

## **The Limit of Us**

*By Michael Crow*

January 2001 Draft - Comments Welcome  
Please do not copy or distribute.

Modified from a speech presented at the State of the Planet Conference

In 1972, the Club of Rome published *Limits to Growth* and established a framework for discourse on the state of the planet that is with us to this day. The question was this: how much population growth and development, how much modification of natural systems, how much resource extraction and consumption, how much waste generation can the earth sustain without provoking regional or even global catastrophe. Since that time, the way we think about humans and the environment, and the way we translate this thinking into scientific research, public debate, and political action, has been framed by the idea of external limits—defining them, measuring them, seeking to overcome them, denying their existence or insisting that they have already been exceeded. For technological optimists, these limits are ever-receding, perhaps even illusory, as science-based technologies allow progressive increases in productivity and efficiency that today allow the billion-and-a-half people living in industrialized and industrializing nations today to achieve a standard of living that was available to perhaps only a few million at the beginning of the last century. For the pessimists there is global warming, the ozone hole, air and water pollution, overpopulation, natural and human-caused environmental disasters, widespread hunger and poverty, rampant extinction of species and destruction of ecosystems. In the face of these conflicting realities, I want to ask whether the idea of external limits is an appropriate foundation for inquiry and action on the future of humans and the planet.

All sides in the limits-to-growth debate would probably agree upon the following two observations: First, the dynamic, interactive system of complex biogeochemical cycles that constitutes the Earth's surface environment is falling significantly and increasingly under the influence of a single, dominant life-form: us. Second, this life-form, notable for its ability to learn, reason, innovate, communicate, plan, predict, and organize its activities, nonetheless exhibits serious limitations in all these same areas.

Consider this: In the past hundred and fifty years or so, the population of the earth has increased by about six times, agricultural productivity has increased by xx times, the size of the global economy has increased by approximately xx times, the number of scientists has increased xxx times, and the volume of retrievable information stored in analog and digital form has expanded by incalculable orders of magnitude. Simultaneously, twenty percent of the planet's bird species have been driven into extinction, 50 percent of all freshwater runoff is consumed, 70,000 synthetic chemicals have been introduced into the environment, the sediment load of rivers is up by five times, and sixty percent of the available marine fishery is being harvested.

As Joel Cohen has brilliantly shown in his book *How Many People Can the Earth Support?*, there are many possible futures available to us. The only thing we can be

certain of is that present trajectories of growth cannot, and therefore will not, be maintained indefinitely. (Malthus got this point right. He simply failed to appreciate the productivity gains that science and technology could deliver.) The central question that faces us is whether we will be able to position ourselves to choose wisely among alternative future trajectories, or if we will simply blunder onward. If we continue to define our problem as external to ourselves, as limits imposed by or internal to nature and environment, then we continue to consign ourselves to a future of blundering. The necessary overarching framework for inquiry and discourse is the limits of human knowledge acquisition and integration, and the limits of knowledge application through organized societal action, that is: the limits of us.

What are these limits? I recognize six categories, separated by very fuzzy boundaries: limits of the individual, of sociobiology, socioeconomics, technology, knowledge, and philosophy. The list may seem to point to hopelessly intractable shortcomings. But my view is precisely the opposite: that hope for finding our place in nature and on the planet resides in embracing our limits and recognizing them as explicit design criteria for moving forward.

**Individual Limits:** We all operate out of self interest. This is entirely rational, to do otherwise is not only meaningless but possibly crazy. I don't mean to say that there is no community or altruism or vision, but, given that we cannot know the impacts of our individual actions on the larger systems in which we are enmeshed, one reasonable alternative is to form some imperfect idea of what serves one's self interest, and act in a manner consistent with this idea. Yet, as social systems grow more and more complex, and as they impinge more and more on natural systems, our individual vision inevitably captures less and less of what is going on. Is a tragedy of the global commons an inevitable consequence of individuals acting rationally?

**Sociobiological Limits:** Humanity's special capabilities in such areas as tool-making, language, self-awareness, and abstract thought, have rendered us extraordinarily fit to engage in the competitive business of individual and species survival. We compete among ourselves at every organizational level, and with other species at virtually every ecological niche. We are inherently competitive; we organize so that we can compete. Cooperation, therefore, is often best achieved at one level (a tribe or a nation, for example) by the need for competition at the next level (a war between tribes or nations, for example). But at the highest levels—the behavior of an entire species competing with—dominating—billions of other species, we have run out of reasons to cooperate—or structures to foster effective cooperation.

**Socioeconomic Limits:** We have done our best to make a virtue out of our individual and sociobiological limits through market economics and democratic politics. Yet we are unable to integrate the long-term consequences of our competition-based society into our planning processes. Our competitive nature values the individual over the group, but the cumulations of individual actions constantly surprise us. Thus, for example, do we all climb into our cars in the morning, fully intending to drive to work, and not in the least intending to sit in traffic jams, exacerbate the trade deficit, and pump greenhouse gases

into the atmosphere. We find it extraordinarily difficult to anticipate or accurately account for the costs and risks incurred over the long term by such group behavior. Indeed, those costs and risks vary wildly from individual to individual, and from group to group. Because of these complexities, efforts to advance the long-term interests of the whole by controlling the short-term behavior of the individual are doomed to failure, as shown most vividly by the global collapse of communism.

**Technological Limits:** And so we have turned to technology to evade the behavioral limits of biology and economy. Indeed, technology, harnessed to the marketplace, has allowed industrialized societies to achieve amazingly high standards of living. In doing so, however, we have put our future into the hands of the lowest bidder. Cheap oil and coal, for example, ensure our continued enslavement to the internal combustion engine and the coal-burning power plant. The problem we face is not a shortage of polluting hydrocarbon fuels, but an excess. History shows that we will develop increasingly efficient energy technologies—and that gains in efficiency will be more than offset by the increased consumption that such efficiency permits. The promise and the limit of technology are the same: they save us from today's predicament, and in doing so amplify the scale of tomorrow's predicament.

**Knowledge Limits:** There is absolutely no a priori reason to expect that what we can know is what we most need to know, given the interaction of our individual, organizational, and technological limits. Science uses disciplinary organization to recognize and focus on questions that can be answered. Disciplines, in turn, are separated by methodology, terminology, sociology, and disparate bodies of fact that resist synthesis. Thus, while disciplinary specialization has been the key to scientific success, it simultaneously takes us away from any knowledge of the whole. Today, the whole encompasses six billion people with the collective capability of altering the biogeochemical cycles upon which we depend for our survival. Can science generate the knowledge necessary to wisely govern the world that science has made? Do we even know what such knowledge might be? Producing 70,000 chemicals was easy compared to the challenge of understanding and dealing with their cumulative and future impacts. Truly, we have not a clue as to the long-term effects of our interference with the planet's biogeochemical cycles, despite the billions we spend studying them. And we have even less knowledge about how to organize and govern ourselves to confront this challenge.

**Philosophical Limits:** For thousands of years, philosophical inquiry has been guided by such fundamental questions as "Why are we here? How should we behave?" Such questions were difficult enough to confront meaningfully when our communities were small, our mobility limited, our impacts restricted. In today's hyperkinetic world, how can we possibly hope to find meaning? The literal answers provided by science amount to mockery: we are here because an expanding cloud of gas some 15 billion years ago eventually led to the accretion of planets, the nucleation of primordial amino acids, the evolution of complex organisms, the growth of complex social structures in primates. Such explanation is entirely insufficient to promote the commonality of purpose necessary for planetary stewardship. We lack a unified or unifiable metaphysical basis for action, just when we need it most.

I list these limits—which could no doubt be parsed and defined in many different ways—not to bemoan them, but to acknowledge the boundary conditions that we face in learning how to most wisely exercise our accelerating impact on the earth. How can we create knowledge and foster institutions that are sensitive to these boundary conditions? This is a sensitivity that we have hardly begun to develop. Our traditional focus on disciplines, for example, has been our strength and our structure for the past century, but it does not provide us the tools we need for better planetary stewardship. These traditions are still powerful: Columbia University, where I work, has not created a new academic arts and sciences department since the 1940s. We need new ways to conceive the pursuit of knowledge and innovation, to understand and build political institutions, to endow philosophy with meaning for people other than philosophers. We trumpet the onset of the "knowledge society," but we might be much better off if we accepted that, when it comes to our relations with nature, we are still pretty much an "ignorance society." Our situation is reminiscent of Sherman McCoy, the protagonist of Tom Wolfe's *Bonfire of the Vanities*, who fancies himself a "Master of the Universe," just as his life is taken over by events far beyond his control. We have the illusion of understanding; we are not humbled by the fact that we do not understand; we refuse even to discuss the possibility.

Hubris, exemplified in the demands we make on science, is a major obstacle to coming to grips with our situation. We are obsessed with trying to predict, manage, and control nature, and consequently we pour immense intellectual and fiscal resources into huge research programs—from the Human Genome Project to the U.S. Global Change Research Program—aimed at this unattainable goal. On the other hand, we devote little effort to the apparently modest yet absolutely essential question of how, given the unavoidable limits embodied in ourselves, we can manage to live in harmony with the world that we have inherited and are continually remaking.

Concepts like sustainability, adaptive management, industrial ecology, and intergenerational equity—new principles for organizing knowledge production and application—offer hints of an intellectual and philosophical framework for creating and using knowledge appropriate to our inherent limits. Sustainability is a concept as potentially rich as justice, liberty, and equality for guiding inquiry, discourse, and action. Adaptive management acknowledges the limits of acquiring predictive understanding of complex systems, accepts that control of such systems is impossible, and dictates that their management must be an incremental and experimental process. Industrial ecology responds to our tendency to organize and innovate competitively, and looks to natural systems for a model of innovation that can enhance competitiveness while reducing our footprint on the planet. Intergenerational equity seeks to apply core societal values such as justice and liberty across boundaries of time, as well as space. Of course we will need many other new ways to think about and organize our actions, but these few indicate a beginning.

Common to all such approaches is the idea that more flexibility, resilience, and responsiveness must be built into all institutions and organizations—in academia, the private sector, and government—because society will never be able to control the large-

scale consequences of its actions. In today's ignorance society, we must recognize that the only way to reduce uncertainty about the future is to take action and see what happens. The more institutional and organizational experiments we conduct, the better the chances that we will learn how to deal with the implications of our own limits.

The epic battle between communism and market democracy can be viewed as one such experiment. A key result is the certain knowledge that accepting our limits works better than trying to suppress them. We now urgently need to conceptualize a new series of experiments, at much lower cost and shorter run-time, to push this result further, and apply it to the problem of ensuring that our global society can continue to be sustained by the web of biogeochemical cycles that makes life possible in the first place.