

Until recently, the main issues in bioethics have arisen in the context of the provision of health care services or the administration of public health programs. But one of the most important aspects of health and human well-being is nutrition and the primary social determinant of nutrition is secure access to safe and nutritious food.

A question that's now gaining global attention is how to feed the world in 2050. What's at stake is not merely answers to technical questions, for example, how to increase yield ratios in order to produce greater quantities of food crops per acre of cultivated land. Intrinsic to all the technical and public policy choices we face are ethical concerns. Of particular importance are questions of justice, how to ensure the fair distribution of benefits and burdens in the design of social and economic arrangements we rely upon to feed the world.

Before we turn our attention to these arrangements and the issues of justice they pose, we need to survey some challenges. It's estimated that the world will need 70 to 100% more food production by 2050. One reason is the demographic transition that lies ahead. The world is expected to increase from 7 billion to 9 billion by 2050. Another reason is the nutritional transition. As some of the residents of the developing world get richer, they increase the variety in their diets and, most significantly, obtain a larger share of their protein requirements from sources other than plants.

As the ranks of the more affluent consumers grow, prices for basic staple grains rise, and as we have seen since 2008, sometimes quite dramatically. One reason for price spikes is the competition between the use of grain for direct human consumption and its use in the production of land-based animals. It takes far more grain to produce a calorie from beef, for example, than it does to produce a calorie from bread or rice.

Matters are complicated further by supply-side considerations, in particular, dwindling resources essential to food production. Three considerations are especially significant in shaping the emergence of global markets. First, the world is running out of land suitable for intensive agricultural cultivation. Roughly 70% of the suitable land is already used for some human activity, including agriculture. Between 30% and 40% of the land under cultivation has become too degraded to support agriculture over the long term. The rate of topsoil depletion vastly exceeds the rate of replenishment in all regions

of the world.

Second, much of the world is running out of accessible fresh water. Although the last 40 years has seen great increases in access to clean water and sanitation, groundwater mining and other water management practices have led to the depletion of aquifers around the world. Current water management practices and land use patterns together with climate-related loss of glacier ice that feeds the world's largest rivers are putting these gains in jeopardy. By 2025, 1.8 billion people are projected to experience absolute water scarcity, and 2/3 of the world will be living under severely water-stressed conditions.

Third, the primary alternative to land for production of food is in similar jeopardy. The major stocks of fish and other aquatic life in the world's oceans are projected to decline by 70 to 90% by mid-century. Trends in the globalization of agriculture, then, are not driven merely by the pursuit of new markets and trade opportunities. They are driven by the perception of new, perhaps unparalleled threats of global scarcity.

Two issues of justice will become more pressing by 2050. First, how to ensure that the intensified global struggle for scarce resources does not lead to greater food insecurity and hunger among the world's most disadvantaged populations. And second, how to ensure that the global food production and distribution system does not create an entrenched, systematic disadvantage more generally. Issues of systematic disadvantage, beyond the obvious concern for secure access to food, include possible negative impacts on economic development and the prospects for poverty relief within poor countries, environmentally sustainable human habitats, particularly ones that are at the greatest risk from land use policies that pollute the air, soil, and the water, and the ability of individuals, communities, and nations to determine their own futures, not only in respect to food security, but their own path to sustainable development.

In the next segments, we examine several emerging forms of market organization at work in the globalization in production and distribution of food. Our ultimate concern is the potential of each of these emerging forms of market organization, alone and in combination, to impose significant avoidable disadvantage on some of the world's poorest and most vulnerable people.