

Facing the Limits to Growth

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Editor's Note: 'Limits to Growth' was first published in 1972. 'Limits to Growth: The 30-Year Update' has recently been published by Chelsea Green Publishing. Below you'll find an excerpt from the newly released version, preceded by some reflections by co-author Dennis Meadows on the 30-year journey that has brought the book -- and the earth -- to this point.

It has been a unique experience to live with a book and a thesis for over 30 years -- watching the statements of both critics and proponents slowly evolve in response to the changing world situation.

From 1970-72 I directed a project at MIT, supported by an international group called the Club of Rome. My colleagues and I developed a computer model about the long-term causes and consequences of growth in population and the physical economy of the globe. The research produced three books. One of them, *Limits to Growth*, caused a huge storm of controversy that has continued until the present. The work pointed out that prevailing policies would almost certainly lead to overshoot and collapse of the global society sometime in the 21st century.

One cannot predict the future with any confidence. But our computer model, known as World3, produce a set of scenarios that showed different possibilities for major global trends out to the year 2100. Most of them manifested collapse. Some of them showed the possibility of sustainable development.

The book was translated into over 30 languages, became a best-seller in many nations, and was eventually voted one of the 10 most important environmental books of the 20th century.

It has also been bitterly attacked, right up to the present. For example a recent advertisement in the Wall Street Journal stated, "In 1972, the Club of Rome published *Limits to Growth*, questioning the sustainability of economic and population growth. the Club of Rome was wrong."

It has been astonishing to me that many politicians and economists can continue to deny the evidence of limits that is announced with ever more frequency and urgency in the daily papers and the evening news. The world's use of materials and energy has grown past the levels that can be supported indefinitely. Pressures are mounting from the environment that will force a reduction. Rising oil prices, climate change, declining forests, falling ground water levels -- all of these are simply symptoms of the overshoot.

It is also a source of sadness for me to see so much energy invested in denial and almost none put into making the changes that would let humanity survive on this beautiful planet in good order more or less indefinitely. For our research clearly points out that feasible changes in cultural norms and goals would let us ease back down to sustainable levels, fulfill basic human needs, and structure an orderly society more or less indefinitely.

Because of the long time horizon involved in our studies, we always realized it would require several decades to get any perspective on the accuracy of our forecasts. Now, three decades later, we are into the 21st century within 20 years of the time when our scenarios suggest that growth will near its end. The basic conclusions are still the same. We have modified our model only a little to reflect some better data about the effects of technology on land yields and birth rates. And we have spent much more time elaborating on the structural features of the global system -- delays, growth, and limits -- that predispose it to overshoot and collapse.

There have also been losses since 1972. One of our four original co-authors, Bill Behrens, dropped out of science to become a builder and alternative energy merchant in northern Maine. And, more devastating, Donella Meadows, our senior author, died unexpectedly of illness in 2001. The most inspiring parts of the book are hers, and we have recognized her contributions by leaving her as senior author on this third edition. (Ed: Donella Meadows wrote extensively for AlterNet. Her archives are available [here](#).)

The first book made an enormous impact. This time we expect much less attention. Iraq, terrorism, and high oil prices are crowding out analysis of longer term issues -- even though they cannot be fully understood unless you see them in the context of an overstressed planet. But there will be widespread use of the book in teaching. And the millions who were educated and inspired by the first edition will find this a useful update.

Limits to Growth Overshoot

To overshoot means to go too far, to go beyond limits accidentally -- without intention. People experience overshoots every day. When you rise too quickly from a chair, you may momentarily lose your balance. If you turn on the hot-water faucet too far in the shower, you may be scalded. The three causes of overshoot are always the same, at any scale from personal to planetary. First, there is growth, acceleration, rapid change. Second, there is some form of limit or barrier, beyond which the moving system may not safely go. Third, there is a delay or mistake in the perceptions and the responses that strive to keep the system within its limits. These three are necessary and sufficient to produce an overshoot.

Overshoot is common, and it exists in almost infinite forms. The change may be physical -- growth in the use of petroleum. It may be organizational -- an increase in the number of people supervised. It may be psychological -- continuously rising goals for personal consumption. Or it may be manifest in financial, biological, political, or other forms. The limits are similarly diverse -- they may be imposed by a fixed amount of space; by limited time; by constraints inherent in physical, biological, political, psychological, or other features of a system. The delays, too, arise in many ways. They may result from inattention, faulty data, delayed information, slow reflexes, a cumbersome or quarreling bureaucracy, a false theory about how the system responds, or from momentum that prevents the system from being stopped quickly despite the best efforts to halt it. For example, delays may result when a driver does not realize how much his car's braking traction has been reduced by ice on the road.

Most instances of overshoot cause little harm. Being past many kinds of limits does not expose anyone to serious damage. Most types of overshoot occur frequently enough that when they are potentially dangerous, people learn to avoid them or to minimize their consequences. For example, you test the water temperature with your hand before stepping into the shower stall. Sometimes there is damage, but it is quickly corrected: Most people try to sleep extra long in the morning after a late night drinking in the bar.

Occasionally, however, there arises the potential for catastrophic overshoot. Growth in the globe's population and material economy confronts humanity with this possibility. It is the focus of this book. The potential consequences of this overshoot are profoundly dangerous. The situation is unique; it confronts humanity with a variety of issues never before experienced by our species on a global scale. We lack the perspectives, the cultural norms, the habits, and the institutions required to cope. And the damage will, in many cases, take centuries or millennia to correct. But the

consequences need not be catastrophic. Overshoot can lead to two different outcomes. One is a crash of some kind. Another is a deliberate turnaround, a correction, a careful easing down. We explore these two possibilities as they apply to human society and the planet that supports it. We believe that a correction is possible and that it could lead to a desirable, sustainable, sufficient future for all the world's peoples. We also believe that if a profound correction is not made soon, a crash of some sort is certain. And it will occur within the lifetimes of many who are alive today.

Any population-economy-environment system that has feedback delays and slow physical responses; that has thresholds and erosive mechanisms; and that grows rapidly is literally unmanageable. No matter how fabulous its technologies, no matter how efficient its economy, no matter how wise its leaders, it can't steer itself away from hazards. If it constantly tries to accelerate, it will overshoot.

By definition, overshoot is a condition in which the delayed signals from the environment are not yet strong enough to force an end to growth. How, then, can society tell if it is in overshoot? Falling resource stocks and rising pollution levels are the first clues. Here are some other symptoms:

- Capital, resources, and labor diverted to activities compensating for the loss of services that were formerly provided without cost by nature (for example, sewage treatment, air purification, water purification, flood control, pest control, restoration of soil nutrients, pollination, or the preservation of species).
- Capital, resources, and labor diverted from final goods production to exploitation of scarcer, more distant, deeper, or more dilute resources.
- Technologies invented to make use of lower-quality, smaller, more dispersed, less valuable resources, because the higher-value ones are gone.
- Failing natural pollution cleanup mechanisms; rising levels of pollution.
- Capital depreciation exceeding investment, and maintenance deferred, so there is deterioration in capital stocks, especially long-lived infrastructure.
- Growing demands for capital, resources, and labor used by the 176 World3: The Dynamics of Growth in a Finite World military or industry to gain access to, secure, and defend resources that are increasingly concentrated in fewer, more remote, or increasingly hostile regions.
- Investment in human resources (education, health care, shelter) postponed in order to meet immediate consumption, investment, or security needs, or to pay debts.
- Debts a rising percentage of annual real output.
- Eroding goals for health and environment.
- Increasing conflicts, especially conflicts over sources or sinks.
- Shifting consumption patterns as the population can no longer pay the price of what it really wants and, instead, purchases what it can afford.
- Declining respect for the instruments of collective government as they are used increasingly by the elites to preserve or increase their share of a declining resource base.
- Growing chaos in natural systems, with "natural" disasters more frequent and more severe because of less resilience in the environmental system.

Do you observe any of these symptoms in your "real world"? If you do, you should suspect that your society is in advanced stages of overshoot.

The Next Revolution: Sustainability

It is as impossible now for anyone to describe the world that could evolve from a sustainability revolution as it would have been for the farmers of 6000 BC to foresee the corn and

soybean fields of modern Iowa, or for an English coal miner of AD 1800 to imagine an automated Toyota assembly line. Like the other great revolutions, the coming sustainability revolution will also change the face of the land and the foundations of human identities, institutions, and cultures. Like the previous revolutions, it will take centuries to unfold fully -- though it is already under way. Of course no one knows how to bring about such a revolution. There is not a checklist: "To accomplish a global paradigm shift, follow these 20 steps."

Like the great revolutions that came before, this one can't be planned or dictated. It won't follow a list of fiats from government or a proclamation from computer modelers. The sustainability revolution will be organic. It will arise from the visions, insights, experiments, and actions of billions of people. The burden of making it happen is not on the shoulders of any one person or group. No one will get the credit, but everyone can contribute. Our systems training and our own work in the world have affirmed for us two properties of complex systems germane to the sort of profound revolution we are discussing here.

First, information is the key to transformation. That does not necessarily mean more information, better statistics, bigger databases, or the World Wide Web, though all of these may play a part. It means relevant, compelling, powerful, timely, accurate information flowing in new ways to new recipients, carrying new content, suggesting new rules and goals (rules and goals that are themselves information). When its information flows are changed, any system will behave differently. The policy of glasnost, for example -- the simple opening of information channels that had long been closed in the Soviet Union -- guaranteed the rapid transformation of Eastern Europe beyond anyone's expectations. The old system had been held in place by tight control of information. Letting go of that control triggered total system restructuring (turbulent and unpredictable, but inevitable).

Second, systems strongly resist changes in their information flows, especially in their rules and goals. It is not surprising that those who benefit from the current system actively oppose such revision. Entrenched political, economic, and religious cliques can constrain almost entirely the attempts of an individual or small group to operate by different rules or to attain goals different from those sanctioned by the system. Innovators can be ignored, marginalized, ridiculed, denied promotions or resources or public voices. They can be literally or figuratively snuffed out. Only innovators, however -- by perceiving the need for new information, rules, and goals, communicating about them, and trying them out -- can make the changes that transform systems. This important point is expressed clearly in a quote that is widely attributed to Margaret Mead, "Never deny the power of a small group of committed individuals to change the world. Indeed that is the only thing that ever has." We have learned the hard way that it is difficult to live a life of material moderation within a system that expects, exhorts, and rewards consumption. But one can move a long way in the direction of moderation. It is not easy to use energy efficiently in an economy that produces energy inefficient products. But one can search out, or if necessary invent, more efficient ways of doing things, and in the process make those ways more accessible to others.

Above all, it is difficult to put forth new information in a system that is structured to hear only old information. Just try, sometime, to question in public the value of more growth, or even to make a distinction between growth and development, and you will see what we mean. It takes courage and clarity to challenge an established system. But it can be done.