RURAL RESOURCES AND FEEDING FOLK FULLY: PROBLEMS, POSSIBILITIES, AND PROSPECTS

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Summary

Making detailed projections of the aggregate food needs for humanity is a task that involves the deployment of considerable information, much of which is even more speculative and uncertain than the analogous information on population levels to which they are applied.

Population growth fuels an expanding need for food for humanity, while there are many active constraints to expanding the resources that serve the food production systems of the world. Meeting the uncertain needs will certainly require a growing role of trade and food aid, particularly in filling the plates of Africans, and, increasingly people in parts of Asia.. As the stubborn problems of agricultural and economic development of that continent persist, some needs will be met by converting more land to cropping, some by better use of the scarce land and water resources, but most must come from new knowledge embodied in more productive technologies and more sustainable farming practices, both of which will derive mainly from rural research, providing that appropriate investment is forthcoming. The prognosis is for increasing resource scarcities and environmental challenges, particularly in heavily populated regions, expanded trade to meet local deficits, and more extensively exploited national comparative advantage. The trade policies of many nations will critically determine the

outcomes.

1. Introduction

Individual perspectives on the topic of the world food situation vary greatly, reflecting not only its inherent complexity and uncertainty but also the diversity of observers' individual perceptions. This observer comes to the topic from a long period of experience in the World Bank's Rural Development Department, and a rather lengthier period of active involvement with the International Agricultural Research Centers (IARCs) of the Consultative Group on International Agricultural Research (CGIAR). Where he sits on the optimistic-pessimistic spectrum will become clear, but he will strive to be realistic, while pointing to some critical conditions necessary for underpinning and rationalizing whatever optimism is in his "realism."

The field is surprisingly controversial, and another approach—one adopted by Alex McCalla in his 1994 Crawford Lecture—would be to review critically some or all of the diverse positions that have been taken. Because McCalla has done this so ably, rather than repeat the exercise, the present simplified interpretation is comforted by the knowledge that this "conditionally conventional" view happens to match his view fairly closely, which is: "Of course, no one knows who will be right. Projections thirty years ahead, particularly those by economists, are invariably wrong. This is partly because of questionable assumptions, limited models, and poor information, but also because a dynamic world economy is self-adjusting since it does not tolerate disequilibrium easily."

2. Some Defining Dimensions of Reality

2.1. Time

A natural first dimension is time. The temporal horizon adopted here is primarily the first three decades of the twenty-first century or so, close enough in time to permit putting aside for the present purpose the many thus far unresolvable uncertainties about the food and agricultural implications of the Enhanced Greenhouse Effect and of policies that bear on its evolution.

2.2. Population

Country group	1995	2025
Developing countries	4.5	7.1
Developed countries	1.2	1.4
Total	5.8	8.5

Table 1. Human population assumptions (in billions, UN data)

The thirty years mentioned, a short period, does offer challenge enough for contemplation, providing as it does for some impressive, if not disturbing, increases in global population, mostly in the developing countries (DCs), as depicted by the projections summarized in Table 1. Various revisions have subsequently been made to these, and the new (lower) projections have not been reflected in what follows. There is considerable uncertainty about what will happen, made more so by the uncertain impact of pandemics such as HIV/AIDS (see *World Demography and Food Supply* and *Projections of Global Carrying Capacity*).

2.3. Food Needs

Making detailed projections of the aggregate food needs for humanity is a task that involves the deployment of considerable information, much of which is even more speculative and uncertain than the analogous information on population levels to which they are applied. For an overview, however, the situation can be appreciated through constructing simplified scenarios focused on the major sources of food energy, namely the cereals (which directly and indirectly account for about two-thirds of food energy intake by humanity), and relating consumption patterns for "average" consumers to plausible changes in average income levels across country groups. Such a process should, if done in a consistent and comprehensive way, involve also the modeling of the formation of market prices of all goods, including food products generally and major sources of food energy specifically, and the corresponding choices by consumers as prices and incomes vary over time. Such comprehensive studies are costly and are subject to inevitable controversy and uncertainty and thus, not surprisingly, are rare. To focus on the global picture, resort is made to one such simplified scenario assembly (Table 2) in which the author was involved.

Country Group/crop	**Approximate 1990**	**Projected 2030**	**Implied average annual growth rate**	**The 1980s historic rate**
	Mt	**Mt**	**per cent**	**per cent**
Developing				
Rice	310	640	1.8	2.6
Wheat	270	770	2.6	3.7
Coarse Grains	300	950	2.9	1.7
Developing total	880	2360	2.5	2.6
Developed total	800	940	0.4	–
World total	1680	3300	1.7	–

Table 2. Food on the plate: 1990 and 2030 (apparent aggregate cereal consumption, rounded)

The 3300 million tons (t) (about 2.5 km^3) of projected total cereal needs in 2030 is nearly double the size of the cereal mountain "consumed" in any year at the end of the twentieth century. The data remind us that apparent consumption involves much seeming waste and much indirect use of cereals (especially coarse grains) for livestock feed and for conversion to biofuels.

Developing countries alone used some 160 million t of cereals for livestock feeding in 1990, and this is projected to increase at about 3.7% per annum, which would constitute a tripling in thirty years. This reflects the consumers' desire to spend more of their growing incomes on livestock products, which translates into increasing proportions of cereals being used to feed poultry, pigs, to some extent dairy animals, and in the developing world, few ruminants used for meat purposes— all notwithstanding continuing concerns in many quarters about the health implications of increasing consumption of livestock products (see *Cultural and Regional Aspects of Human Nutrition*).

Meeting the uncertain needs will certainly require a growing role of trade and food aid, particularly in filling the African plates as the stubborn problems of agricultural and economic development of that continent persist (see *Food Control and International Food Trade*). Among the uncertainties to be resolved are the future of the former Soviet Union as a grain exporter, the market and farmer responses to volatility the wheat market, and the likely future impact on the rice market, along with other issues raised later in this article.

3. Resources: Degradation versus Sustenance

Many of the resources that support agriculture are limited in supply in various ways, such as having a sharply increasing cost per unit beyond some critical level (see *Food and Agriculture and the Use of Natural Resources*). The critical level may be: essentially infinite, as is the case for most atmospheric gasses; probably rather finite, as for, say, petroleum-based energy; slowly approached, as is the case for financial and capital resources; fairly clearly delineated, as is the case for agricultural land; potentially quite confining, such as for water. The list of resources is long and the constraints that may be associated with them diverse, especially in their local specificities. Generalizations thus run the danger of falsity, especially when applied to particular agricultural niches, but they must be made to examine the likely form of the global picture.

The following sections focus on land, water, and knowledge resources, all of which are "human" resources, in the sense that they serve most productively when the property rights in them are clear, secure, and hopefully fair. Depending in part on the nature of such property rights of individual farm managers, the discussion must also recognize the reality that a given resource can vary greatly in quality, over space and over time (often for the worse), in which case the situation may be described generically as resource degradation—encompassing such varied phenomena as desertification, erosion, salinization, exhaustion, compaction, toxification, and so on (see *Salination, Desertification, and Soil Erosion*).

Degradation is thus a phenomenon that has many manifestations, most of which are resource-specific. Land degradation is one of the most widely recognized, especially in its most dramatic form of gully soil erosion, rather less in more subtle forms such as dryland salinity buildup. But every resource is potentially susceptible to degradation and erosion. The knowledge resource itself, for which more detailed suggestions are offered later, can also be degraded, as its structures of support decline. For example:

- an absence of fresh "injections" of human capital from cutting-edge postgraduate programs;
- libraries and their users losing contact with contemporary thinking through nonrenewal of journal subscriptions;
- an absence of current reference texts and ready international professional contacts;
- inadequate incentives to add productively to the knowledge store;
- the deliberate distortion of evidence, constituting scientific fraud (under extreme conditions)

Whether it be land, water, or atmosphere, human capital, the knowledge resource, or other perhaps even more fragile resources, the reality of degradation must be considered and allowed for in assessments of future resource situations. The possibilities are not always "well-balanced" in terms of symmetry, but the obverse of degradation, enhancement of a resource, is in principle possible. Enhancement sometimes may be costly but if the rewards are adequate (which may require increased security of tenure in some resources such as land and forests, and even life itself), happen it will, with the consequent positive outcomes for boosted private returns and productivity.

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Biographical Sketch

Jock R. Anderson, Ph.D., left the home farm at Monto, Queensland, Australia, in a quest for knowledge in agricultural science, at the University of Queensland, and pursued this quest with a twist toward economics. He did graduate work in agricultural economics at the University of New England, Armidale, where he stayed on as a staff member until 1989, with occasional off-campus engagements such as directing the 1984–1985 Impact Study of the CGIAR. He was appointed Professor of Agricultural Economics, University of New England, before joining the World Bank in what was the Agriculture and Natural Resources Department of the Environmentally Sustainable Development Vice Presidency, where he served as Adviser, Agricultural Technology Policy until his retirement.. He spent two years in the Operations Evaluation Department, where he evaluated Bank lending and nonlending operations in agriculture (including agricultural research), health, and education. He then returned to what is now the Bank's Rural Development Department. He is a Fellow of the Australian Institute of Agricultural Science, and of the American Agricultural Economics Association, Fellow of the Academy of Social Sciences in Australia, and Distinguished Fellow of the Australian Agricultural and Resource Economics Society.