

Where Do We Come From? What Are We? Where Are We Going?*: Ethics in an Era of Human-influenced Rapid Climate Change



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***This manuscript is dedicated to Professor A. L. Bhatia,
a valued colleague who has rejoined the universe***

Abstract : In early 2009, humankind was afflicted with a global financial meltdown that, in the United States, has resulted in loss of employment for persons who had thought their jobs were secure. Many individuals who have already retired or are approaching retirement found that a plunging stock market had made a secure retirement plan much less secure. A number of corporations and other institutions had such poor management that the US government had to provide “bailout funds,” which have helped corporations and institutions avoid bankruptcy. Some failing financial institutions that received “bailout funds” because they were “too big to allow them to fail” (since failure would disrupt the global economic system) gave huge bonuses to their top officers, which angered US taxpayers and politicians. However, no moral outrage was voiced when “toxic paper” mortgages were given to citizens who could not afford the house they were buying. Nor was the ethical outrage widespread when anthropogenic greenhouse gas emissions continued rapid increases, endangering both present and future generations. How did humankind get in these unenviable situations? Would a better grounding in ethics have prevented these and other tragic situations?

Key words : Ethics, Global financial meltdown, Global climate change, Rapid ecological change, Evolution, Economic growth, Vested interests, Ethical dilemmas, Pandemic disease.

*This part of the title is inscribed, in French, in the upper left hand corner of one of Paul Gauguin’s most famous paintings, dated 1897. Although the painting was created in Tahiti, it is, at present, at the Museum of Fine Arts, Boston, MA, USA.

Calling a ubiquitous problem a “world problem” is useful only if there is a plausible worldwide solution.

Garrett Hardin, <http://www.garretthardinsociety.org>

Where Do We Come From?

This year (2009) is the 200th anniversary of Charles Darwin’s birth and the 150th anniversary of the publication “*The Origin of Species*”. Rarely has any scientific hypothesis been so widely discussed and validated by investigation and research. However, “. . . people in the United States [one of the world’s leading scientific nations] are much less likely to accept Darwin’s idea that humans and apes share a common ancestor than adults in other Western nations. . . . In European countries, including Denmark, Sweden, and France, more than 80 percent of adults surveyed indicated that they accepted the idea of evolution” (Owen, 2006). Three circumstances may influence this situation (Miller *et al.*, 2006).

1. “. . . the effect of fundamentalist religious belief on opinions of evolution was almost twice as much in the U.S. as in Europe. . . . the U.S. has a tradition of Protestant fundamentalism not found in Europe that takes the Bible literally and sees the book of Genesis as an accurate account of the creation of human life.”
2. “. . . individuals with anti-abortion, pro-life views associated with the conservative wing of the Republican Party were significantly more likely to reject evolution than people with pro-choice views.”
3. “. . . adults with some understanding of genetics are more likely to have a positive attitude toward evolution.”

Wilson (2009) comments on Darwin’s “*The Origin of Species*”: “It is the masterpiece that first addressed the living world and (with *The Descent of Man* following) humanity’s place within it, without reference to any religion or ideology and upon massive scientific evidence

provided across successive decades. Its arguments have grown continuously in esteem as the best foundation for human self-understanding and the philosophical guide for human action . . . (p. vii). The great questions – ‘Who are we?’ ‘Where did we come from?’ and ‘Why are we here?’ – can be answered only, if ever, in the light of scientifically based evolutionary thought” (p. viii). Ruse and Travis (2009) call evolution: “. . . one of the greatest intellectual achievements of Western thought, ranking with calculus and general and specific relativity among scientific discoveries that changed indelibly how we see our world. From seeing nature as fixed forever in form and composition to seeing it as forever changing, we have been transformed utterly by discovery and understanding evolution.”

Scott (2009) states: “Antievolutionism in the United States is entering its second century. Beginning in the early twentieth century and continuing today, with no sign of relenting, antievolutionists have protested the teaching of evolution to children in public schools (p. 370)... The most popular antievolutionist strategy in the future, though, will be directives from school boards or states boards of education for teachers to ‘balance’ evolution with the teaching of ‘evidence against evolution’. (p. 394).” In short, the scientific process, including a preponderance of verified or confirmed evidence, may not prevail.

Any religious or ideological effort to reduce respect for scientists and the scientific process will have a long-term deleterious effect upon science, which will, in turn, have adverse effects upon economics, security, and trade among countries, especially those where science is nurtured. Attempts to undermine the science in studies of global climate change exacerbate the maintenance of scientific integrity. “. . . ‘evidence against evolution’ is a code phrase for creationism; this requires an appreciation of the history of the creationism/evolution controversy” (Scott, 2009) and deserves serious attention if the scientific process is to work effectively.

A significant number of evangelicals (fundamentalist in religious thought) in the United States have joined conservation efforts by calling for efforts to protect God’s creatures. From an ethical standpoint, all creations deserve protection. If humans view themselves as part of nature, rather than apart from it, this viewpoint makes sense. Even from an enlightened self interest viewpoint, protecting natural capital is essential because it is the source of all human capital. Finally, natural capital has provided the ecosystem services that have made life on Earth possible for the genus *Homo*, of which *Homo sapiens* is the last surviving species. In short, the human

economy is a subset of ecological economics. What could be more ethically sound than to nurture the life systems upon which one’s survival depends!

A recent editorial in *The New York Times* (2009) summarizes the heated battle over teaching evolution in the United States.

The Texas Board of Education gave grudging support last week to teaching the mainstream theory of evolution without the most troubling encumbrances sought by religious and social conservatives. But the margins on crucial amendments were disturbingly close, typically a single vote on a 15-member board, and compromise language left ample room for the struggle to continue.

This was not a straightforward battle over whether to include creationism or its close cousin, intelligent design, in the science curriculum. That battle has been lost by Darwin’s opponents in the courts, the schools, and most political arenas.

Rather, this was a struggle to insert into the state science standards various phrases and code words that may seem innocuous or meaningless at first glance but could open the door to doubts about evolution. In the most ballyhooed vote, those like us who support the teaching of sound science can claim a narrow victory. .

At the end of a tense, confusing three-day meeting, Darwin’s critics claimed that this and other compromise language amounted to a huge victory that would still allow their critiques into textbooks and classrooms. One can only hope that teachers in Texas will use common sense and teach evolution as scientists understand it.

Being against evolution is the same as being against science since *The Origin of Species* was first published 150 years ago and a huge amount of evidence has been generated since then. Wilson (2006) remarks: “So solidly have the fields of biology built upon the Darwinian conception of evolution that it makes sense today to recognize it as one of the two laws (universal principles if you wish) that govern our understanding of life.” In short, if one does not believe in evolution, based on the preponderance of evidence, one does not believe in science.

What Are We?

Determining what something is not is sometimes the best way to determine what something is. Some illustrative statements follow.

- (1) Humans are not masters of the universe or even of planet Earth. Technology and cheap, limited petroleum may have given humankind this impression, but peak oil has already passed and economically retrievable oil is becoming scarce.
- (2) Humans are not immune to natural law and cannot continue exponential population growth and will suffer severe consequences for exceeding Earth's carrying capacity.
- (3) Humans are not protected from risks, even though some of their stupid actions are considered compassionate. Real costs and consequences result from, for example, "compassionate" acts that result in overpopulation. The true costs and consequences of human activities must always be evaluated.
- (4) Humans are not apart from natural systems – they are a part of them, and anything that has adverse effects upon natural systems adversely affects humans.
- (5) Humans are not endowed at birth with "rights" by Mother Nature. From quantity, Mother Nature selects quality (e.g., by starvation, disease, death). Fitness to Earth's present environment is more important than individual "rights." Human society may bestow "rights" in the short term, but long-term natural law always triumphs over the scale of evolutionary time.
- (6) Humans are not the pinnacle of evolution but, rather, a stage in the long process of evolution, which will probably continue for billions of years more until the sun dies.
- (7) Humans are not as unique as they often profess. They have DNA similar to that of many other species, which shows an affinity with a multiplicity of other life forms.

If humans are not masters of the universe, immune to natural laws, risk free, or unique, then what are they?

- (1) Humans are producers of music, poetry, space vehicles, art, dance, literature, and advanced technology.
- (2) For the last part of the time that the genus *Homo* has been on Earth, it was the beneficiary of vast amounts of fossil energy

that has given them powers that no species has ever enjoyed,

- (3) Humans are the makers of a Faustian bargain for supplies of cheap, abundant energy. This energy has transformed human lives and has been the basis of a cornucopian era. However, these same fossil fuels have also changed Earth's climate in ways that have already resulted in deleterious effects on the agricultural system and water supplies. The adverse effects are likely to be irreversible for 1,000 years. Perhaps humans should have read the "fine print" more carefully.
- (4) Humans are very optimistic, but say "I'd rather not hear that" when faced with bad news.
- (5) Humans probably came from other life forms according to science. Some religions state that humans were specially created as an article of faith. Is this belief helpful in these troubled times? – to quote a former candidate for the US vice presidency – "you betcha!"
- (6) Humans are not the only species to have an economy (e.g., Tullock, 1971, 1994).

Where Are We Going?

When it comes to the future, there are three kinds of people: those who let it happen, those who make it happen, and those who wonder what happened. **John M. Richardson, Jr.**

Friedman (2008) notes: "John Dernbach, the environmental law expert, once remarked to me that in the final analysis, 'the decisions Americans make about sustainable development are not technical decisions about peripheral matters, and they are not simply decisions about the environment. They are decisions about who we are, what we value, what kind of world we want to live in, and how we want to be remembered.'" However, the issues that will determine the future are all global: climate change, overpopulation, ecological overshoot, carrying capacity, toxics, biotic impoverishment, energy policy, and financial security. Humankind is attempting to move from a small group species (i.e., tribal) to a global society and is not having a smooth transition. I envision three possible scenarios, any of which could happen, depending on human activities in the next decade or two. Of course, some stochastic event, such as a large object from space smashing into Earth, could occur. However, at present, humankind has a decade,

possibly two, to make the substantive lifestyle changes that would improve its future. If society makes the appropriate changes (e.g., population stabilization based on carrying capacity), the decision will be based on ethical values guided by scientific evidence.

Three illustrative scenarios, arranged in order of probable occurrence, follow: (1) a “hard landing” resulting from “business as usual,” (2) a “medium impact landing” based on some effective remedial actions, and (3) a “soft landing” based on the assumption that all global issues will be addressed effectively in a decade or two. This third scenario does not mean totally and immediately – for example, immediate reduction of greenhouse gas emissions to achieve at least 350 ppme carbon dioxide by a specific date. However, most important, leaving a habitable planet for posterity is not an economic or scientific issue – it is an ethical issue.

(1) Hard Landing

The scientific community, many laypersons globally, and even a few politicians have been aware for many decades of the deleterious effect humankind’s activities have been having on the biospheric life support system. The speed and magnitude of adverse changes since 1980 introduce a sense of distress close to panic. The prospect of passing a number of ecological, social, and economic tipping points that are only “visible” after they occur is particularly unsettling. The global financial “meltdown” of 2008 and 2009 has shown human society that spending US\$5+trillion may not achieve previous conditions. Moreover, should human society want to go back to where it was?

Another major concern that increases the probability of a hard landing is the ever increasing probability of speeding up the positive carbon feedback loops while simultaneously decreasing the effectiveness of carbon “sinks.” The world’s oceans have been a superb carbon sink. Now this is changing; Safina (2009) refers to this situation as “the bankruptcy of Nature.”

(2) Medium Impact Landing

Climate change experts agree that the world will not meet a 2°C warming target, and “an average rise of 4-5°C by the end of this century is more likely, given soaring carbon emissions and political constraints” (Adam, 2009). A 3°C increase will produce major catastrophes. A 4-5°C increase will result in change not tolerable to most species, including humans. Moreover, Brown (2009) states: “Our global civilization depends on a functioning network of politically healthy nation-states to control the spread of infectious disease, to

manage the international monetary system, to control international terrorism and to reach scores of other common goals. If the system for controlling infectious diseases – such as polio, SARS or avian flu – breaks down, humanity will be in trouble. Once states fail, no one assumes responsibility for their debt to outside lenders. If enough states disintegrate, their fall will threaten the stability of global civilization itself.” As if this scenario were not enough, “the International Monetary Fund said the global recession will be deeper and the recovery slower than previously thought as financial markets take longer to stabilize (Homan and Kennedy, 2009). Humankind must make major changes in its lifestyle. The probability for a medium impact landing does not seem promising – possible, yes; probable, no. Scheffer *et al.* (2001) have analyzed the sudden dramatic shifts to a contrasting state than can occur in ecosystems. An abrupt shift to an alternative state of the world’s major ecosystems will destabilize them, reduce ecosystem services, and diminish available resources badly needed because of exponential human population growth. However, how can humankind monitor ecosystems to provide an early warning of change? If significant population reduction begins at once, if anthropogenic greenhouse gas emissions are reduced 80% by 2020, if positive feedback greenhouse gas emissions of sequestered carbon (e.g., frozen hydrated methane) do not worsen, if ecological overshoot is eliminated by 2020, a medium-hard impact landing might be achieved.

(3) Soft Landing

Given present lack of substantive progress to avoid passing major ecological and societal tipping points in the next decade, a soft landing is, at present, a fantasy. If substantive progress occurs, the soft landing could be reconsidered.

Economic Growth Anathemas

Daly (2009) has analyzed economic growth that, arguably, is the source of global, ecological destabilization problems: “Continuous growth would only make sense if the economy were not a subsystem of a larger finite ecosystem, the economy were growing in a nonphysical dimension, or the laws of thermodynamics were negated.” Daly (2009) discusses three anathemas on limiting economic growth.

1. Some economists actually do seem to think of nature as a set of subsectors of the economy (grasslands, forests, fisheries, mines, wells) and see the economy, not the ecosystem or

biosphere, as the whole. If the economy is the whole, then it is not a part of any larger thing or system that might restrain its expansion. If some natural sector gets scarce, we will just substitute other sectors for it and growth will continue, not into any restraining biosphere, but into the infinite void.

2. Some economists say that what is growing in economic growth is value, and value is not reducible to physics. The latter is true, of course, but does not mean that value is independent of physics. After all, value is price (\$) times quantity (q), and quantity is always basically physical. . . . And, it does not help to speak instead of "value added" (by labor and capital) because one must ask to what is the value added? And, the answer is natural resources, low-entropy matter or energy.

3. If resources could be created out of nothing and wastes could be annihilated into nothing, then we could have an ever-growing throughput with which to fuel the continuous growth of the economy. But the first law of thermodynamics says we cannot do this. . . .

So if we cannot grow our way out of all problems, then maybe we should reconsider the logic and virtues of nongrowth, the steady-state economy. . . . Without growth the only way to cure poverty is by sharing. But redistribution is anathema. Without growth to push the hoped for demographic transition, the only way to cure overpopulation is by population control – a second anathema. Without growth the only way to invest in environmental repair is by reducing current consumption – anathema number three. Three anathemas and you are damned.

These three anathemas illustrate why ethics is needed to guide the use of the finite resources on a finite planet. Dowd (2009) remarks: "As President Obama renegotiates the terms of American leadership this week in Europe, those of us left at home struggle to get over our affluenza." Several publications (Warner, 2005; Lovelock, 2009; Sanger, 2009) presently available discuss the costs of being distracted from primary issues and the substantial number of lost opportunities.

Assault on Science

Not only is concern for global climate change far below the issue of the economy in the view of most

individuals, but science (e.g., evolution and climate change) and reason are under assault. US President Obama made a statement in fall 2008 indicating that the science concerning climate change is certain and factual. However, "More than 100 scientists – including a number of Canadian government scientists and university professors – have signed a full-page newspaper ad denouncing U.S. President Barack Obama's remarks about climate change last November [2008] as 'untrue'" (CBC News, 2009). Sheldon Rampton, Centre for Media and Democracy, states: "I think this should be viewed as a statement by the Cato institute, who are initiating it, directing it and paying for it. It's not the scientists who are doing that" (CBC News, 2009). The *New York Times* newspaper advertisement alone would cost US\$150,000 – "Even think-tanks don't pay for this unless there's someone who's willing to shoulder the cost" (Rampton in CBC News, 2009). "Rampton cautioned against giving the institute's climate change ad too much weight. This practice of collecting scientists and putting them in ads, should not be viewed as reflecting the mainstream views of the scientific community, . . . many of the scientists who signed the ad are not climate specialists" (CBC News, 2009). However, these attacks on US President Obama and mainstream science are to be expected when financial interests feel threatened. In the book *A Patient from Hell*, Schneider (2005) describes how the good science presented at the Intergovernmental Panel on Climate Change's Working Group II meeting was manipulated until it satisfied all of the national representatives present. The words used to express the consequences of global heating were blurred until they were acceptable to representatives from the oil-producing nations, who saw their national interests threatened by the scientific truth.

This alteration of scientific documents is unethical and is almost inconceivable, although the individuals blurring the science probably felt they were just doing their job. However, they are on the same finite planet that is home to the scientists and all are going toward the same future. Did the political representatives understand that situation? If so, they should not have been blurring the science. In this case, economics triumphed over both ethics and science. Lovelock (2009) reflects on this happening: "Do not suppose that conventional wisdom among scientists is similar to consensus among politicians or lawyers. Science is about the truth and should be wholly indifferent to fairness and political expediency."

Lack of Meaningful Action

The tribal (disciplinary) separation of all complex problems into the academic structure based on compartmentalization of disciplines is understandable, but this compartmentalization is fatal when attempting to understand a dynamic, multivariate system such as climate. Of course, the biosphere's structure and function are at the core, but, for quite "reasonable" reasons, they are fragmented both in governmental agencies and in allocation of funding. Worse yet, the funding is usually for a few years and decided by the political system rather than the long-term biospheric time frame. Very few people visualize the whole system in the way some scientists do. Lovelock (2009) views the health of Earth as primary without the constraint that the welfare of humankind comes first. Without the biospheric life support system, maintenance of conditions favorable to humans could not exist. Furthermore, Lovelock (2009) states: ". . . why I speak out so strongly and talk of catastrophe is because I am a scientist influenced by evidence coming from the Earth and viewed through Gaia theory. I work independently, and am not accountable to some human agency – a religion, political party, or commercial or government agency."

The lesson here is that, if humankind could not even prevent the recent global financial meltdown, how can it expect to cope with the complexity of the biospheric life support system? Many complex human forces are at work, including incompetence, greed, failure to question ideology (e.g., free markets are self regulating), belief in perpetual increases in values of houses, and so on.

Deniers, Passengers on the *Titanic*, Ecologically Illiterate

Lovelock (2009) remarks: "Most climate-change deniers fail to hide a vested interest in the status quo and are unconvincing or even boring. (p. 79) . . . We often forget that an industrialist's duty is to his company's shareholders, not to the community or the government, and certainly not to the planet. Industrialists are not greedier or more insensitive than the rest of us, but tax and subsidy distort their ability to make a profit, and so they usually chose inefficient but profitable sources of energy and agricultural products over long-term sensible and efficient but less profitable choices" (p. 77). Not a very charitable assessment but, in my opinion, very accurate.

One cannot help but wonder if the deniers merely resent obstacles to making a profit or realize that their position is unethical. I suspect the former. Some people

feel that, if they are on the *Titanic*, they might as well go first class. Others, possibly the majority, are so ecologically illiterate that they do not have a clue regarding the dangers of rapid climate change. Otherwise, how can one explain the inadequate remedial action?

The Palaeocene–Eocene Thermal Maximum (PETM)

Turney (2008) states: "A whole host of different carbon sources have been suggested for the extraordinary carbon shift seen during the PETM." Turney suggests the probability that the primary gas was methane. In 2009, methane hydrates are found in both cold oceanic sediments and frozen ground in such places as Siberia and are being released from both these sources. The PETM can be divided into three phases (Turney, 2008): (1) a vast amount of carbon was rapidly released into the ocean and atmosphere, (2) this event occurred in probably less than 2,000 years, but drove massive warming over 30,000 years or so, (3) after this period, warm conditions persisted for another 60,000 years. Another 70,000 years passed before temperatures started to drop and return to what they were before. These happenings occurred about 55.6 million years ago. The PETM illustrated how rapidly, in geologic time, climate change can occur.

Details on major effects of small changes in global mean temperature (GMT) are discussed by Lynas (2008), especially the consequences of a 3°C increase. Even though Lynas gives scientific details, the fascinating issue is how ethics and behavior must change. Lovelock (2009) states: "Not only must we survive but also we must stay civilized and not degenerate into mob rule where gang leaders promote themselves as warlords."

The 3°C GMT increase will probably occur in the 21st century (Lovelock, 2009). Famines are already happening and are likely to worsen due to both climate change and exponential population growth. Eco-refugees have been frequently discussed, and the numbers are likely to worsen appreciably. Strong leaders to direct humankind out of this global crisis are rare – US President Obama may be such a leader. International good intentions are far below what is needed for a global crisis. Most humans in developed countries did not feel their survival was endangered until the global financial meltdown started in 2008. More than half of the global population has lived with survival issues for decades. Almost anything could happen when a pandemic disease, a major volcanic eruption, an asteroid impact, or a nuclear war are thrown into the mix.

Global Ethical Dilemmas

About four decades ago, Hardin (1968) began writing about a growing population on a finite planet with finite resources. He wrote about the basic problem of resource generation being linear and population growth being exponential, so they easily could get out of synchronization. Of course, technology temporarily produced an exponential growth of food and some other resources. However, in 2008 and 2009, over 1 billion people go to bed hungry each night, over 2 billion are inadequately nourished, and 215,000 more mouths must be fed each day.

Hardin used the metaphors of the hypothetical Spaceship Beagle (the name of the sailing ship on which Darwin made his famous voyage) and of a lifeboat with swimmers in the ocean nearby who need rescue as illustrations of scarce resource problems. Both the spaceship and the lifeboat have finite space and finite resources, but the lifeboat has the additional problem of desperate people begging for permission to board a lifeboat already at capacity. Taking even one more person aboard would increase the risk to the passengers already on board. From these situations, Hardin developed his famous examinations of “lifeboat ethics.”

In 2008, demonstrations and riots occurred in many third world countries because of the increased cost of basic foods. If global climate change or other factors (e.g., conversion of food to ethanol for vehicles) increase, the situation may worsen. Increased affluence in China and India places increased demand on the global meat supply and, thus, increases prices. In some nations, some people may spend as much as 70% of the household income on food. How should both nations and individuals respond to this situation? The disparity of income has increased dramatically in recent years. Is there an ethical solution to this problem? In the United States, fierce resistance has surfaced to “the redistribution of wealth” – an increase of taxes from 36% to 39% for individuals with incomes of US\$250,000 per year. Should the United States be converting corn and other foods to ethanol for automotive fuel when approximately 1 billion are going to bed hungry every night?

Immigration and other migrations of people is also a major ethical issue. If humans can get more food and/or bigger financial rewards for their labor, naturally some will migrate, even if it is illegal. If each nation is regarded as a lifeboat, how many more people can each nation support? The answer is surprising – in most cases, none. Earth is overpopulated and humankind is using more

resources than Earth can regenerate. In September 2008, humankind had used all the resources Earth could generate in one year. For example, old growth forests were cut down, and, sometimes, new young trees were planted. The number of trees is the same, but the difference in size is dramatic.

Living sustainably means living within Earth’s means. However, left to their own judgment, most people would use as many resources as they can get their hands on. Government authorization is anathema to most people – they do not want any government telling them how many children they can have, the size of their dwelling, what kind of food they can eat (e.g., less meat), or the fuel efficiency of the automobile they drive. They might accept rationing in a spaceship or a lifeboat, but not in their hometown. What is the ethical solution to this dilemma? Freedom also requires responsibility, but, if people will not behave responsibly on their own initiative, how can consumption of resources stay within the carrying capacity of a lifeboat, a spaceship, or Earth itself? Human society accepts carrying capacity for elevators, bridges, and airplanes, but cannot accept this concept for Earth, possibly because Earth is not a technological device.

Although over half the surface of Earth is water, only a tiny fraction is freshwater, and the finite supply has been under severe pressure for years, especially in places like the Middle East. In addition, water flows across boundaries. Even in the United States, individual states compete for water that remains within the national boundaries.

Earth’s population is expected to reach 9 billion in 2040. Since humankind is not living sustainably with a population just below 7 billion, what could be done to achieve sustainable living for 9 billion? The population would have to be reduced to approximately 2 billion, fossil fuels use would have to be drastically reduced, and ecological overshoot must be eliminated. The global financial meltdown has reduced the use of petroleum, but many citizens cannot wait until the economy returns to “normal.” The global financial meltdown has demonstrated how fast things move once a tipping point has been passed.

Irreversible Climate Change

Irreversible climate change has occurred due to carbon dioxide emissions. The severity of the human-induced climate change depends not only on the magnitude of the change, but also on the potential for irreversibility – 1,000 years after emissions stop (Solomon *et al.*, 2009). Damage might be halted, perhaps

even reversed, by a return to 350 ppm atmospheric carbon dioxide (<http://www.socialsustenance.org/content/350ppm-newsletter-issue-9>). The value of 350 ppm will not likely be reached before a major tipping point occurs, but the possibly is worth stating at any time because of its effect upon the survival of some species, perhaps even humans.

Rate of Change

Some discussions and global climate change science publications proclaim that ice ages and warm climates have been characteristic of global climate in the past and that they are nothing to become excited about now. Barnosky (2009) remarks: "What all of this means from a species perspective is that many scales of climate change are, in fact, natural, from the slow tectonic scale, to the fast changes embedded within glacial and interglacial times, to the even more dramatic changes that characterize a switch from glacial to interglacial. So why worry about global warming which is just one more scale of climate change. The problem is that global warming is off the scale of normal in two ways: the rate at which this climate change is taking place, and how different the "new" climate is compared to what came before. (p. 27) . . . we see that the fastest rates are around 4°C (7.2 F) per 1.5 million years, or about 0.000001°C per year. At the last global warming event, the transition from the last glacial age to our present interglacial (the Milankoviæ scale), the rate was about 5°C per 5,000 years, or about 0.001°C per year. At yet a quicker timescale, the Medieval Warm Period, which as the name implies was a warm spell that commenced around 1,150 years ago and lasted 400 years, the rate was about 1°C per 100 years, or 0.01°C per years." (p. 27-28). In short, the rate is getting faster as in more recent times the rate of discharging anthropogenic greenhouse gases into the atmosphere is increasing dramatically. Time to take remedial action is diminishing and the political system does not appear to understand the problem.

Pandemic Diseases

The disease of concern at present is the Mexican killer swine flu: "The World Health Organisation (WHO) has given warning that the mutant strain sweeping Mexico could create a global pandemic" (Sherwell *et al.*, 2009). Exponential human population growth, crowding, and rapid transportation from one part of the planet to another, plus starvation and malnutrition of billions of people, are a perfect setting for a pandemic disease (Daily and Ehrlich, 1996).

Thomas Jefferson's faith in an informed citizenry developed in a time when present global conditions could hardly have been visualized. In short, no context exists for the present circumstances. Still, humankind is not taking any of the measures that are obviously necessary – for example, immediate drastic reduction of greenhouse gas emissions and stabilization of the human population within Earth's carrying capacity. Human society is rushing into an unknown future without regard for the consequences of "business as usual." Naturally, we will soon find out where we are going, but, when we do, we may not like it.

Conclusions

"Where do we come from?" Strong, actually overwhelming, evidence indicates that the process of evolution produced the dazzling array of species now on the planet, and DNA evidence shows that humankind is related to other life forms. Five major extinctions have occurred, and the evolutionary process has restored biodiversity, but, in general, the new species were quite different from those that became extinct. A sixth great extinction of anthropogenic origin is now in progress, and one hopes that biodiversity will be restored when it is over.

"What are we?" is a difficult question to answer. Humankind is creative in many ways – literature, music, art, science, and technology. Humans are a species obsessed with economic growth, which has increased material wealth but has concurrently caused the loss of habitat for many other species, and even extinction of many species. Anthropogenic greenhouse gases are altering the planet to such an extent that many species (e.g., the pika and polar bear) are unlikely to survive much longer. A more ethical perspective would definitely improve matters for both humans and the other life forms with which they share the planet.

"Where are we going?" is really like trying to see through a brick wall. Much has been written with detailed guidelines on what could be done with existing technology (e.g., Krupp and Horn, 2009). However, the crucial issue is whether human society will voluntarily reduce its consumption of fossil fuel and material goods. The global financial meltdown has reduced consumption of both, but mostly because the average individual has far less discretionary money. An unanswered question is whether people will be consistently frugal in the long term if the economy recovers. At present, the concept of a global, voluntary reduction in energy and material goods consumption is exceptionally optimistic. However, it is a possibility.

Heads of state will have major problems getting support for the transition to non-carbon sources (e.g., wind, solar, geothermal) in order to accomplish a major reduction in greenhouse gas emissions in time to avoid catastrophes. When the next global climate tipping point is passed, it will almost certainly overshadow the global financial meltdown that occupies governments at present (April 2009). “Familiar climates are likely to disappear in many places and novel ones likely to appear . . . causing loss of species and loss of some of the most biodiverse ecosystems on the planet” (Barnosky, 2009). In other words, the biospheric life support system will take a big hit. Will the life support system continue to maintain conditions favorable to humans?

One of the major obstacles is efforts of industry to undermine science. In the United States, successful strategies were used by the tobacco industry to discredit science, although eventually science prevailed. Many of the same strategies are being used to discredit the evidence on climate change. “For more than a decade the Global Climate Coalition, a group representing industries with profits tied to fossil fuels, led an aggressive lobbying and public relations campaign against the idea that emissions of heat-trapping gases could lead to global warming. . . . The coalition was financed by fees from large corporations and trade groups representing the oil, coal and auto industries, among others. In 1997, the year an international climate agreement that came to be known as the Kyoto Protocol was negotiated, its budget totaled \$1.68 million, according to tax records obtained by environmental groups” (Revkin, 2009). Perhaps these anti-science groups thought they were not on the same planet as the mainstream scientists because the topic was global climate change. However, climate change deniers had a huge impact and blocked reduction in anthropogenic greenhouse gas emissions, which would have improved projects for posterity. Such actions have a pronounced effect on “where we are going”

Acknowledgments

I am indebted to Darla Donald for transcribing the handwritten first draft and for editorial assistance in preparing it for publication. Karen Cairns called the Paul Gauguin painting to my attention. Paul Ehrlich, Paula Kullberg, Peter Leigh, and R. Eugene Turner called useful articles to my attention.

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