



## Limits to Growth Model Worth Another Look

Posted by [David Murphy](#) on April 25, 2009 - 9:55am

Topic: [Miscellaneous](#)

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*This post relates to an article written by my advisor Charles Hall and a close friend of his. The article is [available from American Scientist](#) (paywall) or [from Professor Hall's web site](#).*

There are only finite resources in the world, but population continues to grow. How will this situation resolve itself? This was a question a group of scientists (Meadows et al), commissioned by the "Club of Rome," attempted to answer back in 1972, in a book called *Limits to Growth*. The model they presented predicted growing resource scarcity, increasing pollution, and eventual population decline, all prior to 2100.

Charles A. S. Hall and John W. Day revisit these predictions in an article published this month in *American Scientist* called [Revisiting the Limits to Growth After Peak Oil](#). Their analysis indicates that the predictions from 1972 were surprisingly accurate, considering how long ago they were made:

parameter	predicted	actual
population	6.9 billion	6.7 billion
birth rate per 1,000 people	35	45
death rate per 1,000 people	11	8.5
<b>values vs. 1970 levels</b>		
resources	0.53	
copper		0.5
oil		0.5
soil		0.7
fish		0.3
pollution	3.0	
CO <sub>2</sub>		2.1
nitrogen		2
per capita industrial output	1.8	1.9

According to Hall and Day, "The values predicted by the limits-to-growth model and actual data for 2008 are very close."

Hall and Day immediately acknowledge that the academic world has paid most attention to human impacts on biodiversity and climate change and not enough on general resource issues. They believe that there are numerous resource issues related to peak oil that are “coming home to roost” and that all of these issues were laid out quite accurately in 1972 in the Limits to Growth model. They write:

As many continue to dismiss what those researchers in the 1970s wrote, there is growing evidence that the original “Cassandras” were right on the mark in their general assessment, if not always in the details or exact timing, about the dangers of the continued growth of human population and their increasing levels of consumption in a world increasingly approaching very real material constraints. It is time to reconsider their arguments in light of new information, especially about peak oil.

According to the authors, there has been widespread belief that the original 1972 forecast was incorrect:

Economists particularly disliked the perspective of the absolute scarcity of resources, and they wrote a series of scathing reports directed at the scientists mentioned above, especially those most closely associated with the limits to growth. Nuclear fusion was cited as a contender for the next source of abundant, cheap energy. They also found no evidence for scarcity, saying that output had been rising between 1.5 and 3 percent per year. Most importantly, they said that economies had built-in, market-related mechanisms (the invisible hand of Adam Smith) to deal with scarcities.

An important empirical study by economists Harold J. Barnett and Chandler Morse in 1963 seemed to show that, when corrected for inflation, the prices of all basic resources (except for forest products) had not increased over nine decades. Thus, although there was little argument that the higher-quality resources were being depleted, it seemed that technical innovations and resource substitutions, driven by market incentives, had and would continue indefinitely to solve the longer-term issues. It was as if the market could increase the quantity of physical resources in the Earth.

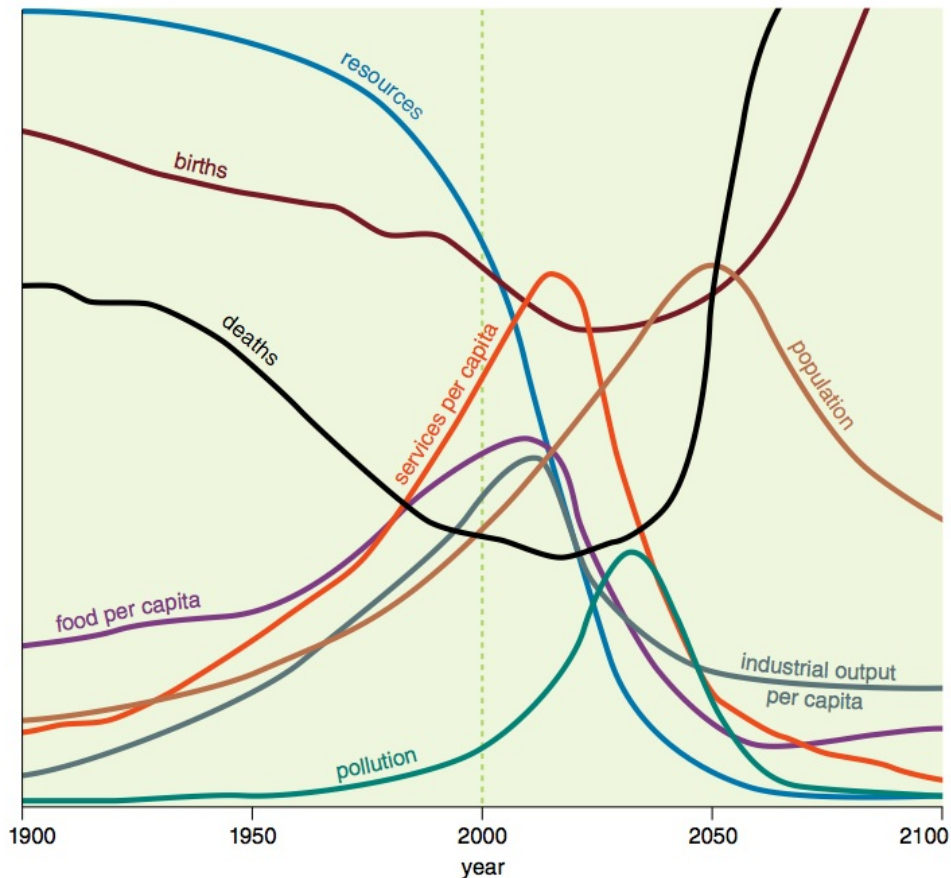
But analyses since then have proven these arguments false. According to the authors,

For example, Cutler J. Cleveland, an environmental scientist at Boston University, reanalyzed the Barnett and Morse study in 1991 and found that the only reason that the prices of commodities had not been increasing—even while their highest quality stocks were being depleted—was that for the time period analyzed in the original study, the real price of energy had been declining because of the exponentially increasing use of oil, gas and coal, whose real prices were simultaneously declining. Hence, even as more and more energy was needed to win each unit of resources, the price of the resources did not increase because the price of energy was declining.

Of course, the time period since the study has been very different, with less growth in resources

and higher prices, showing that Barnett and Morse's conclusions did not hold for the long term.

Another reason that some believed *Limits to Growth* was wrong was confusion over what one summary graph showed. The graph shows dates only at the two end points--1900 and 2100--so was somewhat confusing to read. A graph of the forecast, with more intermediate dates, is shown below:



According to Hall and Day, this forecast is "largely accurate" to date. "We are not aware of any model made by economists that is as accurate over such a long time span." We cannot know at this time how accurate future projections will prove to be.

Another reason people have been reluctant to believe forecasts predicting shortages is because the forecast of Thomas Malthus back in 1798 proved wrong. Malthus predicted that population would grow more rapidly than food supply, resulting in starvation. A major reason he was wrong was because of the growth in the use in fossil fuels, and the resulting increase in food production.

Looking to the future, the authors see peak oil to be a key issue:

... a key issue for the future is the degree to which fossil and other fuels will continue to be abundant and cheap. Together oil and natural gas supply nearly two-thirds of the energy used in the world, and coal another 20 percent. We do not live in an information age, or a post-industrial age, or (yet) a solar age, but a petroleum age. Unfortunately, that will soon end: It appears that oil and gas production has reached, or soon will reach, a maximum...

Most environmental science textbooks focus far more on the adverse impacts of fossil

fuels than on the implications of our overwhelming economic and even nutritional dependence on them. The failure today to bring the potential reality and implications of peak oil, indeed of peak everything, into scientific discourse and teaching is a grave threat to industrial society.

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