Reactions to Unwelcome Knowledge

by William R. Catton Jr.

Although I never met Donella Meadows, almost immediately after publication of *The Limits to Growth* I heard about her work. A young New Zealander, Guy Salmon, whom I met at a population conference in Wellington, mentioned that book with deep concern about its message. He had been to Stockholm at the time of the 1972 Conference on the Human Environment, convened by the United Nations with the hope of working out some way to prevent our only Earth from being rendered less and less capable of supporting more and more billions of human beings. My already keen anxiety about the effects of our population explosion (at a time when world numbers were just approaching four billion — over two billion more have been added since) was shared by Mr. Salmon. For him that first Report to the Club of Rome, by Meadows et al., documented humanity's dire prospect if global population were to continue increasing at nearly two percent per annum.

Impact of the Meadows Studies

The Limits to Growth (Meadows et al. 1972) became a widely influential document and spurred a worldwide controversy about the future. How much larger could world population grow, and how much longer could economic growth continue? The book's publication nurtured awareness of the immediacy of need for a change of course. An eventual transition to steady state ecological relations between the human population and the biosphere could well be too late. But the Meadows group also made clear that coping with the problems of transition would require actions that would violate conventional wisdom as well as current values.

If the general public rather vaguely recognized something called "the postwar baby boom," people generally tended to assume only such countries as India and China might realistically have to worry about "overpopulation." That word was customarily enclosed in quotation marks to suggest it represented a questionable notion. After all, in America there were still enormous open spaces. A popular song had not seemed implausible after World War II in demanding, "Give me land, lots of land…Don't fence me in." People assumed that the global environment was so huge it could accommodate all our progeny and also function as a universal sink into which anyone had a perfect right to empty wastes of all kinds. The folly of that assumption was elegantly portrayed in 1968 by Garrett Hardin in his paper "The Tragedy of the Commons," appearing in *Science* magazine.

With the advent of computer technology, early warnings about the consequences of unrestricted population growth and associated environmental degradation, often seen as "doomsday prophecies," called for devising models to test their validity. Scientists at the Sloan School of Management at MIT worked out implications of such models under sponsorship by a group of concerned businessmen called the Club of Rome. Application of system dynamics computer models to social systems was initiated by J. W. Forrester, who described the procedure in his books *Urban Dynamics* (1969) and *World Dynamics* (1971). The Forrester-Meadows series of world models outlined in *The Limits to Growth* received great initial publicity, and then more detailed discussion in *Toward Global Equilibrium* (1973).

These individuals were pioneering holistic study of the human predicament. Earlier ecological warnings had tended to focus on or became identified with one particular limit to growth. For Osborn (1953) the problem was depletion of natural resources. For Carson (1962) it was pollution by careless or excessive use of chemicals. For Ehrlich (1968) it was population growth. Polemics of that sort were vulnerable to counter arguments exaggerating human adaptability and claiming problems

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could always be solved by "finding" new resources.

By identifying a range of important interactive connections among a number of basic variables, the World3 computer model sought to reveal the cumulative effects of these on-going interactions. Runs of the model seemed to show that a "strategy of borrowing from Peter to pay Paul would not work much longer" (Ophuls and Boyan 1992, p. 41).

A few years later, using a similar approach, *The Global 2000 Report to the President* (1980) came to the same conclusion. Later still, the World Commission on Environment and Development, headed by Norway's Prime Minister, issued a report entitled *Our Common Future* (1987) which found unsustainable the current rates of economic development and environmental degradation.

Vienna-born sociologist Paul Neurath (1994) has described the views of critics who charged that these studies were based on excessively pessimistic Malthusian assumptions about the alleged limits, and that the assumptions determined their outcomes. With supposedly "more reasonable" (i.e., optimistic) assumptions about the dynamics of populations, about the availability of resources, and about technology for pollution-control, etc., entirely different conclusions could result, they insisted. The Reagan administration shrugged off *The Global 2000 Report* as a "doom and gloom" document and inflicted budget cuts upon the agencies that had prepared it (Ophuls and Boyan 1992, p. 42). However, such retaliation against infidels could not eradicate the problems cited in the report.

Economist Robert Heilbroner (1974, pp. 127, 132) had said that humanity was "entering a period in which rapid population growth, the presence of obliterative weapons, and dwindling resources" would result in perilous international tensions. The danger would not subside, he said, unless we somehow achieved population equilibrium and the distribution of wealth in the world somehow became more equitable. He doubted these changes would be accomplished in time. We were more likely to undergo what he termed "convulsive change" resulting not from calculation but from catastrophe. "As with Malthus's much derided but all too prescient forecasts, nature will provide the checks, if foresight and 'morality' do not."

As a sociologist, I have devoted much of my attention in recent years to a reconsideration of a thesis expounded by Emile Durkheim (1893 [1984]). He expected division of labor in human societies to mitigate competition. He invoked increasing population density as a force that would foster division of labor and thus limit the range of anyone's competitive relations to members of one's own specialty. However, since he published those ideas, world population has so multiplied that the intensification of competition has, I am convinced, far exceeded any power of occupational specialization and differentiation to mitigate it.

Meanwhile, my involvement with the issue required a growing acquaintance with the literature of ecology. The multivariate studies by the Meadows group began to lift some sociologists who read them out of a disciplinary rut. The more we studied the writings of eminent academic ecologists, the more a colleague and I became convinced of the fact that all populations of organisms use environments to serve not one but three functions (Dunlap and Catton 1992-93). Metabolism requires that every living population, human or not, must have a Supply depot, Activity space, and a Disposal site. It may be "SAD," but it is a fact that the potential for mutual interference among these three environmental functions, S, A, and D, grows as a population outgrows a finite abode. Each additional billion humans thus accentuates the finiteness of our planet.

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The late British-born ecologist, Arthur S. Boughey, head of Environmental and Population Studies at the University of California, Irvine, from 1965 to 1978, cited extensively (and favorably) at various places in his 1976 book, *Strategy for Survival*, the work of "the Meadows group" with its World3 model. He linked its influence with a number of other works that appeared before and after it. Paul Ehrlich's *The Population Bomb* (1968), he said, had helped revive attention to warnings about overpopulation that trace back to Adam Smith, T. R. Malthus, and David Ricardo. Preceding both the Ehrlich book and the work of the Meadows group, there was a

serious warning of environmental deterioration by Rachel Carson. Her *Silent Spring* (1962), had shown how unrestricted use of broad-spectrum pesticides was enormously fraught with environmental side-effects. Barry Commoner (1972) broadened that issue in *The Closing Circle*, examining the impacts of industrial pollution, and industrial society's perilous reliance on nonrenewable resources. Together, such books as these compelled reconsideration of long-held assumptions.

System dynamics computer models, necessary to supersede intuitive mental models, were constructed from mathematical assumptions that would incorporate the multiple feedback loops among interacting variables real systems comprise. Thus they could reflect numerous and intricate linear or nonlinear relationships. In contrast, traditional mental "models" typically considered real processes too simplistically and could hardly cope with the complexities of multiple interactions and nonlinear relationships. So, as Boughey (1976, p. 5) noted, when available statistics were entered as data into the computer model and run for an appropriate time, the results were frequently unexpected and counterintuitive.

Boughey (1976, pp. 161-165) credited the Meadows group's system dynamics World 3 model with having provided the opportunity for "the first attempt to assess the extent of technological and social adjustment to our global system that will be needed to bring it into equilibrium in the foreseeable future." The group's procedures, he said, were "extremely logical." Their method made possible an ordered sequence of modifications to various input variables of the global model.

The Meadows model first simulated the global socioeconomic system's behavior from 1900 to 1970 and then went on to project its future behavior through to 2100. This run showed the Meadows group that the present historical set of input variables would not enable the global system to reach equilibrium within the stipulated time period. It would not reach stability in any of the state variables examined. Considerably before the end of this model run there would occur catastrophic depletion of nonrenewable resources. Systems collapse would ensue. Depletion of resources leading to economic collapse would occur so swiftly that the size of the industrial base would be constricted, but the previously excessive growth of that industrial base would have already produced immense pollution. Together, increasing pollution and a declining industrial base would lead to famines, and they would increase mortality. Deaths would come to exceed births so population would begin to decline, reinforcing the system collapse.

Stubborn Reliance on the Cornucopian Faith

However, the idea of an inexhaustibly cornucopian world remains an inordinately seductive dogma. It has been embraced in the industrial era "with almost ferocious loyalty," according to a retired director of research for an oil company (Carr 1976, p. 252) who recognized the disorienting effect of the Meadows team's repudiation of such an idea. "Without a steadily growing economy," he said, "Keynesian economists…are like dogs without noses."

To devotees of the cornucopian faith, the findings of studies by Donella Meadows and her associates were simply unacceptable. These faithful have supposed the finiteness of our planet poses no insoluble problems for a burgeoning population. Technology-based economic progress is, in their ideology, inherently perpetual. Together with economists' presumed infinite substitutability of one resource for another, it ensures that growth can continue forever (Maurice and Smithson, 1984).

Pre-eminent among such "true believers" was the late Julian Simon, an economics Professor at the University of Maryland and an insistent Pollyanna. With futurologist Herman Kahn, late head of the Hudson Institute in New York, he wrote a book-length rejoinder to *The Global 2000 Report to the President* (1980). In it, Simon and Kahn (1984) categorically rejected the validity of *The Limits to Growth*. They took issue with *Global 2000*'s expectation that "global problems of alarming proportions" would arise from projected population increases requiring unsustainable exploitation of natural resources. As dogmatic cornucopians, they insisted continued growth would not further erode the ability of biological systems to meet human needs.

Global 2000 had extensively documented the fact that Earth's human carrying capacity could be and was being damaged by overuse. Understandably, many people accustomed to the remarkable achievements of industrialized nations find that prognosis hard to accept. Simon and Kahn scoffed at such a frightening prospect, declaring (p. 45), because of increases in knowledge, the earth's "carrying capacity" has been increasing in the

decades and centuries and millennia to such an extent that the term "carrying capacity" has by now no useful meaning. They proposed that the actual (and foreseeable) trends were diametrically different from those depicted both in 1972 by the Meadows team and eight years later in *Global 2000*.

In 1971 the Meadows team saw physical limits to human use of materials and energy looming some decades in the future. But two decades later, when they looked again at the data, their computer model, and their own experience of the world, they realized that despite improved technologies, greater awareness, and stronger environmental policies, many resource and pollution flows had already outgrown carrying capacity — the limits of sustainability.

"In a way we had known it all along," they said, after admitting in their Preface to *Beyond the Limits* (1992) to being surprised. Of course they had seen with their own eyes leveled forests, erosion gullies in croplands, rivers choked with silt. They had known about the chemistry of the ozone layer, and were aware of the greenhouse effect. They already knew of global fisheries that had been overfished. Water tables, they recognized, had been drawn down, and various species had been driven to extinction. But in the past twenty years they had been reading suggestions by other authors who believed resource use and pollution flows had already grown beyond sustainability. And they found their colleagues did not question it when they eventually concluded overtly that the world had now gone beyond its limits.

Yet until they set out to update *The Limits to Growth* they had shared, more than they realized, their culture's acceptance of the myth of limitlessness, so they had not let their minds fully accept what they knew. Their continuing research brought them face to face with the fact that "the present way of doing things is unsustainable." Indefinite material growth was not going to be the solution to poverty, which would have to be addressed amid a contracting material economy. "Like everyone else," they said, "we didn't really *want* to come to these conclusions" [my emphasis]. "But the more we compiled the numbers, the more they gave us that message, loud and clear."

Ecological Precedents

Populations of many non-human species have undergone the experience of resource bankruptcy after irrupting — increasing exponentially when they escaped from previously constraining circumstances. But we humans have supposed no such fate could befall us because we are thought to be fundamentally unlike other animals. We have misconstrued our "superiority" over the rest of the animal kingdom. We have actually been experiencing a double irruption, and it confronts us with an intensified version of the plight of animal species that have overshot carrying capacity. The double irruption consists of the fact that, as I have written elsewhere (Catton 1980), *Homo sapiens* as a biological type had been increasing more or less exponentially for ten thousand years (since the onset of agriculture — basically, the start of human manipulation of ecosystems), and especially for the last four hundred years (since the Western Hemisphere became accessible for European expansion into a "New World").

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In addition, our resource-consuming tools had been irrupting for the last two hundred years (since the Industrial Revolution, i.e., human reliance on fossil energy). It is conceivable that the resource demands of what I call *Homo colossus* might be brought back within the limits of permanent carrying capacity by shrinking ourselves to a less colossal role in the ecosystems in which we are participants. To become less colossal would mean giving up or drastically refining much of our "prosthetic" apparatus — the equipment that enlarges our per capita resource appetites and our environmental impacts. Can we divert ourselves from the prodigal style of living such apparatus has made possible?

Throughout the time of mankind on Earth, discoveries and inventions have sporadically enabled human societies to tap new forms of wealth. With new skills, increasing human numbers have repeatedly been able to exceed previously unsurpassable limits. Eventual stabilization within new limits has always resulted — when evolutionary processes restored natural balances.

Today, though, we have become so numerous and so colossal that the limited size of this planet we inhabit must ultimately preclude any further repetition of such limit-boosting.

Cultural Lag

In contrast to warnings of the Meadows team, it was asserted by Simon and Kahn (1984) that we could anticipate "a progressive improvement and enrichment of the earth's natural resource base, and of mankind's lot on earth."

Those two men are both dead now, but their exaggerated optimism survives them. Anthony Browne (2001), writing in Britain's *Guardian Unlimited Observer*, ridiculed a *Time* magazine article that said "Everyone knows the planet is in bad shape" because oceans are polluted, forests devastated, species driven to extinction, etc.

To the contrary, Browne asserted, "There's a growing belief that what everyone takes for granted is wrong: Things are actually getting better." His assertion was based on a new book by a Danish statistician, Bjørn Lomborg, entitled *The Skeptical Environmentalist*, claiming the world's rivers, seas, rain, and atmosphere are all getting cleaner, forests are not declining, extinctions of species are few, and once-endangered ones are thriving.

This view is, says Browne, "part of a growing backlash against green groups," now coming as much from renegade environmentalists as from the more traditional right-wing opponents of environmentalism. Lomborg's book is scheduled for republication in September 2001 by Cambridge University Press after first coming out in Scandinavia. It is said to claim conservation efforts have been so spectacularly successful that most of the main forms of pollution have been eliminated, oceans are becoming cleaner, acid rain has not killed the forests, the ozone layer is recovering, and "Many environmental scares have simply failed to happen."

Some facts remain. Just since the Meadows team produced their warning of the consequences, per capita resource appetites and environmental impacts have continued escalating and Earth's human population has increased by another two billion.

U.S. emission of carbon dioxide, the principal greenhouse gas contributing to global climate change, increased by forty-one million tons from 1999 to 2000 even while it was declining elsewhere. There is overwhelming evidence that our accelerating fossil fuel consumption is changing global climate (Bradley, 2001). The U.S. president who abandoned the Kyoto Protocol has been told by a panel from the National Academy of Sciences that global warming is real and worsening (Seelye, with Revkin, 2001). Many scientists oppose the administration's commitment to procrastinating about emissions reduction policies (Revkin 2001).

And the Census Bureau's estimate of the projected increment of world population during this presidential term of office — all of them hoping to use their proportionate share of climate-endangering fuels — will exceed the present population of the U.S. Everyone should read at least pp. 201-207 in *Beyond the Limits* (1992), where the Meadows team showed it is perilous to procrastinate. They ran the World3 model with certain changed inputs (stabilized population, and new technologies to reduce emissions, erosion, and resource use), and compared two twenty-year delay intervals. Putting these changes into effect in 1995 and running the model revealed that population could level off at 7.7 billion and have "a comfortable standard of living with high life expectancy and declining pollution until at least the year 2100." Had the changes gone into effect twenty years earlier, in 1975, the results would have been conspicuously better. Were the changes not made until 2015, though, they would lead to huge fluctuations in life expectancy and sustainability would remain unreachable!

In retrospect, says William McNeill (1980, pp. 73-74), this industrial era of the past two centuries may well be seen as "the work of spendthrift generations who mined fuels and minerals recklessly," with consequences for natural balances it may require millennia to heal. Humanity's recent proliferation and breakaway from older modes of life has caused such violent upheavals of ecological patterns, he reminds us, that no managerial bureaucracy can realistically expect to avoid large-scale crises. Indeed, our appar-ently probable reactions are likely to exacerbate them.

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