

Is *Homo sapiens* Just Another Stochastic Event in the History of Life on Earth?



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Abstract : Surprisingly, mass extinctions probably account for the disappearance of less than 5% of all extinct species – 95% of species extinctions occur between mass extinctions. In short, extinction can occur at any time in Earth’s history. The concept of sustainable use of the planet assumes that humans can live on the planet indefinitely – or at least until the sun dies. However, human production of greenhouse gases is resulting in rapid climate change that threatens human society globally. In addition, greenhouse gas emissions are increasing markedly, and no agreement has been reached on specific goals for reducing emissions. Finally, coal is being used to replace diminishing supplies of petroleum, despite evidence that coal produces about twice as many greenhouse gas emissions per unit of energy produced than petroleum. Although alternative sources of energy (e.g., wind, solar, geothermal) are becoming increasingly popular, humankind’s primary source of energy is fossil fuels. Global climate change resulting from anthropogenic greenhouse gas emissions has already affected food production, water supplies, natural habitat, and human security. Climate change and other types of habitat destruction threaten the biospheric life support system upon which human survival depends. All these issues suggest that *Homo sapiens* may be just another stochastic event that is adversely affecting life on Earth.

Key words : Extinction of *Homo sapiens*, Climate instability, Major global extinctions, Social evolution, Anti-intellectualism, Short time for social change.

They’ll forgive you for being wrong. What they won’t forgive you for is being right.

Robert L. Bartley

He knew the truth and was looking for something better.

Jim Dandy, in William Saroyan’s *Fat Man in a Famine*

Tonight I want to argue that the way in which we humans have long imagined the future must be rethought, as the scope and depth of the cascading crises we face become painfully clearer day by day.

Robert Jensen

All human situations have their inconveniences. We feel those of the

present but neither see nor feel those of the future; and hence we often make troublesome changes without amendment, and frequently for the worse.

Benjamin Franklin

The problem with the future is that it becomes the present.

Hobbes of *Calvin and Hobbes*

Mass extinctions probably account for the disappearance of less than 5% of all extinct species, but the evolutionary opportunities they have created have had a disproportionate effect upon the history of life (Erwin, 2008). The correlation between the magnitude of extinction and the pace of recovery is unclear, and the presence of many lineages that persist through an extinction event may disappear during the subsequent recovery (Erwin, 2008). The five

great mass extinctions Earth has already endured have traditionally been recognized by paleontologists, although growing evidence indicates at least one more event occurred in the early Cambrian era. In addition, evidence also indicates that the sixth mass extinction is underway in the new epoch that, in 2000, Nobel Laureate Paul Crutzen called the Anthropocene (Erwin, 2008). “The Anthropocene could be said to have started in the late eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane” (Crutzen, 2002). As usual, minor disagreement has occurred about the name because the Anthropocene Epoch is not based on fossils or physics (e.g., Alden, 2008).

The important factor for this discussion is that 95% of extinctions occur between the episodes of mass extinction due to the loss of carrying capacity, habitat, disease, or displacement by one or more competitive species. For example, pollution and global heating threaten Asia’s most important freshwater source (Schneider and Pope, 2008). Since about 1,000 tons of water is needed to produce a ton of grain, water affects the food supply as well as industry and the quality of life. A number of influential scientists in Asian studies now state that control and management of the Tibetan Plateau’s vast supply of freshwater is emerging at the center of the increasingly tense political and cultural strife between China and Tibet. According to studies by the United Nations and several global environmental organizations, almost half of the world’s population lives in the watersheds of the rivers whose sources lie in the Tibetan Plateau (Schneider and Pope, 2008). Both water and air cross national boundaries all over the planet, and the oceanic commons is even more likely to produce both conflicts and abuse since national boundaries are defined near land masses.

Survival of *Homo sapiens*

Today’s Earth is no longer “natural” due to anthropogenic activities. Changes in the biospheric life support system affect human survival and well being. The major irony is that many of the ecological changes that might affect human survival and that of millions of other species are of anthropogenic origin. Viewed from that perspective, the appearance of *Homo sapiens* is just another stochastic event, such as an impact of Earth with a large object from space or the eruption of a super volcano that results in the extinction of many species. (*Stochastic* may be defined as randomly determined or having a random probability distribution or pattern that may be analyzed statistically but may not be predicted precisely.)

Five major extinctions have occurred so far (Eldredge, 2001).

(1) First major extinction (c. 440 million years ago). Little life existed on land, so climate change (relatively severe and sudden cooling) was at work at the first of these Ordovician mass extinctions that primarily affected marine life.

(2) Second major extinction (c. 370 million years ago). This extinction occurred near the end of the Devonian Period and may or may not have been the result of global climate change.

(3) Third major extinction (c. 245 million years ago). This extinction was, so far, the greatest, occurring at the end of the Permian Period, and may have been due to bolide impact (a meteor, asteroid, or comet that hit Earth).

(4) Fourth major extinction (c. 210 million years ago). This extinction occurred at the end of the Triassic Period, shortly after dinosaurs and mammals had first evolved.

(5) Fifth major extinction (c. 65 million years ago). The most probable cause of this

extinction was collision(s) between Earth and an extraterrestrial bolide (probably a comet).

(6) Sixth major extinction (now in progress). This extinction has a biotic (*Homo sapiens*) rather than a physical cause. This extinction appears to have two phases (Eldredge, 2001).

(a) Phase 1 – began when *Homo sapiens* dispersed to different parts of the planet about 100,000 years ago.

(b) Phase 2 – began when humans produced the Agricultural Revolution about 10,000 years ago (and the Industrial Revolution a few thousand years later). Agriculture represents the most profound ecological change in the entire 3.5 billion-year history of life on Earth for two reasons: humans did not have to interact with other species for survival and could manipulate other species for their own use, and humans did not have to adhere to the ecosystem's carrying capacity and, consequently, could overpopulate (Eldredge, 2001).

In a worst case scenario – abrupt major climate change – humans and many other species would become extinct as other species did five times before humans evolved (e.g., Cairns, 2007; Davis, 2008). In a less horrendous scenario, from a homocentric viewpoint, the human agricultural system could be severely damaged or destroyed by abrupt, major climate change and the remaining humans become, by necessity, hunter/gatherers. For most of its time on Earth, humankind supported itself by hunting and gathering. Philosophers have traditionally regarded such a life as nasty, brutish, and short (Diamond, 1987). However, the average daily food intake of Bushmen (during a month when food was plentiful) was 2,140 calories and 93 grams of protein, considerably greater than the recommended daily allowance for people of their size. This intake can be contrasted with the planet in 2008

when food shortages have caused disturbances and riots in many third world countries. If the global grain harvest is poor in 2008, the present situation will worsen, but, even now, approximately half of the world's population is inadequately nourished, has poor health care and inadequate housing, and lacks a dependable supply of potable water.

Rapid global climate change has deservedly received much attention as a threat to humankind's survival and well being. However, ecological overshoot (i.e., ecological deficit) of over 30% is arguably a comparable threat, especially when exponential population growth continues. Also, per capita consumption is increasing in many countries (e.g., China) due to increased affluence: "If China were to follow the consumption patterns of the United States, it would demand the available biocapacity of the entire planet" (People and the Planet, 2008). However, the average Chinese citizen has an ecological footprint of 1.6 global hectares, below the world average of 2.2, and a fraction of the 9.6-hectare ecological footprint of the average US resident (People and the Planet, 2008). The United States as a country and many of its citizens individually are deeply in debt, and a huge number of people in once poorer nations are becoming more affluent. Many aspire to live like Americans in terms of material goods, but Earth is already over exploited. What then? Humankind must address this question or Mother Nature will do it, and the penalties for exceeding carrying capacity are severe!

The Unsustainable Planet

If humankind is living unsustainably, even suicidally, in the present, is it delusional to believe that one's children, grandchildren, and great grandchildren will inherit a habitable planet? The biosphere of the past does not appear to have produced conditions as favorable to humans as those of the recent

past. Conditions are already changing for the worse (e.g., oceanic dead zones, altered rainfall patterns, droughts and floods, environmental toxins, loss of topsoil and old growth forests, etc.) and are changing rapidly, especially in the safety and abundance of food and water supplies. Hansen (2008a) notes that, if CO₂ emissions from coal are phased out over the period 2010-2030 and if use of unconventional fossil fuels (tar shale, tar sand) remain negligible, atmospheric CO₂ would peak at 400-425 ppm. In this situation, improved forestry and agricultural practices, especially reforestation, could bring atmospheric CO₂ below 350 ppm *within a century or less* (italics mine) (Hansen, 2008a).

At the same time, humankind must begin a humane and orderly reduction of human population size, eliminate the ecological deficit, and restore lost natural capital and the ecosystem services it provides. These changes could be accomplished if no major climatic or ecological tipping points are crossed on the way to 425 ppm atmospheric CO₂.

For example, the startling loss of Arctic sea ice has major meteorological, environmental, and ecological implications (McKie, 2008). The region acts like a giant refrigerator that has a strong effect on the northern hemisphere's meteorology. Without its cooling influence, weather patterns will be badly disrupted. This situation calls for more than "business as usual," but continuing unsustainable practices has been humankind's response.

Is Direct Experience Necessary?

Direct experience seems to trigger changes in social behavior; however, achieving change through direct experience on a global scale is impossible. When I began my first professional position in 1948, I had a strong belief that, if others could see the same evidence expressed in terms that laypersons

could understand, they would come to the same conclusion I had reached. Wrong, wrong, wrong! The 20th century was an age of specialization, and the competition within each specialty was so severe that most specialists did not have the time and energy to venture outside of their area of competence.

For the general public, the last half of the 20th century was almost euphoric. Energy was cheap; for material goods and food, the ambiance was cornucopian for about half the planet's population, who believed that the poor half would soon join them. Such books as Paul Ehrlich's *The Population Bomb* and the Club of Rome's *The Limits to Growth* were regarded as unjustified "gloom and doom" publications. However, in the early part of the 21st century, persuasive evidence appeared to indicate that resources were not unlimited and that exponential growth caused severe problems. Nevertheless, human population stabilization and keeping within Earth's carrying capacity are not frequently discussed. Instead, the solution to the high gasoline prices is "Drill here, drill now, pay less" that is espoused by former US Congressman Newt Gingrich and is favored by a substantial majority of Americans (http://222.youtube.com/watch?v=sld_xUUR4Bg), despite oil magnate T. Boone Pickens' statement that the oil crisis is "A crisis we can't drill our way out of" (http://www.usatoday.com/money/indust...nergy_N.htm?us). Pickens is not against drilling for oil, he just is against drilling when it will not solve either a short-term or long-term problem: "Neither presidential candidate is talking about solving the oil problem. So we're going to make 'em talk about it" (Pickens as quoted in Reed, 2008).

Influence of Irrational Considerations

"Despite the preponderance of scientific evidence, humankind is continuing practices that are destroying paradise. Why is that?" (Cairns, 2008). This behavior appears to be

suicidal. In many ways, the human mind is an evolutionary hodge-podge, a series of good enough solutions to the problem of understanding and responding to the environment (Marcus, 2008). The social and political implications of the human brain can be discussed as kluges – improvised engineering responses to a problem; the product of a tinkerer playing around with odds and ends and creating a functional machine (Gardner, 2008).

Arguably, the most important message is that, in many situations, especially when quick responses are demanded, situations simply overwhelm the rational side of the brain and stampede one into actions that do not really stand up to serious analysis (Abramsky, 2008). The result is the emergence of an increasingly irrational political system, a sort of Truman show in which reality is continually altered by an omnipresent media superstructure (Abramsky, 2008).

Biological evolution has created serious problems in the human brain's ability to address long-range problems and even to respond effectively to short-range problems. Some plausible hope is provided in the form of cultural evolution, which, at its best, can offset the deficiencies of biological evolution (Ehrlich and Ehrlich, 2008).

No other animal transmits culture on remotely the scale that humans beings now do. It is incomparable not just in its scale but also in its spread to all corners of the globe, and in the devices that *Homo sapiens* has evolved to preserve it and give it continuity. And no other animal depends on culture so completely . . . Those big brains that our ancestors evolved over the past couple of million years have allowed human beings to enter an entirely new realm of evolution, one of large-scale cultural evolution:

change in that unprecedentedly vast pool of non-genetic information stored in human brains and in the artifacts those brains have devised (Ehrlich and Ehrlich, 2008, p. 70).

The terrorist attacks in the United States on September 11 have provided a perfect example of the fight/flight reaction with reason turned off. Humankind needs to keep the reasoning part of the brain fully active to prioritize the dangers to society and survival in a rational way. In the 21st century, humans have failed to rely on reason and have used emotions (i.e., “gut feelings”) to protect human society and the biospheric life support system essential to the survival of the species. Thomas Jefferson stated in 1816: “If a nation expects to be ignorant and free, in a state of civilization, it expects what never was and never will be” (leading quote – flyleaf, Jacoby, 2008). In present day terms, this admonition could be stated as: “To call for resolution and a spirit of patriotism and sacrifice is to call upon people to rise above their everyday selves and to behave as true citizens. To keep telling Americans that they are just folks is to expect nothing special – a ratification and exaltation of the quotidian that is one of the distinguishing marks of anti-intellectualism in any era” (Jacoby, 2008, p. 4). Ideas (e.g., anthropogenic greenhouse gas emissions) are an important factor in global heating) need not result in straightforward attempts at censorship or intimidation – for example, “However, there are ways of trying to strangle ideas, that do not involve straightforward attempts at censorship or intimidation. The suggestion that there is something sinister, even un-American, about intense devotion to ideas, reason, logic, evidence, and precise language is one of them” (Jacoby, 2008, p. 10).

Justification of Hope

Time for sweeping global social evolution is terribly short – probably a decade or less.

Still, hope for humankind to accomplish extensive lifestyle changes is not totally irrational. Hawken (2007) describes the people who would gather after each of the nearly 1,000 talks he gave over the last 15 years:

These people were typically working on the most salient issues of our day: climate change, poverty, deforestation, peace, water, hunger, conservation, human rights. They came from the nonprofit and nongovernmental world, also known as civil society; they looked after rivers and bays, educated consumers about sustainable agriculture, retrofitted houses with solar panels, lobbied state legislatures about pollution, fought against corporate-weighted trade polices, worked to green inner cities, and taught children about the environment. Quite simply, they had dedicated themselves to trying to safeguard nature and insure justice.

But is There Enough Time?

Greenhouse gas emissions are still increasing markedly, and vast stores of organic carbon are trapped inside frozen permafrost covering one-fifth of the world's land mass and would, if thawed, release organic carbon that is roughly equivalent to one-sixth of the entire carbon content of the atmosphere for North America. The size and mix of landscapes in the northern reaches of Europe and Russia are about the same, and probably contain a comparable amount of carbon-dioxide producing matter currently held in check only by the cold (Agence France-Presse, 2005).

Other situations also cause concern. Wetlands contain 771 billion tons of greenhouse gases, one-fifth of all the carbon on Earth and about the same amount of carbon that is now in the atmosphere (Zabarenko, 2008). Mismanagement of the planet's wetlands would almost certainly result in displacement of much

of this carbon into the atmosphere to exacerbate markedly the impact of global climate change. Another source of major concern is gas hydrate, a mixture of water and mostly methane, which is believed to occur under the world's oceans in great abundance, but it quickly changes to gas when the temperature rises or it is removed from high pressure (Integrated Ocean Drilling Program Management International, 2005). In addition, two coal-fired power plants lacking carbon capture and sequestering in Colorado will be shut down to benefit public health and reduce carbon-dioxide emissions (Proctor, 2008). Finally, world-class climate scientist James Hansen (2008b) states: "A firm choice to halt building coal-fired power plants that do not capture CO₂ would be a major step toward solution of the global warming problem."

Conclusions

Earth has already passed one major climate tipping point and, if humankind persists in "business as usual" (i.e., unsustainable practices), more are probably in the not too distant future. This window of opportunity for effective, major, remedial action appears to be 10 years at the most.

If humankind fails to heed the preponderance of scientific evidence, climate changes may result in the deaths of billions of people and the disappearance of the present civilization and social system. *Homo sapiens* has already caused the extinction of many species, and exceeding additional climate tipping points will undoubtedly eliminate many more. If no effective remedial action is taken soon and the sixth major extinction continues, the appearance of *Homo sapiens* may reasonably be regarded as a stochastic event similar to the ones that resulted in five major extinctions of life on Earth.

One can take comfort in the fact that life on Earth will probably recover over time as it

has at least five times in the past. This situation could be true even if *Homo sapiens* survives as a low density species that lacks the ability to acquire and burn vast quantities of fossil fuels.

Of course, as a member of *Homo sapiens*, I regret the loss of the arts, books, poetry, music, and plays that the creative individuals of the species produced. Hopefully, some of these activities will persist even if the human species is reduced drastically in numbers. *Homo sapiens* has spent only a comparatively brief time on the ecological stage of the evolutionary theater. Many species have persisted much longer – others only briefly. Humankind should be grateful that it spent thousands of years on Earth's ecological stage, although the reasoning part of the human brain should have enabled the species to live sustainably as part of the interdependent web of life. In fact, I remain optimistic that humans can continue as a part of the interdependent web of life if human society makes the necessary, albeit painful, changes in lifestyle.

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References

- Agence France Presse. (2005) : Global warming time bomb trapped in Arctic soil: study. TerraDaily 24Aug <http://www.terradaily.com/2007/080824170027.p937t12p.html>.
- Alden A. (2008) : Introducing the Anthropocene: A brand-new name for the geologic present. About.com:geology 11Aug http://geology.about.com/od/geotime_dating/a/anthropocene.htm.
- Abramsky S. (2008) : The misshapen mind: how the brain's haphazard evolution left us with self-destructive instincts. AlterNet 20Aug <http://www.alternet.org/healthwellness/95689/>

[the_misshapen_mind:_how_the_brain's_haphazard_evolution_left_us_with_self-destructive_instincts/](http://www.alternet.org/healthwellness/95689/).

- Cairns J. Jr. (2007) : Postponing the quest for sustainability: survival first – then sustainability. Chapter 25 – Autobiography <http://www.johncairns.net>.
- Cairns J. Jr. (2008) : Destroying paradise. *Asian J Exper. Sci.*, **22(3)**, 177-181.
- Integrated Ocean Drilling Program Management International. (2005) : Scientists gain new insights into 'frozen' methane beneath ocean floor. ScienceDaily 7Nov <http://www.sciencedaily.com/releases/2005/11/051107083255.htm>.
- Crutzen P. J. (2002) : Geology of mankind. *Nature*, **415(3)**, 23.
- Davis M. (2008) : The era of catastrophe? Geologists name new era after human influence on the planet. AlterNet 11Aug http://www.alternet.org/environment/89940/the_era_of_catastrophe_geologists_name_new_era_after_human_influence_on_the_planet.
- Diamond J. (1987) : The worst mistake in the history of the human race. *Discover*, May, 64-66.
- Ehrlich P. R., Ehrlich A. H. (2008) : The Dominant Animal: Human Evolution and the Environment. (Washington, DC: Island Press).
- Eldredge N. (2001) : The sixth extinction. ActionBioscience Jun <http://www.actionbioscience.org/newfrontiers/eldredge2.html>.
- Erwin D. H. (2008) : Lessons from the past: biotic recoveries from mass extinctions. *Proc. Nat. Acad. Sci.*, **98(10)**, 5399-5403.
- Gardner D. (2008) : The Science of Fear: Why We Fear the Things We Shouldn't – and Put Ourselves in Greater Danger. (New York: Dutton).
- Hansen J. (2008a) : Trip report. 5Aug http://www.columbia.edu/~jeh1/mailings/20080804_TripReport.pdf.
- Hansen J. (2008b) : Letter to the Hon Kevin Rudd, MP, Prime Minister of Australia, Australian Parliament, Canberra, Australian Capital Territory 2600 http://www.columbia.edu/~jeh1/mailings/20080401_DearPrimeMinisterRudd.pdf.

- Hawken P. (2007) : *Blessed Unrest: How the Largest Movement in the World Came into Being and Why No One Saw It Coming.* (New York: Viking Penguin).
- Jacoby S. (2008) : *The Age of American Unreason.* (New York: Pantheon Books).
- Marcus G. (2008) : *Kluge: The Haphazard Construction of the Human Mind.* (New York: Houghton Mifflin).
- McKie (2008) : Meltdown in the Arctic is speeding up: scientists warn that the North Pole could be ice free in just five years' time instead of 60. *The Guardian* 10Aug <http://www.guardian.co.uk/environment/2008/aug/10/climatechange.arctic>.
- People and the Planet. (2008) : China's ecological footprint could cover the planet. 9Aug <http://www.peopleandplanet.net/doc.php?id=3353>.
- Proctor C. (2008) : Xcel takes unusual steps to shut down coal power plants. *Denver Business Journal* 20Aug <http://denver.bizjournals.com/denver/stories/2008/08/18/daily23.html>.
- Reed D. (2008) : Texas oilman T. Boone Pickens wants to supplant oil with wind. *USA Today* 19Aug http://www.usatoday.com/money/industries/energy/2008-07-08-t-boone-pickens-plan-wind-energy_n.htm.
- Schneider K., Pope C. T. (2008) : China, Tibet and the strategic power of water. *Circle of Blue* 8May <http://www.circleofblue.org/waternews/world/china-tibet-and-the-strategic-power-of-water/>.
- Zabarenko D. (2008) : Wetlands could unleash "carbon bomb." *Reuters UK* 20July <http://www.reuters.com/article/environmentNews/idUSN1745905120080720>.