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Food Scarcity. Unavoidable by 2100? Impact of Demography & Climate Change

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Scientific studies that examine the food supply and its correlation to human population have a long tradition extending back to Thomas Malthus and his *Essay on the Principle of Population* of 1798. From then on, the field has remained politically charged. Still today, Malthus is often dismissed as a doomsday prophet whose apocalyptic predictions turned out to be wrong. But Malthus lacked the modern concept of “overshoot and collapse” and he never predicted the kind of population crashes that we associate with modern famines (Kolb, 1972; Bardi, 2016). Another study often accused of having been overly alarmist in terms of the future of the human population is the Club of Rome’s *The Limits to Growth*, first published in 1972. This is also a misinterpretation, since none of the several scenarios reported in 1972 foresaw a population decline before entering the second half of the 21st century (Bardi, 2011).

Of course, there are also counter-examples showing that it is perfectly possible to make wrong predictions about the future of the food supply. For instance, in 1968 Paul Ehrlich (1968) wrote that widespread famines would afflict humankind in the 1970s and 1980s. On the contrary, the 1980s saw the start of a historical phase in which no major famines were recorded for at least three decades (Penuel and Statler, 2011), yet despite this hunger still persists in the world.

These considerations are meant to show how difficult the subject of food supply is and how easy it is to let politically charged considerations bend the results of a study to fit preconceived views of the world. So, it takes a certain courage to

venture in this field, but nevertheless it is an important subject which needs to be faced. The authors of *Food Scarcity*, Raul Weller and Kris Demuyneck, have done exactly that with their book dedicated to the central subject pursued by the Club of Rome: the future of humankind. Weller is a member of the Club while the study is sponsored by the Club's EU chapter. Analogous to the first report to the Club of Rome, *The Limits to Growth*, of 1972, the book by Weiler and Demuyneck approaches an old problem with a new methodology. While *The Limits to Growth* was one of the first studies to apply system dynamics to the study of the economy, *Food Scarcity* is among the first study to apply modern network theory to the world's food system – a subject also approached earlier by Zimmerman et al. (2016), but not on such a wide scale.

The resulting book, *Food Scarcity*, is an ambitious attempt to pack an enormous amount of material into just 150 pages. It starts with a review of the situation of the world's food supply with extensive data on the different climate systems, cultivation technologies, geographical conditions, and more. It then proceeds to an analysis based on modern network theory, where the authors describe the correlations between the various ecosystemic, geographic, and climatic elements of the system. The subsequent section considers various perspectives on current techniques of food production. Finally, the book provides a set of recommendations for the future.

The depth and the breadth of the analysis attempted by the authors is impressive but, at the same time, the book gives the impression of not having been completely successful in tackling the title subject of *Food Scarcity*. The book targets many important elements of the world's *food production* system, including climate change, soil erosion, technological effects and others, but it does not include some which are fundamental to the subject of *food supply*, which is not the same thing as *food production*. In particular, there is no mention of the importance of the financial system in the issue of feeding the world's population. In ignoring financial factors, *Food Scarcity* follows the approach that was previously taken by the authors of *The Limits to Growth* – which may be considered a necessity given the many unknowns generating the wide fluctuations of the financial markets. Yet, in dealing with food supply at the global level we cannot ignore how the fact that large famines disappeared for the past 40 years rests only in part on the increased yield of agriculture. Another major factor, perhaps the most important one, has been the capability of the world's commercial system to deliver food everywhere.

However, food is delivered because people are able to buy it, otherwise it would rot where it is produced. A global financial crisis, such as the one that took place in 2008, could cause major famines if it were to last more than a few years. So, it is disappointing to read the nine “Recommendations” of the book, all based on suggestions of how to increase food production, or at least avoid its decline (e.g., avoid producing biofuels). These are all good suggestions, albeit perhaps temporary ones, but none of them mention factors related to delivering food where it is needed. One problem here is that we are still at an early stage in understanding what makes complex networks resistant to external perturbations, and we are unable to predict how and when a complex system will crash, even though crashing is a typical property of these systems (Bardi, 2017).

This book can be seen as an important first step in using network theory for understanding a major sector of the world’s economy, that of food production and supply. But it is only a first step, and much more work will be needed to be able to manage the world’s food supply system in a way that will make humankind truly safe from famines.

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