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The future is now: The Meadows report accuracy, from 1972 to present day (2008)

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Abstract

The Meadows et al report strong conclusion is that perpetual material growth will lead before 2100 to a "collapse" of the world that we live in. By "collapse", one should not understand the end of humanity, but a sharp decrease of the population, along with a significant degradation of the living conditions for the surviving fraction.
Evolution of the main variables is studied between 1900 and 2100 with natural resources equal to the known resources in 1970. Also, an evolution of the main variables is evaluated under a huge natural resources assumption. In this case, it is not the exhaustion of natural resources that lead to a collapse, but the "explosion" of pollution. In the model, it then leads to a decrease of the agricultural output, which regulates the population. Let's note that the common word used for a regulation of the population caused by a decrease of the agricultural output is ... starvation or a major war.
This paper shows that when we compare the predicted population curve with the actual one, they fit remarkably well. Does that mean that we are facing a real collapse in human population? This question remains unanswered.

Keywords: systems, globalization, population, pollution, limits.

The 1972 Meadows report

In 1972, following a request by the Club of Rome, a team of research workers from the Massachusetts Institute of Technology, headed by Dennis Meadows, published a report analyzing the limits of economic growth [1]. This, now famous, report is known as the 1972 Meadows report.

What the report says

Its sole strong conclusion is that perpetual material growth cannot go on forever. A catastrophic Malthusian limit, a collapse, is bound to be reached before 2100 [2]. By "collapse", one should understand the end of the world has we know it, not the end of humanity. This means: a sharp decrease of the population, along with a significant degradation of the living conditions (decrease of the industrial output per capita, of the food per capita, health care, pension levels, etc) for the surviving fraction.

To reach this conclusion of an impending collapse for the future generations to deal with, which indeed is not a mild one, they have done what is now current practice in many disciplines: they have built a standard computer based numerical model. At the time, that was a bold step. Today, computer based numerical models are used in every scientific endeavour. Models are simplified representations of the reality. They enable the researcher to focus on the main variables, and to ignore unwanted detail. That's the main reason they are so useful. Most of the times, a good model is a simple one.

This computer model was truly global. It focused on population (the most valuable variable), pollution, industrial production, food production and resources. The raw conclusions are presented in the next figure, based on the original one, where the horizontal axis is time, from the year 1900 to 2100:

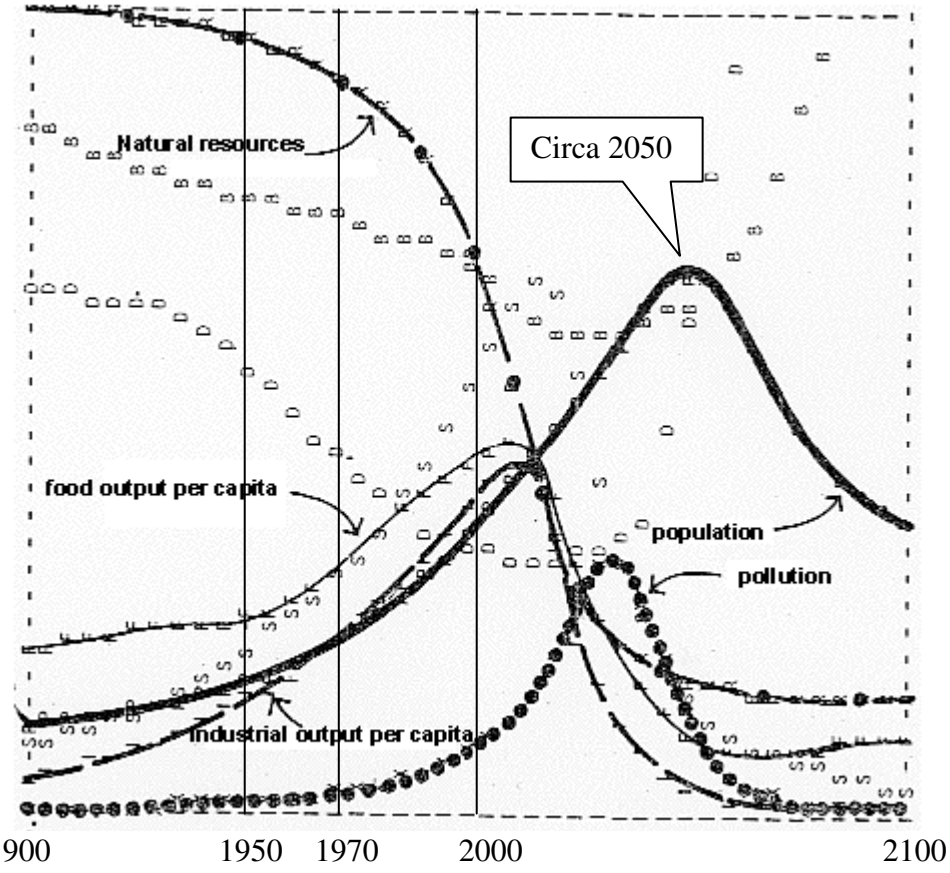

Figure 1: The general model. The fast rising population peak is followed by an equally strong decline.

As depicted, this general model predicts that growing problems (decline in food per capita) start to show up pretty soon after the beginning of the 21st century.

How reliable are these predictions?

The model used is a simple one. For instance pollution is represented by a single variable, when there is one pollution by pollutant. Also, there is no regional discrimination of demography or of resources that are not evenly allocated such as arable land. All non renewable natural resources are treated as a single one.

But this model made use of a powerful systems concept: feedback. As simple as this global model may be, it is considerably more refined than the forecasting tools used for public policies, which most of times do not include even one explicit feedback of any kind [3].

What if …?

One does not need a computer model to realize that there are physical limits to growth on a finite planet. Population and industrial growth are inherently exponential. The fact is: exponential growth reaches existing limits rather quickly, whatever their magnitude may be. Also, global economics will most likely adjust to limits by overshoot and collapse, not by well behaved S shaped growth.

Proposed alternative scenarios were also considered, as the one in the next picture, were huge natural resources and very good pollution control are assumed.

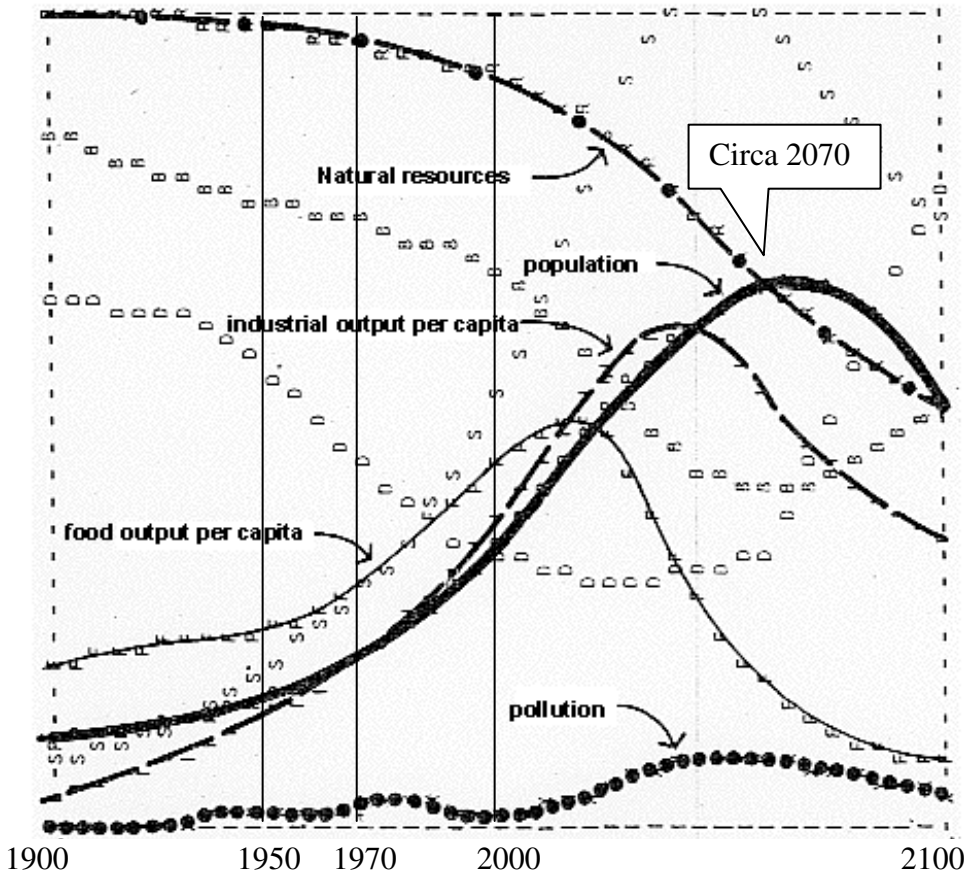

Figure 2: Assuming huge resources and almost perfect pollution control, the population peak is by the year 2070, followed by a steady decline.

Or this one, with huge natural resources and mild pollution control:

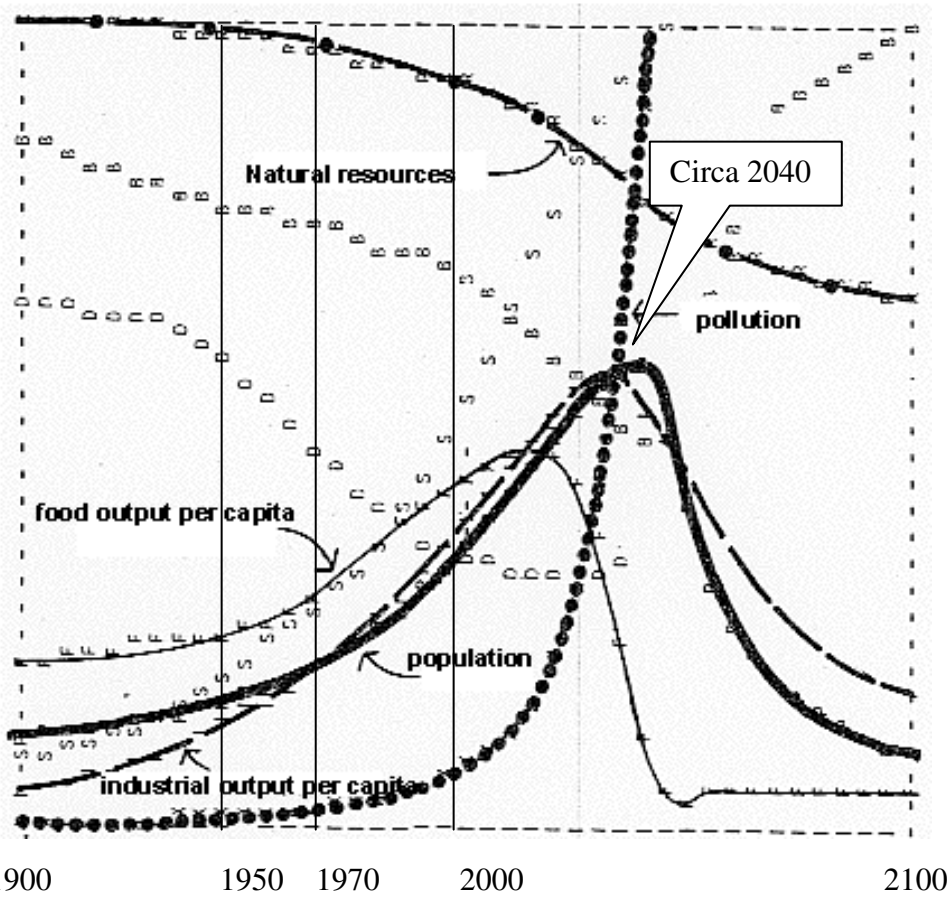

Figure 3: Assuming huge resources and imperfect pollution control, the population peak is by the year 2040, followed by a sharp decline.

In either case, the final outcome is a large decline of the world population. As a matter of fact, only the peak values and the timing details show some variation. The general shape and outcome is the same.

Conclusions

Thirty-five years of data show that the original study results were mainly correct [4]. Politics and the market forces are inherently unsuited to adopt well behaved policies, if only we knew which. Oil depletion, global warming and the present financial crisis come to mind. The main policies have not changed, and the overshoot is almost certainly already occurring.

Acknowledgements

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