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Scientists, Time Management, and the Global Environmental Crisis

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Abstract

The 21st century environmental crisis is vastly different from any other in human history. All the major components of the crisis are caused by humankind. With the largest human population ever on finite Earth, global warming and other aspects of climate change (e.g., altered rainfall patterns) threaten an already precarious food supply. The biospheric life support system is being damaged to a degree unprecedented in human history. Many agricultural systems are highly mechanized and will be adversely affected by decreased availability of oil. Scientists have a major role to play in this crisis, but doing so will require skillful time management and a major reordering of priorities.

Keywords: Scientific time management, Global environmental crisis, Ethical and moral responsibilities of scientists, Environmental literacy, Biospheric life support system.

"The age of hypocrisy has been succeeded by that of indifference, which is worse, for indifference corrupts and appeases: it kills the spirit before it kills the body. It has been stated before, it bears repeating: the opposite of love is not hate, but indifference."

– Ellie Wiesel

"It is not the job of public-affairs officers to alter, filter or adjust engineering or scientific material produced by NASA's technical staff."

– Michael D. Griffin, (US National Aeronautics and Space Administration)

1. Overview

Scientists in academic institutions have multiple responsibilities, such as teaching, keeping abreast of the professional literature, mentoring students, serving on committees, acting as reviewers and editors, or serving on editorial boards of scientific journals. In addition to these demands upon the time of scientists, new knowledge must be generated, verified or falsified, and communicated to the general public at the local, regional, national, and global levels. For scientists, these activities are not only ethical and moral responsibilities, but also a matter of enlightened self interest since, if the biospheric life support system is impaired, social disequilibrium will follow and scientists will not be able to continue their efforts. However, the process of science is not well understood by the general public, resulting in denigration of science and ignoring the evidence scientists generate (e.g., global warming). Consequently, leaders, decision makers, politicians, and the general public must become more literate about global warming, ecological overshoot, pollution, possible acidification of the world's oceans, and probable changes in ocean currents. Scientists have been punished over

the ages for theories backed by evidence that some powerful people feel are a threat to their beliefs. However, three factors make the present situation different from the historic precedents: (1) economic globalization has raised the stakes for those people who feel threatened, (2) the technological and demographic rates of change are unprecedented and may be an order of magnitude greater than those of the past, (3) the probability of reaching one or more global tipping points has increased dramatically. All these factors pose major, unprecedented challenges for scientists. Of course, if society does not wish to become more informed about science, not much value will be gained by scientists spending a substantial amount of time attempting to improve public understanding of the scientific process. However, a considerable body of evidence indicates a general interest by society in science when scientists can communicate their enthusiasm. Even citizens not interested in science should be passionate about the health and well being of the planet's biospheric life support system. However, they must understand the degree to which humans are dependent upon the continued function of the biospheric life support system at present levels.

2. The Problem

The special September 2005 issue of the highly respected journal *Scientific American* announces on its cover "Crossroads for Planet Earth" and notes "The human race is at a unique turning point. Will we choose to create the best of all possible worlds?" The next 50 years will be decisive in determining whether the human race can ensure the best possible future for itself (Musser, 2005). The global economy is now so large that humankind can no longer safely pretend to operate within a limitless ecosystem (Daly, 2005). Economist Daly (2005) recommends that an economy be developed that can be sustained within the finite biosphere. This awareness should have begun at the end of the last century when persuasive evidence of an ecological overshoot became available (e.g., Catten, 1980; Wackernagel *et al*., 2002; Meadows *et al*., 2004). Regretfully, the United States is an important contributor to the overshoot, at a time when mainstream science in the United States is under attack on such matters as global warming and evolution. Instead of allowing the quality of the evidence to be evaluated by the well established scientific process, American congressmen, political appointees, and judges, who have no credentials in science, are deciding whether the analysis of the evidence is adequate.

Instead of spending time responding to requests from American congressmen to furnish information already published in peer-reviewed journals (e.g., Cairns, 2005), scientists should be refining their predictive models or studying crucial environmental catastrophes, such as the record drought that is crippling life along the Amazon River (Rohter, 2005) or changes in major ocean currents. Further, studies are essential on the probable acidification of the world's oceans (e.g., Quadfasel, 2005; Bryden *et al*., 2005) that affect such resources as fisheries stocks.

As a group, scientists vary widely in types of formal education, professional responsibilities, age, geographic location, degree of interest in environmental problems, skill at communicating with decision makers and the general public, types of field experience, and tolerance of risk. This variety is essential to solving complex, multidimensional issues such as the global environmental crisis. However, many risks are typically outside the experience of most scientists, including conflicts resulting from powerful political, corporate, and religious groups and private property owners who perceive science as threats to their practices. Ecological overshoot, exponential growth (economic and population), economic globalization, and rate of technological and demographic change have made present societal decision making processes obsolete. The internet disseminates a huge volume of information rapidly and inexpensively. However, it lacks a robust quality control system, which is a major strength of the scientific process.

Above all, the message from scientists during the global environmental crisis must be one of hope for the future, not one of despair. Irrational exuberance is not appropriate. For example, a finite planet cannot accommodate an exponentially expanding human population. However, steps are available for significantly reducing the crisis. Contrast this hopeful approach with the fear that has been the basis for counter terrorism strategies. Sustainable use of the planet (which could deflate the current environmental crisis) is a cause for hope. Science is based on the expectation that reason, guided by evidence, will eventually prevail.

3. The Roles of Scientists and Citizens

Humans are neither passengers nor observers on spaceship Earth. They are, however, as much as they may protest, responsible members of the "crew" with the usual duties and responsibilities for the "ship" that is their home. Since humankind's activities are a major cause of the present crisis, changes in human behavior and practices can reduce the crisis, or even eliminate it. Scientists can furnish useful information crucial to societal value judgments. However, the information is only useful if society respects and uses scientific evidence for

major policy decisions. Both scientists and the other crew members must have a mutualistic relationship if humankind aspires to achieve sustainable use of the planet. Sustainability requires an adequate scientific literacy of all crew members, as well as a willingness to devote more personal time, both before and after sustainability has been achieved. The most important determinant for success is the realization that both science and faith are major components of the human condition. Science is based on verifiable evidence, while matters of faith are not verifiable by the scientific process. It is inexcusable to insist that they be taught in the educational system as if they are different value judgments.

4. Obstacles

For many years, social psychologists have studied how people behave, especially in different social environments. A recent conference produced evidence that emotions and implicit assumptions often influence why people choose their political affiliations and that partisans stubbornly discount any information that challenges their preexisting beliefs (Vedantam, 2006). In addition, when unpalatable information was rejected, the study volunteers gave themselves "feel good pats" because the reward centers in their brains were activated. How can this happen in any society that affirms a respect for science? Recent evidence indicates that more than 60% of the public school students in some areas of mathematics and science learn from teachers who have not majored in the subject taught or have no certification in it (Editorial, 2006). If citizens were more literate about the process of science, they would not tolerate some of the attempts by politicians or political appointees to denigrate or alter scientific evidence (e.g., Cairns, 2005).

In 1948, when I began carrying out research on environmental pollution, I believed that, if others were aware of the same evidence that was available to me, they would reach the same conclusion — namely that pollution was a threat to all living things, including me. How wrong I was! Some anthropologists call the assumption that other individuals and cultures think like themselves "mirroring." Since the basis of science is replication of the results obtained by other scientists, this assumption appears reasonable. Since 1948, massive amounts of confirming or validating evidence have been gathered; however, despite a number of success stories, environmental pollution has worsened. Many governmental officials still refuse to acknowledge the threat of global warming resulting from anthropogenic greenhouse gases. Officials responsible for public safety in the United States claim they could not have anticipated Hurricane Katrina despite the availability of explicit warnings beforehand. Uncertainty is inevitable in science, as it is in most factors affecting the human condition (e.g., politics). Assuming the reasoning is moderately sound, how can the mirroring problem be effectively resolved? From the outset of my career, my mentor Ruth Patrick encouraged me to interact with engineers, statisticians, corporate executives, fisheries personnel and recreational sportsmen, citizens, etc. To solve the problems under investigation, we needed their help, and, to use the information we generated, they needed our help. This work was difficult and none of us had adequate prior experience. This approach did not always work, but it did work a surprising number of times.

Inevitably, I was exposed to literature and situations I might otherwise not have encountered. Publishing in journals that were quite different from the ones I initially used helped me have empathy for other reasoning processes. Since I was unable to keep up-to-date on all the literature in the field of biology, I decided to focus on literature relevant to the issues of interest to me. The literature inevitably transcended the boundaries of my "home discipline," so my reading involved many areas new to me. However, the time management problem did not change – I could not read everything so I prioritized my reading to make the conceptual connections that seemed essential. This process is exciting because new information and new relationships are always available. The joy of engaging in these activities remains undiminished at present and even increases. I routinely encounter unexplored interfaces and relationships, so the time-management problem remains.

5. Coping with the Undermining of Science

As a young professional, I witnessed the savage attack on Rachel Carson after she published *Silent Spring*, which made me realize how powerful, well financed industries could attack a scientist whose views appeared to threaten their income. The news media were initially treating this major attack as a good story, not as a threat to science. Since use without abuse of the planet requires the effective cooperation of all components, I was distressed to witness some parts of industry attacking a well credentialed scientist. Eventually, Carson's book became a classic in environmental literature; unfortunately, Carson did not live long enough to witness the acclaim. For individual scientists who publish, the lesson is clear — a heavy price may have to be paid, even if the publication is eventually highly regarded.

A more reassuring lesson can be found from the history of science. Science has flourished in a variety of geographic areas, cultures, and nations. For the world's leaders and politicians, the lesson becomes: attacking science when it conflicts with political ideology or appears to threaten powerful economic interests, and religious faith does not provide long-term benefits to society. One hopes that globalization will not threaten potential refuges for science and scientists. Should this happen, serious adverse consequences will develop for humankind.

During my professional career, science has been under siege numerous times in the United States: (1) the attack on Carson, (2) the disbelief in the adverse effects of cigarette smoking on human health, (3) the attacks on the evidence for evolution by the creationists and those who substitute intelligent design, (4) the efforts to suppress stem cell research, and (5) global warming. Global warming is the most puzzling disregard of scientific evidence because mainstream science at a global level strongly endorses the evidence of global warming. Glaciers are visibly melting in a diverse array of geographic locations. The effects of global warming in the US State of Alaska are both dramatic and easily observable by laypersons. The United States has been repeatedly and publicly chastised for impeding global progress on reducing greenhouse gases. However, some US states and industries are taking steps to reduce anthropogenic greenhouse gases, which should reassure the global community that some parts of the United States are influenced by scientific evidence. In addition, the evidence for evolution is accepted by mainstream science in the United States and globally. Nevertheless, since the dispute is between science and faith, it is unlikely to disappear for some time. Arguably, the most serious long-term adverse consequence is the ongoing effort to alter science texts in the public school systems by persons with limited or no scientific credentials.

Scientists should also take comfort in the ultimate outcome of the Carson book conflict, the successful campaigns describing effects of cigarettes on human health, and the continued interest in genetic stem cell research. I am also confident that the scientific evidence for the effects of anthropogenic greenhouse gases will eventually be accepted, even where resistance to the concept is greatest. Scientists should continue to have faith in the scientific process, which ultimately prevails in an enlightened society. This recognition will occur in a shorter time if scientific literacy is increased in both the general public and its leaders. It is an act of enlightened self interest for scientists to devote a significant amount of their time to accomplishing this goal.

6. Predicting Disasters

Schiermeier (2005) notes that the scientific basis for predicting disasters is not robust. However, volcanologist S. Sparks, at the University of Bristol, UK, has examined the analysis of current trends by the German reinsurance firm Munich Re. The analysis indicates that the world can now expect three to five major events per year; each will kill more than 50,000 people. Of equal or greater concern is the rapidity at which the potential for disasters is forgotten. In the United States, the anthrax scare of 2001, which caused government buildings to be closed, resulted in the news media becoming obsessed with the possible dangers. Now, although the risk of biological terrorism is still with humankind, the particular issue is practically ignored. Why does the United States focus so intently on terrorism but, at the highest level of government, deny that global warming is a major (perhaps the major) threat to human society?

However, the anthrax scare also illustrates another interesting anomaly. Neither the US administration nor the US Congress (neither has accepted the evidence of mainstream science on global warming) questioned the scientific evidence on the risks of anthrax exposure. In addition, a number of government facilities (e.g., congressional office space) were quickly evacuated as a precautionary measure. What is responsible for this marked difference in attitude toward scientists and the evidence they generate? Will there be a comparable dichotomy in response to other global environmental crises? If so, an integrated environmental policy will be unattainable. One can only hope that intelligence guided by reason will prevail. If it does, scientists must be prepared to allocate more of their time to ensure that the processes of science are better understood.

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