

A BRIEF HISTORY OF THE LIMITS TO GROWTH

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The point is not to see who may be the more correct, but to see the areas which will be particularly vital in the future and also to note some of the profound moral, ethical, and human questions which will be raised. - Sir George Thomson

Club of Rome Limits to Growth (1972)

In the summer of 1970, Professor Jay Forrester of MIT presented a global computer model to the Club of Rome conference in Cambridge, Massachusetts. This global model which took into account over 100 factors including population, agricultural production, natural resources, industrial production, and pollution, enabled the analysis of the behaviour and dynamic relationships of these factors.

An international team under the direction of Professor Dennis Meadows was set up to examine five basic factors that determine and ultimately limit growth on our planet. Many different model runs were made based on different inputs of the physical aspects of humankind's behaviour. In all model runs capital and population growth were allowed to continue until they reached some natural limits.

The results of the study were published in the book *The Limits to Growth*. When population and capital growth were allowed to grow without human constraints, there was no policy that avoided the scenario of an exponential growth of population and capital followed by collapse. Some policies delayed collapse, but a collapse scenario by the year 2100 and earlier were common to all model runs without human constraint.

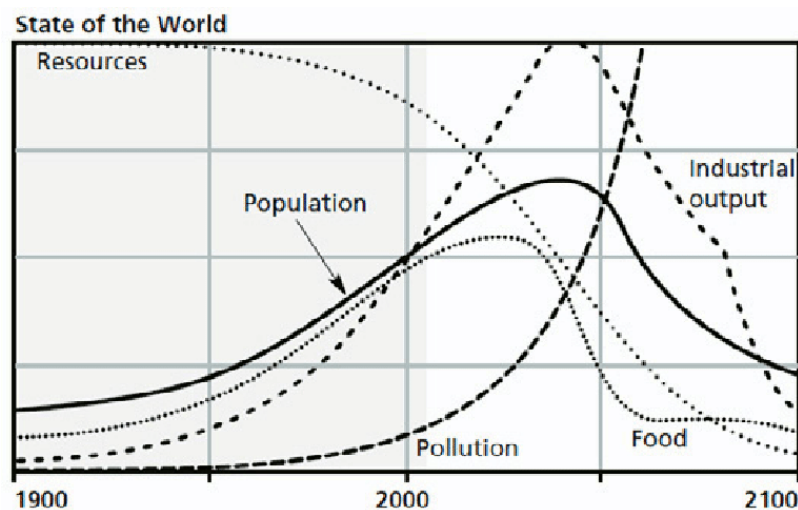


Figure 1: Business as Usual Model of Collapse

In the process of seeking the requirements for global equilibrium, constraints on population and capital growth were each tested separately. It was found that the collapse scenario also applied for these conditions. When simultaneous constraints on population and capital growth were tested, global equilibrium was achieved.

The *Limits to Growth* made the following four points:

1. National policies that existed prior to and in 1972 promoted exponential growth in population and material consumption.
2. There are limits to growth because the Earth is finite.
3. Exponential growth on a finite planet will inevitably stop either voluntarily or due to mounting global pressures.
4. The sooner we act to slow down exponential growth and stop growth in population and material consumption, the more possibilities will be available for future generations.

The minimum requirements for steady state were defined as being:

1. "The capital plant and the population are constant in size. The birth rate equals the death rate and the capital investment rate equals the depreciation rate.
2. All input and output rates - births, deaths, investment, and depreciation - are kept to a minimum.

The levels of capital and population and the ratio of the two are set in accordance with the values of the society. They may be deliberately revised and slowly adjusted as the advance of technology creates new options." (Meadows et al., 1972, pp 173-4)

The above minimum requirements for global equilibrium, or steady state, in a human ecosystem are equivalent to the conditions for climax in other ecosystems.

Critique of the Limits to Growth (1973)

In 1973, a year after *The Limits to Growth* was published, thirteen essayists associated with the Science Policy Research Unit of the University of Sussex published the book *Thinking about the Future: A Critique of The Limits to Growth*. This book represented a severe criticism levelled against the findings of *Limits to Growth*. The team was co-ordinated by Marie Jahoda, Professor of Social Psychology at the University of Sussex. The main criticisms of the Sussex team were as follows:

1. There is insufficient data available to construct a satisfactory world model.
2. The Limits to Growth team concentrated on physical limits to growth and omitted to take into account changes in values.
3. That there are strong simplistic technocratic tendencies inherent in Forrester's approach. (Cole et al., 1973)

The general nature of criticism was on points of methodology which the Limits to Growth team itself had pointed out. Some criticisms were on points of accuracy. The general conclusion of the Sussex team was that forecasts of the world's future are very sensitive to a few key assumptions and the Sussex team suggested that the assumptions made by the Limits to Growth team might be unduly pessimistic. The Sussex team concluded:

"The major weakness of the world dynamics models is that they illustrate the pessimistic consequences of exponential growth in a finite world without taking account of politics, social structure, and human needs and wants. The introduction of an extra variable – man - into thinking about the world and its future may entirely change the structure of the debate which these models have so far limited to physical properties." (Cole et al., 1973, p209)

The main finding of the Limits to Growth team - that unless population and capital growth are constrained, further growth would eventually lead to collapse - was and continues to be unsuccessfully challenged. As Kenneth Boulding stated in the United States Congress House in 1973, "Anyone who believes that exponential growth can go on forever in a finite world is either a madman or an economist."

1976 heralded in the publication of the second report to The Club of Rome - *Humankind at the Turning Point*. Mihajlo Mesarovic and Edward Pestel headed the research team which also used a world dynamics model with the following major structural characteristics:

"The world system is represented in terms of interdependent subsystems, termed regions. This is essential to account for the variety of political, economic, and cultural patterns prevailing within the world system.

The regional development systems are represented in terms of a complete set of descriptions of all essential processes which determine their evolutionary, i.e.; physical, ecological, technological, economic, social, etc.

Account is taken of the apparent capability possessed by the world development system to adapt and change." (Mesarovic & Pestel, 1976, p36)

The computer model used about 100,000 relationships as compared to a few hundred in other world models. The following conclusions were made:

"A world consciousness must be developed through which every individual realises his role as a member of the world community...

A new ethic in the use of material resources must be developed which will result in a style of life compatible with the oncoming age of scarcity. This will require a new technology of production based on minimal use of resources and longevity of products rather than production processes based on maximal throughput.

An attitude toward nature must be developed based on harmony rather than conquest.

If the human species is to survive, humankind must develop a sense of identification with future generations, and be ready to trade benefits to the next generations for the benefits to himself. If each generation aims at maximum good for itself, Homo Sapiens is as good as doomed." (Mesarovic & Pestel, 1976, p147)

Limits to Growth Revisited

There were three publications of *Limits to Growth* (1972) with updates 20 years later in 1992 and 30 years later in 2004. The *Limits to Growth* (1972) was interpreted by some critics as being a prediction of gloom. This is incorrect. *Limits to Growth* (1972) was not about a preordained future, but instead was about choice. *Limits to Growth* (1972) raised questions such as:

1. What will happen if growth in the world's population continues unchecked?
2. What will be the environmental consequences if economic growth continues at its current pace?
3. What can be done to ensure a human economy that provides sufficiently for all and that also fits within the physical limits of the Earth?

Limits to Growth (1972) certainly contained a warning, but also a message of promise and hope.

In 1991 the Club of Rome team had a relook at prevailing environmental data and realised that despite the world's improved technologies, humanity had already overshoot the limits of Earth's support capacity. Research independent of that of the Club of Rome and quoted in the Club of Rome's 1992 edition indicated

that resource and pollution flows had grown beyond their sustainable limits. Pollutants affecting the ozone layer was a prime example. There was also growing evidence that the rain forests were being cut at unsustainable rates, speculation that grain production could no longer keep up with population growth, and research had gathered evidence of a trend that the global climate was warming. The conclusions of the *Limits to Growth (1972)* report were accordingly strengthened in the 1992 edition *Beyond the Limits: Global Collapse or a Sustainable Future*, as follows:

“1. Human use of many essential resources and generation of many kinds of pollutants have already surpassed rates that are physically sustainable. Without significant reductions in material and energy flows, there will be in the coming decades an uncontrolled decline in per capita food output, energy use, and industrial production.

2. This decline is not inevitable. To avoid it two changes are necessary. The first is a comprehensive revision of policies and practices that perpetuate growth in material consumption and in population. The second is a rapid, drastic increase in the efficiency with which materials and energy are used.

3. A sustainable society is still technically and economically possible. It could be much more desirable than a society that tries to solve its problems by constant expansion. The transition to a sustainable society requires a careful balance between long-term and short-term goals and an emphasis on sufficiency, equity, and quality of life rather than on quantity of output. It requires more than productivity and more than technology; it also requires maturity, compassion, and wisdom.” (Meadows et al., 1992, pp. xv-xvi)

In anticipation of further misinformed claims of predictions of gloom, *Beyond the Limits (1992)* added the following clarification to the above conclusions:

“These conclusions constitute a conditional warning, not a dire prediction. They offer a living choice, not a death sentence. The choice is not necessarily a gloomy one. It does not mean that the poor must be frozen in their poverty or that the rich must become poor. It could actually mean achieving at last the goals that humanity has been pursuing in continuous attempts to maintain physical growth.” (Meadows et al., 1992, p. xvi)

In 2004 The Club of Rome published the 3rd edition of *Limits to Growth (1972)* with the title of *Limits to Growth: The 30-Year Update* referred to hereon as *Limits to Growth (2004)*. The 3rd edition was published in order to “restate our 1972 argument in a way that is more understandable and better supported by all the data and examples that have emerged during the past decades”.

Environmental data subsequent to 1992 further supported the *Beyond Limits (1992)* message that humanity had already approached overshoot mode. For example, Mathis Wackernagel et al. (1997) had measured the ecological impact of 52 large countries inhabited by 80% of the world population and compared it to Earth’s carrying capacity. The carrying capacity was expressed in terms of the land area that would be required to

sustain humanity at its current level of population and material consumption while both absorbing carbon dioxide (CO₂) emissions from the combustion of fossil fuels and preserving ecological systems and the eco-services that nature is able to regenerate. Wackernagel et al. concluded that in 1992 the impact of population and material consumption, or humanity's ecological footprint, exceeded the Earth's carrying capacity by 20%. By 1997, the ecological footprint exceeded the Earth's carrying capacity by 33%. *Limits to Growth (2004)* concluded:

“Consequently, we are much more pessimistic about the global future than we were in 1972. Humanity has largely squandered the past 30 years in futile debates and well-intentioned, but half-hearted, responses to the global ecological challenge.”

Notwithstanding that humanity is in overshoot mode, *Limits to Growth (2004)* stressed that “resulting damage and suffering can be greatly reduced through wise policy”, and once again clarified that:

“We do not write this book in order to publish a forecast about what will actually happen in the twenty-first century. We are not predicting that a particular future will take place. We are simply presenting a range of alternative scenarios: literally, 10 different pictures of how the twenty-first century may evolve. We do this to encourage your learning, reflection, and personal choice”.

The three editions of *The Limits to Growth* reflect a changing understanding of climate change. The 1972 publication showed the CO₂ curve going up, but the CO₂ curve was included primarily to illustrate an example of persistent pollution. It was known in 1972 that CO₂ emissions from the combustion of fossil fuels is a persistent pollutant which stays in the atmosphere for a long time and that a build-up of CO₂ affects the local climate. In 1972 there was limited understanding and concern about climate change. Over the intervening years climate change has now become a major over-riding global environmental pressure. Notwithstanding the current global focus on climate change, climate change is but one of several symptoms caused by population growth and growth in material consumption.

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