

The Challenge of Sustainability

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One Halloween night, a retired Methodist preacher answered a knock on his door. Opening the door, he saw a vision of innocence in the form of a little girl dressed up as an angel, clutching a trick-or-treat bag. Moved nearly to tears, the preacher said "Oh, a little angel! I'm going to get something extra special for you." Whereupon he hurried off to the kitchen to get the biggest, juiciest apple he could find. He proudly returned and, with a flourish, dropped the apple into the little angel's bag. Immediately, the little girl broke into tears. Puzzled, the preacher looked down at this beautiful creature and asked: "My dear little angel, what could be the matter?" With eyes narrowed and tears streaming down her little angelic cheeks, she looked up at him and said: "Mister, you broke—all—my—damn—cookies!"

My topic is broken cookies. Specifically those cookies that symbolize old and comfortable assumptions about science, politics, and economics. Cookies that have been shattered in the course of the past half century. The collapse of Soviet communism and the end of the Cold War have changed many of the beliefs that oriented American politics and science. During the past half century, we always knew what we were against. We organized our affairs accordingly to oppose the spread of communism. Reliable enemies are harder to find now, and history is asking, "What are we for?"

An adequate answer requires that we see our place in the wider historical topography of our age, a vantage point that lets us see what is not apparent in the daily headlines. The world built on the philosophies of Galileo, Descartes, Newton, Smith, and Marx is lying in ruin all about us. The philosophies, ideas, and epistemologies that we patched together for the modern world are now considerably more problematic than we once believed. Old divisions between primary and secondary qualities drawn by Galileo, or those between object and subject made by Descartes, have not withstood close scrutiny. The world is far more complex and ironic than the founders of modern science imagined it to be. It is a world of relativity, uncertainty, randomness, and chaos. And we are not the simple self-maximizers that Adam Smith and his heirs assumed us to be in their models of "rational economic man." Humans are far more complex and paradoxical than could be described in mechanical models.

We know now that ecological assumptions embedded in communism and capitalism are badly flawed. Those flaws were not apparent when there were fewer than a billion people on the earth, living at what we consider to be low technological levels. With five and a half billion people on earth, and some of those living considerably more extravagantly than others, those flaws loom very large. Human impact on climate and the earth's biogeochemical cycles is now greater than the background rates of change. Since the death of Descartes, we have lost six million square kilometers of forest, an area larger than Europe. Our use of water has increased to roughly 3,600 cubic kilometers per year. We have doubled the amount of methane in the atmosphere. We have increased the amount of CO₂ in the atmosphere by

25%. Emissions exceed background rates: lead by 18 times, cadmium by five times, and zinc by three times. And we added some 70,000 chemicals to the environment; most of these have effects that are unknown and, probably, unknowable (1).

The Cold War is over and, for the foreseeable future, the most important issues on the human agenda will be concerned, directly or indirectly, with the habitability of the earth. This issue will dominate and permeate all others. For example, security is now as much an ecological problem as it is a military problem (12). The ecological emergency will have a major impact on the distribution of wealth and on the prospects of future generations. The ecological challenges before us can be dealt with in ways that either reinforce or erode citizen competence and democracy.

Sustaining the earth's vital signs is a challenge to our perception of time. This crisis came upon us with blinding speed, and our response has been far slower than the rate of exponential change. In 1972, the authors of "The Limits to Growth" gave us roughly a century to control the ill-effects of population growth, resource overuse, and pollution (8). That study, which extrapolated existing trends into the future with generous assumptions about technological possibilities, was widely dismissed as too pessimistic. Now we know that it was not realistic enough. We did not have a century in which to act. One source, Tom Lovejoy of the Smithsonian Institution, believes that we have only this decade in which to save what remains of the tropical rainforests. Perhaps we have a bit longer to control emission of greenhouse gases. But if we intend to survive and prosper, it is clear that we do not have another 80 years to procrastinate. The authors of "The Limits to Growth" focused on the supply side of the industrial economy. The disposal side—the emission of heat-trapping gases, CFCs, methane, and toxic materials—has proved to be far more threatening. In 1972, no one was talking about climate change, or about the loss of biodiversity, or about the destruction of stratospheric ozone. Between the publication of "The Limits to Growth" and the publication of its sequel, in 1992, "Beyond the Limits," a span of 20 years, the damage to the earth continued to accelerate (9). Population rose from 3.7 billion to 5.5 billion. Deserts expanded by 120 million hectares. World oil consumption increased from 17 billion barrels to 24 billion barrels per year. Municipal waste in "developed" nations grew from 302 million tons to 420 million tons per year.

These numbers are too large for us to grasp easily. Reduced to a daily toll, they may be more comprehensible. If today is an average day, we will add to the atmosphere 15 million tons of CO₂, and an equivalent amount of other heat-trapping gases. We will lose approximately 120 square miles of tropical rainforest. We will drive some 75–250 species into extinction. We will convert approximately 72 square miles into unproductive and barren deserts. We will lose 71 million tons of topsoil around the world. We will add 250,000 people to the earth. We will generate one million tons of hazardous waste. And we will create three to five new chemicals.

We are engaged in a great global debate about what it means to live sustainably on the earth. However, the word "sustainability" is fraught with confusion. In large part, this is because we are

trying to use it before we define it, and before we decide what we intend to sustain and how we propose to go about it.

What does a decent regard for our long-term prospects require of us? At one level, the answer is obvious. We need to transform how, and how rapidly, we use the earth's endowment of land, minerals, water, air, wildlife, and fuels. We need an efficiency revolution to buy us time. Beyond efficiency, we need another revolution that transforms our ideas of what it means to live decently: a sufficiency revolution. The efficiency revolution is mostly about technology and economics. The sufficiency revolution is about morality and values. Taken together, they suggest the combination of reverence for life and purely rational calculation by which we will want to be both efficient and to live sufficiently. After all the talk, sustainability comes down to discovering our rightful place as citizens in the community of life. The challenge of sustainability is, in fact, a series of six challenges.

The first of these has to do with overcoming our tendency to deny inconvenient realities. A comfortable status quo always exerts a considerable tug on our better judgement. Winston Churchill faced the problem of denial in the middle and late 1930s in his attempts to alert the British people to events in Germany. And denial still keeps many of us from facing up to the magnitude of the ecological trap we are creating for ourselves and our children. We continue to think of the ecological emergency as a set of problems that are, by definition, solvable with technology and money. In fact, we face a series of dilemmas that can be avoided only with wisdom and a higher, more comprehensive level of rationality than we've yet shown. Better technology would certainly help, but our crisis is not fundamentally one of technology; it is one of mind, will, and spirit. Denial must be overcome by worldwide ecological enlightenment predicated on the courage to face reality.

The second challenge of sustainability has to do with establishing accurate indicators of human and ecological health. Imagine a conversation on the flight deck of a 747 where the pilot, reading one set of gauges, says that everything is fine. The co-pilot, reading another set of gauges, argues that the plane is about to crash. The minimally prudent passenger would want this dispute resolved sooner rather than later. Something like that conversation is presently going on between ecologists and economists. Ecologists, paying attention to rates of species extinction (16), co-option of net primary productivity (14), and the effects of climate change (6), believe that the world faces disaster within the next century. Economists, on the other hand, looking at the rise of GNP and rates of technological innovation, believe that things are basically fine. While many ecologists believe that economic growth, the quantitative increase of materials and energy consumption, must be halted, few economists agree. Resolving this dispute should be a high priority everywhere, within economic institutions and scientific organizations of all kinds. To do so will require a marriage of sorts between ecology and economics like that being proposed by the founders of the journal "Ecological Economics."

The third challenge concerns questions about the kinds of technology necessary to make the transition to sustainability. Writer George Orwell once warned that the drift of modern technology "is to reduce the human being to something resembling a brain in a bottle" (10). Faced with any new technology, we seem to suffer a kind of cultural-immune deficiency that weakens our ability to say "no." As a result, we accept that whatever can be done, will be done, and call it "progress." Those who question technology are dismissed as Luddites by people who, as far as I can tell, know little or nothing about the real history of Luddism. Technology worship has become a fundamentalism, no less rabid, mindless, and theological than other kinds of fundamentalism. Technology is able to do many marvelous things, but some of these things, as good judgment and hindsight suggest, should not be done. Technology is always justified in the name of efficiency. But efficiency is rarely defined broadly enough to include the long-term effects of technology on health, community stability, ecological integrity, and our sanity. Efficiency, narrowly

defined, just isn't efficient enough. If we take our longevity seriously, we will need a better philosophy of technology; one that helps us distinguish between those things we can do and those things we ought to do. This is a task for scholars, scientists, and teachers at all levels.

The fourth challenge of sustainability is educational. The crisis is, first and foremost, one of mind, perception, and values. It is, therefore, a challenge to those educational institutions that presume to shape minds, perceptions, and values. Twenty years into the age of ecology, the evidence indicates that most students still graduate from high school and college as ecological illiterates ignorant of how the biophysical system of the planet works, or even why this knowledge is important to them. More of the same kind of education won't help our prospects much.

This needs to be stated strongly to underscore the fact that the environmental crisis is not primarily the shortcoming of the uneducated. It is rather the fault of well-educated people who, in Gary Snyder's (13) words:

make unimaginably large sums of money, people impeccably groomed, excellently educated at the best universities—male and female alike—eating fine foods and reading classy literature, while orchestrating the investment and legislation that ruin the world.

These are people with college and university degrees who have been educated to think that human domination of nature is our rightful destiny. This is not an argument against education, but rather an argument for the kind of education that prepares people for lives and livelihoods suited to a planet with a biosphere that operates by the laws of ecology and thermodynamics.

The skills, aptitudes, and attitudes necessary to industrialize the earth, however, are not necessarily the same as those needed to heal the earth, or to build durable economies and good communities. Resolution of the great ecological challenges of the next century will require us to reconsider the substance, process, and purposes of education at all levels. In the words of Yale historian Jaroslav Pelikan, we must do so "with an intensity and ingenuity matching that shown by previous generations in obeying the command to have dominion over the planet" (11).

The fifth challenge is one to our loyalties and deepest affections. Harvard biologist Stephen Jay Gould (3) puts it this way:

We cannot win this battle to save species and environments without forging an emotional bond between ourselves and nature as well—for we will not fight to save what we do not love.

Scientists do not talk much about love, or emotional bonds, or, for that matter, fighting. Why do we find it so hard to talk about the most powerful of human motives, love, in relation to the most powerful of human activities, science? I believe that it is time to make our affinity for life, or what E. O. Wilson calls "biophilia," a legitimate subject of academic conversation and inquiry (7). We need to become students of biophilia in order to understand more fully how life comes to be and how it prospers. This will require a greater consciousness about how language, models, theories, and curriculum can sometimes alienate us from life. Words that render nature into abstractions of board feet, barrels, N_e , sustainable yields, and resources drive out such feelings and the affinities we have at a deeper level. We need better tools, models, and theories, ones that are calibrated to our innate loyalties; ones that create less dissonance in what we do for a living, how we think, and what we feel as creatures who are the product of several million years of evolution.

We know that love sets limits to what we do and how we do it. Love is, as Erich Fromm once wrote, an art requiring "discipline, concentration, and patience" (2). What does the art of love have to do with the discipline of science? On one hand, love is not a substitute for careful thought. On the other hand, when the mind becomes, in Abraham Heschel's words, "A mercenary of our will to power . . . trained to assail in order to plunder rather than to commune in order to love," ruin is the logical result (5). In either case, it is evident that personal motives matter, and different motives lead to very different kinds

of knowledge and very different results on a planet with a biosphere.

Finally, the sixth challenge of sustainability is to rebuild our democratic institutions. A century of hot and cold wars have eroded democracy and democratic values. Secrecy, in the name of national security, became the norm between 1940 and 1992. Democracy, however, requires an informed, engaged, and sometimes, enraged public. Without it, there will be no constituency ready to fight for the changes that must be made in the years ahead. The revival of democracy requires that we open the doors and windows of governing institutions to again allow the light of public scrutiny into the halls of Congress, the White House, and other federal agencies. Revitalizing democracy will also require that we restore the moral basis of political life. It is corrupted by too much manipulation, too many sound bytes, too little substance, and too much money. All of us, and particularly those of us in the academic world, have an obligation to roll up our sleeves and help to restore, in Vaclav Havel's words, "Genuine politics . . . serving those around us: serving the community, and serving those who will come after us" (4).

If economic depression, fascism, and communism were the challenges of the past generation, the crisis of ecology is the challenge to our generation. That crisis is both global and local, it is a threat to human survival, and it is now a permanent feature on the human agenda. It is as much a crisis of values and politics as it is one of science and technology. It is a test of our loyalties and of our foresight. To those of us in education and research, it is a test of our intellectual creativity and the depth of our commitment to larger truths. The challenge of sustainability exerts a centrifugal effect on the mind, pulling it across the boundaries of specialization and discipline. It requires a wide-angle view of the world, and a longer time perspective that measures value, not over a year or a decade, but over centuries. It calls us to

focus on big issues, some of which may be professionally inconvenient. It calls us to join our science with an ecological ethic. And that, I submit, is the ultimate challenge of sustainability.

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