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ADAPTING TO THE SYMPTOMS OF GLOBAL WARMING RATHER THAN ADDRESSING THE CAUSE

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Climate skeptics who ask impatiently why we should care about a "degree or two" increase in the global mean temperature understand neither the climate nor the social and economic systems in which we live. Both climate and society are subject to great instability, nonlinear responses and high unpredictability.

Jeffrey D. Sachs (2006)

Since the election of US President George W. Bush in 1990 and with a majority of Republicans in Congress, global warming has been ignored and scientists producing evidence supporting this hypothesis have been denigrated and investigated (e.g., Cairns 2005). Then, as the scientific and visual evidence mounted (e.g., melting glaciers) that indicated global warming was a reality, the message shifted: "'Yes, indeed, global warming *may* (italics mine) be occurring, but it is not caused by human activities." Now the message is shifting again, and humankind is being called upon to adapt to global warming. The cover of *US News and World Report*, 5 June 2006, asks: "Global Warming: Can we live with it?" (also see Oh 2006).

In all of this posturing, I see no apology to the present-day Cassandras (mainstream scientists) from politicians who have tried to describe the global warming message as incorrect because they do not like it. An exception is former US Vice-President, and unsuccessful presidential candidate in 2000, Al Gore, whose new movie "An Inconvenient Truth" has made a dent in public indifference to the problem of global warming. Too bad Gore was not more outspoken when he was in a position of power. His book *Earth in Balance* (Gore 1993) indicates he was aware at least over a decade ago of global warming and other environmental problems. In the United States, respect for science, at least in the nation's capitol, has greatly diminished. Yet the global problems that affect both ecological and social integrity will require both robust science for and an understanding of the processes of science by both politicians and citizens.

Symptoms vs Causes

"Adapting" to global warming essentially means adjusting to the symptoms (e.g., increased temperatures, altered rainfall patterns, desertification, etc.) while ignoring the cause – increased atmospheric greenhouse gases. However, if politicians and the general public have disbelieved or ignored the scientific evidence for global warming, what evidence will be persuasive for identifying and adapting to climate changes? Will scientific evidence prevail over counter claims of special interest groups? The well-financed disinformation campaigns about global warming by special interest groups have been extremely effective. The amount of damage that has been rendered to science and scientists is difficult to judge, but the damage is there.

However, the central issue rests on what basis the general public uses to make decisions about what changes to expect. If scientists are no longer respected or trusted, who will replace them? Will authority become the politicians and special interest groups who denigrated science? Or, more importantly, even if humankind adjusts to the changes (which is by no means certain), the changes will continue until something is done about the causes of climate changes. For global warming, the cause is greenhouse gases. Robust evidence indicates that a significant portion of climate changes results from human activities and human behavior that can be modified (e.g., fuel-efficient cars and alternative sources of energy such as windmills and solar power). These changes almost certainly would reduce the magnitude of the problem. However, the major issue becomes: where will the information come from to induce people to change their behavior?

Mainstream science has endorsed the evidence for global warming and the major anthropogenic greenhouse contribution to it. In 2006, the major news services identified global warming as a major problem for human society. One of the most important problems in the United States is the inconsistent policies of government agencies for communicating

scientific findings to the public (Revkin 2006). US Republican Senator John McCain requested that a review of this issue be undertaken by the National Science Board (an independent group of scientists that advises the US Congress and the White House). The Board found that, if policies do exist, they are often focused more on the ability of scientists to discuss their findings than on guaranteeing a free flow of information. The National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration had taken steps in the right direction, but other agencies continued to lack consistent standards. Senator McCain sought the review in February 2006, after Civil Service workers and scientists at the National Aeronautics and Space Administration and other agencies complained publicly that political appointees had interfered with efforts to discuss global warming and other controversial issues.

For humankind, global security depends on the ability of the biospheric life support system to maintain conditions that have been so favorable to humans for many thousands of years. One can only hope that neither the courageous individuals who spoke out will pay too steep a price for doing so nor that society will be endangered by inadequate information about the causes of global warming.

Global Insecurity

For many centuries, humankind believed that appeasing the forces of nature through religious rituals, for instance, meant that all would be well, but that if humans transgressed, the consequences would be appalling. Then came the era of cheap, abundant energy with a multitude of energy-dependent technologies, and humans decided they could control nature without appeasing it. Humans could fly like birds; travel faster than a horse by using air-conditioned cars; live in houses with climate control; and purchase abundant, inexpensive food at the local supermarket and a variety of clothing at a nearby mall. Pills were developed to reduce the effects of disease, and sprays controlled pests. In the 21st century, huge amounts of information became available on the Internet. Everything looked good in the advertisements, but has not worked out as expected. Humans have become addicted to cheap energy and, in the United States, to an automobile culture. Life is both controlled by energy and increasingly threatened by the byproducts of cheap energy, such as greenhouse gases.

When my companion of 63 years, Jeannie, died from complications associated with Alzheimer's and Parkinson's afflictions, I agonized over what I could have done to delay this last stage of her life. Even though little could have been done to help, my feeling of responsibility for what happened was not eased. Eventually, I was able to concentrate on the many good years we had together. Even the last five were far, far better than nothing.

However, in the case of global warming, humankind could do much to reduce the problem and still have a sound economy. In his commencement address at Louisiana State University in Boston, US Vice President Dick Cheney noted that humankind's quest for security is an illusion. He further shared the observation that life is full of setbacks and events rarely turn out the way they were planned. Obviously, results will come closer to expectations if based on evidence gathered and analyzed by credentialed scientists and published in peer reviewed journals. Of course, humans are imperfect, but they must cease being as imperfect as they now are in order to achieve sustainable use of the planet or, increasingly likely, just to survive as a species. Whatever humans do, they may be trapped by a fate they cannot control because their ability to adapt is imperfect. Recognizing this situation should create a bond between humans and other life forms now living and once living. The capacity of other species to adapt had limits just as the human species most certainly does.

Many, perhaps all, humans have chronic anxiety, but is their perception of risk congruent with reality? The US government is obsessed with risks from terrorists while ignoring or minimizing the risks from global warming. In the United States, terrorists have killed thousands; global warming and other associated consequences of climate change could kill millions by disrupting the production of food stuffs. Humans cannot produce a risk free environment, but risk analysis can provide a means of reducing risks more effectively. Effective risk analysis requires verified scientific evidence, which should neither be suppressed nor altered by political appointees with no scientific credentials. Will human society adapt to this urgent need or continue to ignore or denigrate scientific findings? In an information age, ignoring or denying the existence of scientific information can easily be fatal. Even if scientific information is used and followed, events may not go as expected. In the past, major climatic change (e.g., the global drought that occurred 240 million years ago) produced conditions to which much of life on Earth could not adapt.

Adapting Without Cheap Energy Technology

When people in developed countries speak of adapting, they usually mean with technology, which requires cheap energy: too hot or too cold? – use heaters or air conditioners; out of cigarettes or beer? – drive to the nearest mini-market; no time to prepare a home cooked meal? – have a pizza delivered by automobile. However, even with energy still comparatively cheap, ecological overshoot and greenhouse gas problems still exist. If humankind cannot adapt its lifestyle to reduce these problems at present, is it realistic to expect such changes in human lifestyle when conditions worsen (e.g., more people – higher energy costs) in the future? To adapt is to make fit, often by modification (*Merriam-Webster Online Dictionary*). Some illustrative scenarios follow.

1. Positive feedback loops accelerate global warming.

The export of methane and carbon dioxide from thawed permafrost in northeastern Siberia is already known. The area covers nearly 400,000 square miles and has an estimated average depth of 82 feet. It probably holds about 500 billion metric tons of carbon, which could be released if present trends continue. This amount far exceeds the at least 6 billion tons of carbon dioxide put into the atmosphere annually by cars, power plants, and other fossil fuel burners (Zabarenko 2006). As Zabarenko notes, parts of Alaska, Canada, and northern Europe also have massive lodes of permafrost. If just the Siberian site released its greenhouse gases, it could be an unstoppable contributor to global climate change.

Just how would humans adapt to a continually increased warming scenario? Moving the Alaskan Inuit villages 150 miles inland could hardly be termed adaptive if the situation continually worsens, unless long intervals of climate stability were also experienced.

2. Climate change and diminished cheap fuel markedly decrease the production of foodstuffs.

Much of the world's grain is produced by highly mechanized agribusiness and, thus, will be vulnerable to any price increases for petroleum products. Add to this scenario some changing rainfall patterns, including both floods and droughts, and one can easily envision major problems in the production of foodstuffs. Worse yet, world grain stocks have fallen to 57 days of consumption and, concomitantly, world grain prices have started to rise (Earth Policy Institute 2006). The estimated world grain harvest of 1,984 million tons is down 24 million tons from 2005 (1%) and down 2,044 million tons from 2004 (3%). However, the human population continues to grow at a rate of 70 million per year, which is likely to continue until 2020.

Peak oil has added another dimension to this problem – use of grain-based ethanol for cars. Approximately 60% of the world grain harvest is consumed as food, 36% as animal feed, and 3% as fuel. However, while use of grain for food and feed is expected to grow only 1% per year, the growth in use for fuel is growing by over 20% per year. Cars will be competing with people and livestock for a finite and shrinking grain supply. Finally, approximately 1,000 tons of water is needed to produce a ton of grain, a huge number is the context of severe water shortages in some parts of the world. To those who say "adapt to global warming" comes the question: "how, and for how long?"

3. Toxic effects are often strongly influenced by environmental conditions such as temperature and pH.

At present, precisely predicting how global warming and other types of climate change will affect the response of life to toxic substances is difficult, but the effects of some toxicants will probably worsen. Climate change will also influence how toxic chemicals are partitioned and transformed in the environment. Floods will move contaminated sediments to new locations. China's environmental chief has indicated that serious water and air pollution are fueling social tensions, protests, and riots (Reuters 2006). Some of the transported nutrients, such as divalent iron, are transported to the oceans, which could, in turn, affect the global environment (Wang 2006). Humankind would have difficulty adapting to alterations of the world's oceans when it is unwilling to limit carbon emissions.

The problem in evaluating non-linear response curves is that the system may be close to a lethal threshold and have no-observable signs of stress (Cairns 1992). Rapid climate change will result in rapid shifting of crucial toxicological thresholds. How can humankind possibly cope with this situation? Even partial success requires a heavy dependence on scientific information and a trust in the scientific process. One of the problems I encounter frequently is being labeled a purveyor of "gloom and doom." However, the evidence indicates that human addiction to fossil fuel is a major cause of global warming. Should this evidence be ignored because it is "bad news"?

4. How should humankind adapt to the very real probability that global warming will reduce the carrying capacity of the planet for its species?

Since the production and distribution of foodstuffs will be increasingly uncertain, should the human population be stabilized at a point that permits the accumulation of reserve food to offset unexpected emergencies or should starvation, death, and disease control population size? Since an almost pathological reluctance exists to the discussion of the limitation of human population size (China is a notable exception), population size will probably be limited in brutal ways.

5. Since all subsets of capital (human, financial, manufactured) are derived from natural capital (Hawken et al. 1999), they all should get serious attention from decision makers.

Humankind is using resources at a rate 20% greater than Earth's regenerative capacity (Wackernagel et al. 2002). This ecological overshoot appears to be increasing about 1% per year. Overshoot is made possible because humankind is decreasing stores of natural capital, which cannot continue for many years.

6. The cheap, convenient, readily available energy that has given humankind such power over nature is becoming scarce and expensive. With less cheap energy to power protective technology, humankind's power over nature is diminished – a scary thought for most people. Humans cannot overuse Earth's resources as they have been doing for over two decades without serious consequences. Humankind's search for zero risk has always been futile, despite assurances to the

contrary. Substituting one fossil fuel (coal) for another (petroleum) will increase the risks associated with global warming. The most carbon intensive fuel, coal, is responsible for nearly 40% of American emission of carbon dioxide (Goodell 2006). Many scientists feel that avoiding dangerous climate change requires a reduction of greenhouse gas emissions by 50-70% by 2050. Much recent evidence indicates that humans have greatly overestimated how much time is left (due to positive feedback loops) to avoid a climate catastrophe.

Concluding Statement

All of the above and more are due to the increasing feeling of loss of control. The simple fact is that humankind does not control the universe. Stochastic events do occur. However, humans do control their lifestyles and behaviors, and these actions contribute to global warming and other environmental disruptions. Merely adapting to the symptoms of a deeper problem is not the answer. Humans must adapt to the laws of nature by acknowledging their dependence upon the biospheric life support system. This adaptation means accepting that humankind is not in control, never has been and never will be. In short, humans are vulnerable to all the risks that affect other life forms. The use of science to track changes in the biospheric life support system that affect humankind will reduce, but not eliminate, risks. Cheap, abundant energy has given humans the belief that they are in charge. As cheap, abundant energy supplies diminish, humans will see how addicted they were, and their illusion of inherent dominance will diminish – a shattering, but not necessarily fatal, experience for the species. After all, humans survived between 140-150 thousand years without the conviction that they dominated nature.

Yes, humans have survived because they adapted to natural change over which they had little or no control. However, to adapt to changes in climate caused by anthropogenic greenhouse gases is suicidal when changes in human behavior could markedly lessen or perhaps even eliminate the problem.

Of course, uncertainties will always be present in the scientific information. In fact, life is full of uncertainties. However, humans act on the best information available, and, if the outcome or consequences of their actions could be catastrophic, they take precautionary measures to reduce the probability of a catastrophe occurring. Not doing so in the case of global warming is reckless.

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