free the unborn: a proposal for slowing down politics. The Guardian 21Oct http://www.monbiot.com/archives/2008/10/21/free-the-unborn/.

Monbiot G. (2008b) : The triumph of ignorance. The Guardian 28Oct http://www.guardian.co.uk/commentisfree/2008/oct/28/us-education-election-obama-bush-mccain.

Palmer T., Pringle R. (2008) : In case you weren't scared enough: Palin on "fruit fly research." Huffington Post 27Oct http://www.huffingtonpost.com/todd-palmer-and-rob-pringle/in-case-you-werent-scared_b_138089.html

Tainter J. A. (1990) : *The Collapse of Complex Societies (New Studies in Archaeology)*. (UK: Cambridge University Press).