# SOCIAL AND POLICY ISSUES OF AGRICULTURE AND FOOD

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## Contents





## Summary

This chapter highlights five issues critical to agriculture and food in the 21st century. World food and agriculture is emphasized, but United States agriculture is emphasized in some instances because of readily available studies. The first issue recognizes the place of agriculture in four stages of conjoint transitions: economic, technological, environmental, and demographic. Of seminal significance is the little-charted mature stage IV in those transitions and characterized by declining population and problems of obesity. The second issue, global food supply-demand balance in the 21st century, notes that expansion of food supply sufficient to hold down real food prices will be a major challenge in coming decades despite declining global population as noted for stage IV in the conjoint transitions.

The third food issue is market structure. The agribusiness sectors defined as farm input supply and product marketing firms ("middlemen") historically have been criticized by

populists for exercising market power, that is, for charging prices in excess of marginal costs. Given the food price pressures from food demand pressing lethargic food supply in early stage IV and given the declining role of the public sector in agricultural science, agribusiness will need to vigorously pursue research and development to improve food sector productivity. It will need to use market power, charging prices in excess of marginal costs to cover huge technology development expenses. Economic education will be important if farmers and consumers are to accept such behavior.

The fourth issue, the major food and agriculture problem confronting stage IV societies, is chronic overeating. Obesity causes morbidity and mortality, but is an especially public concern because many of the costs are externalities borne by others. Finding the appropriate mix of public policies including food taxes and subsidies will remain contentious social and policy issues.

The fifth issue, the major food and agriculture problem confronting developing countries, is some 800 million food insecure people. The paradox is that a proven standard economic food policy model is available to ensure sufficient domestic income for any country to end poverty and food insecurity. Why do poor countries reject a workable economic prescription for economic success? The answers lie in institutions (including politics) and culture. At issue is the ethics and feasibility of intervening in cultural values such as tribalism that cause violence and hunger.



## 1. Introduction

The economic, physical, political, social, and technological environments for agriculture and food are in flux. As a consequence, policies for 21st century agriculture will be quite different than those for the 20th century. The objective of this study is to identify and briefly analyze five critical issues that will influence public policy in the United States and the world. Agriculture will lose much of its exceptionalism, becoming less exploited in poor countries and less subsidized in rich countries. Agricultural firms will be viewed as pretty much like firms in other industries. This is not to say that agriculture will not face severe challenges. The struggle to advance food supply as fast as demand and avoid rising real food prices will be challenging indeed. More burden will be placed on the private sector for research and development, and society will need to grow more comfortable with firms exercising market power to hold prices above competitive market levels as a means to recoup very high technology development costs. These and other social and political issues facing agriculture are best analyzed in the context of a four-stage economic and demographic transition model as explained in the following section.

## 2. Stages Underlying Contemporary Social and Policy Issues of Agriculture

Contemporary issues of agriculture are best understood in the context of four stages of transition depicted in Table 1 (*Shiptsova (1998) empirically modeled the components of the economic, trade, and demographic transitions. The components were statistically related and jointly determined, with income per capita a strong driver of the transition from one stage to another*). Demographically, the first or traditional phase of the transition is characterized by high birth and death rates and very slow and erratic

population growth. Although this chapter focuses especially on stage IV, the mature state, most of the some 100,000 years of human existence was spent in stage I, the traditional state. Due to low population and primitive tools, humans exerted few demands on global natural resources and the environment in stage I. Nearly all able bodied adults and many children were engaged in hunting and gathering food. Life for most people was Hobbesian—short if not also nasty and brutish.

| | Stage I Traditional | State II Developing | Stage III Developed | Stage IV Mature |
|---|---|---|---|---|
| Demography | • Birth and death rates high<br>• Population density and growth low | • Birthrate remains high<br>• Death rate slows<br>• Population increases at increasing rate<br>• Increasing urbanization | • Birth and death rates fall<br>• Population increases at decreasing rate | • Birth and death rates low<br>• Death rate exceeds birth rate<br>• Population declines |
| Economy | • Low economic growth<br>• Low income and living standards | • Per capita and total income grow at increasing rate<br>• Living standards rise<br>• Exploitation of agriculture | • Per capita and total income grow at decreasing rate<br>• Emergence of service economy<br>• Subsidization and protection of agriculture as its share of economy falls | • Per capita and total income rise slow<br>• Health industry dominates<br>• Agriculture loses economic exceptionalism<br>• Post industrial |
| Environment | • Natural resources abundant<br>• Degradation minimal | • Exploitation and degradation rise | • Raw materials exploited<br>• Conservation policies reduce exploitation | • Productivity gains offset exploitation<br>• Environmental protection predominates |
| Technology and agriculture | • Primitive<br>• Hunting and fishing turns to agriculture<br>• Plant/animal domestication | • Growing industrialization<br>• Accelerating agricultural productivity | • Science and technology, not farm production resources, main source of more food<br>• Rising role of women due to technology | • Technology directed at health, biotech, infotech.<br>• Private sector dominates agricultural research<br>• Problems of food abundance overshadow those of scarcity |

**Source:** Adapted from Tweeten and Zulauf 2002, p.55.

Table 1. Stages in the Transition from Traditional to Mature Societies
**Source:** Adapted from Tweeten and Zulauf 2002, p.55.



### 2.1. Stages II and III: The Rise and Decline of Agriculture

The seeds for transition from stage I to stage II, developing society, began with the emergence of agriculture that in turn coincided with the domestication of plants and animals about 11,000 years ago (Diamond 1997, p.86). Permanent settlement, irrigation, and improved yield of land in supplying food afforded by agriculture facilitated growth of nonfarm activities including government administration, schooling, and building of infrastructure such as roads and irrigation. Such developments enhanced agricultural productivity in stage II. Resulting growth in income and food supply enabled population

to grow but degraded the environment more than in stage I. Governments of societies still in stage II typically have in net taxed (extracted resources from) their food and fiber producers through agricultural export duties, an overvalued foreign exchange rate, or other means as noted by Nobel laureate T.W. Schultz (1964).

Birth rates fall faster than death rates to usher in Stage III, developed society characterized today by industrialized countries (Table 1). Population continues to grow but at a decreasing rate. The socioeconomic status of women advances as they receive more schooling, rights, and job opportunities. With ever-smaller proportions of people living on farms, most parents derive less and less economic value or "social security" from children. Emerging birth control technology allows adults to have no more children than they desire.

Investments in knowledge generate improvements in technology, enabling income to continue to rise but in general at a slowing rate in Stage III. Large investments in science and education are required to maintain productivity growth for several reasons. Many technological breakthroughs in Stage II came from innovative laypersons; breakthroughs in Stage III tend to require scarce, highly trained, experienced, and costly technicians and scientists not many countries can afford. Obsolescence of current technology requires investment in maintenance science. The most readily accessible innovations and raw materials have been exploited by the end of Stage III.

Productivity in service activities, which grow in importance, is harder to increase than in agriculture and manufacturing. Many countries make the decision to sacrifice some growth to provide greater economic equity as Stage III progresses. Rapid productivity gains continue for agriculture in Stage III as investments in education and science made in Stage II produce long-term payoffs. At the same time, slowing rates of income growth and population growth coupled with falling income elasticities of demand for food slow food demand growth. Food self-sufficiency increases in some countries after falling in Stage II. However, agricultural trade grows on average as more affluent consumers demand a variety of foods sourced around the world and as economies of size in food supply cause specialization and shipments of differentiated intra-industry products among countries. The farm and food industry continues to grow but accounts for a declining share of the total economy.



### 2.2. Stage IV: Mature Economies

The world's developed countries are now entering Stage IV as mature economies that are the principal focus of this treatise. Because the classic depiction of the demographic transition contains only stages I to III, stage IV is poorly charted. Stage IV represents the future. At some distant time most of the world's inhabitants likely will be in stage IV. Notable characteristics of stage IV include the prominent role and status of women, the loss of production agriculture's exceptionalism, a high level of care and keeping of the environment, and scattered problems of food scarcity overshadowed by ubiquitous problems of excessive calorie intake.

The agricultural exceptionalism--characterized by exploitation of farmers through net taxes in stage II and by favoring farmers with large subsidies and shelter from

competition in stage III—will fade in state IV (Table 1). One reason for loss of exceptionalism is that the general public will come to realize that their farmers are largely of two types—a few large, commercial, prosperous business operations producing most of the food, and large numbers of small farmers able to pursue their hobby by drawing on their substantial off-farm income and wealth. Mid-size farms too demanding of time for the operator to work much off the farm and too small to be efficient will all but vanish. Production agriculture will be viewed less as a public utility or welfare case and more as mainstream industry undeserving of privilege. Small farms will thrive as hobby farms owned and operated by affluent persons with off-farm income. Large farms will thrive as efficient sources of food and fiber. Mid-sized farms will slowly fade in numbers; few persons will note their passing.

Environmental Kuznets curves relating environmental protection to income indicate that countries in stage IV will take measures as necessary to reduce resource degradation and depletion per capita (Hervani and Tweeten 2002). Nonpoint source pollution in production agriculture will be aggressively remediated and with less willingness of governments to pay farmers to "stop doing bad things". Where possible, environmental externalities in agriculture will be addressed with "cap-and-trade" and other market-creating schemes rather than with command-and-control mandatory regulation schemes.

Service industries will dominate stage IV societies; industries such as health and education will dwarf the food industry. Few jobs anywhere in stage IV societies will require brute strength, stamina, and drudgery characteristic of traditional extractive and manufacturing industries. Rather, they will require attributes characteristic of service industries—rigorous education, ability to access information, and skills to interact successfully with others in marketing, management, and finance. The ability of women to excel in such service industries and occupations will enhance their status in society.

## 3. Food Supply and Demand

We turn now to the food supply-demand balance in a 21st century world characterized by major agricultural countries being in stage IV. An important conclusion of this section is that the 21st century will be notable for a tighter food supply-demand balance than has characterized recent decades. It will be easier in that economic environment to convince the public that markets work in agriculture. Thus this section will not contradict the case for agricultural unexceptionalism advanced in the previous section. Trends in global food demand are addressed before turning to food supply.

Factors mentioned above including the rising importance of women in the work force, easy access to family planning, and declining economic value of children to parents will bring low birth rates. As a consequence, the seminal attribute of Stage IV in Table 1 is negative global population growth (NPG). NPG is at variance with the long-held view that global population will grow indefinitely or will stabilize. The case for NPG is strong, however, and its implications are enormous for agriculture in the 21st century and beyond. The medium population variant of the United Nations (2002), widely viewed as a useful prediction, calls for global population to rise from 6.1 billion persons in 2000 to 7.9 billion in 2025, to 9.3 billion in 2050, and to stabilize eventually near 11 billion people. Meanwhile the rate of population growth, after averaging near 2 percent

annually from the 1950s to the 1980s, is projected by the UN to fall from 1.3 percent per year in 2000 to 0.9 percent in 2025 and to 0.4 percent in 2050. Numerous other experts project that world population will stabilize at even lower level than projected by the UN and will begin to decline well before the end of the 21st century (see Tweeten 1998).

Food demand per capita grows nearly 0.3 percent annually because people spend part of their rising income for food, especially for more livestock products. The tendency for that percentage to get smaller over time because food demand becomes less responsive to income (falling income elasticity of demand) is offset by the fast growth in and share of the world's income in poor countries (with high income elasticities) (Tweeten 1998). Combining the UN medium population projections with the income effect, food demand is projected to be 141 percent of its 2000 level in 2025 and 179 percent of its 2000 level in 2050. If world population stabilizes at 11 billion persons and food demand per capita grows on average by 0.25 percent per year from rising income, then food demand will be double its 2000 level by 2068. Thus based on defensible though admittedly crude assumptions, food demand seems destined to stabilize during the 21st century except for modest continuing growth from rising income.

Can food supply keep up? If food demand outpaces supply, food real price will rise; if food supply outpaces demand, food price will fall. Food supply depends on yield and area. Cereals (corn, rice, wheat, etc.) directly and indirectly (through livestock feed) account for two-thirds of the world's food supply. Figure 1 reveals a most dramatic finding: global cereal yields have been increasing at a linear rate since 1961—the first year for which reasonably reliable data are available. The linear trend line is a good "fit", accounting for 99 percent of the variation in annual cereal yields from 1961 through 2001. Yields (metric tons per hectare) doubled from the 1960s to 2001, but the annual percentage rate of increase was cut in half during that period and continues to fall.

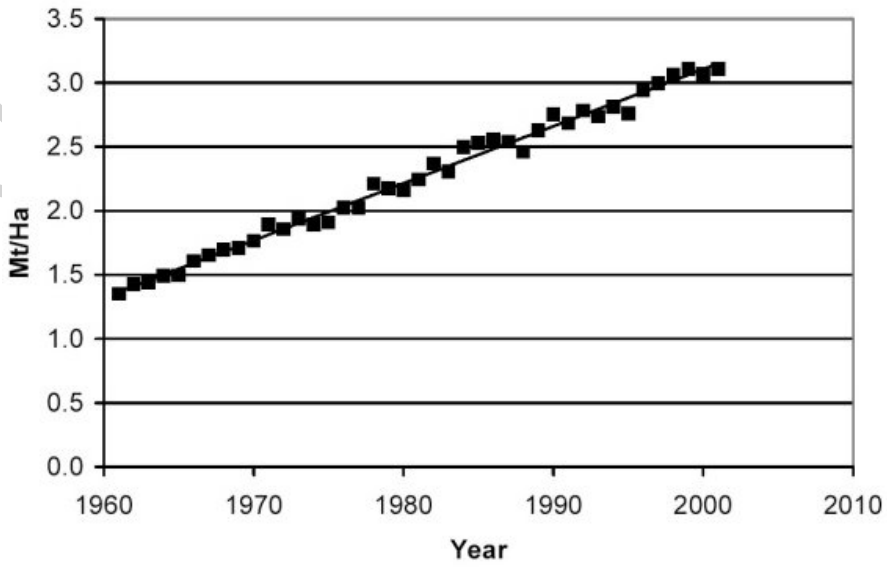


Figure 1. Global cereal yield, actual (dots) and predicted (line), 1961 to 2001 (FAO 2002)

Yield trends were also analyzed for five other major crops, with results summarized in Table 2. Yields of each crop increased linearly and hence at a decreasing percentage rate. Trend yields of cereals and oil crops (soybeans, rapeseed, etc.) were increasing at 3.3 to 3.5 percent respectively per year in 1961, well in excess of global population growth of 2.0 percent per year. By 2001, trend yields of these two crops had fallen to 1.4 to 1.5 percent annually, far below the global population growth rate of 1961 but nearly equal to the actual population growth rate in 2001.

| Crop | Area (Million Hectares) | | | Trend Yield Increase (Percent/Year) | | |
|---|---|---|---|---|---|---|
| | 1961 | 1981 | 2001 | 1961 | 1981 | 2001 |
| Cereals | 648 | 729 | 671 | 3.26 | 1.97 | 1.41 |
| Oil crops | 114 | 164 | 223 | 3.53 | 2.07 | 1.46 |
| Pulses | 64 | 62 | 66 | 0.92 | 0.78 | 0.67 |
| Roots and Tubers | 48 | 46 | 52 | 1.39 | 1.21 | 1.07 |
| Fruits | 24 | 33 | 49 | 0.49 | 0.45 | 0.41 |
| Vegetables and Melons | 24 | 26 | 43 | 1.91 | 1.38 | 1.08 |

Source: FAO 2002

Table 2: Global area and yields of major crops, 1961, 1981, and 2001
Source: FAO 2002

Of concern is that trend yields of cereals and oilseeds were only keeping up with the rate of population growth at the beginning of the 21st century. Yield increments in all crops are falling in percentage terms over time, and yields of other crops are growing even less rapidly than those of cereals and oilseeds. Yields of livestock measured by output per animal unit also on average increased at a slower rate than cereal yields (Tweeten 1998).

Food production depends on area as well as yield. Cereals accounted for 61 percent and oil crops 20 percent of all crop area in 2001, hence land devoted to these crops heavily influences food supply. Total area in the six crops listed in Table 2, after increasing on average by 0.6 percent per year from 1961 to 1996, remained nearly stable thereafter. Considerable expansion of cropland in Brazil has been offset by losses of cropland to grass and trees in the former Soviet Union and to urban and built-up uses throughout the world.

Additional animal units of livestock or greater productivity of livestock per animal unit could potentially expand food production. Unfortunately, many of the world's grazing lands are in deplorable condition, and will require large investments to become sources of greater food supply.

Approximately one-third of global agricultural output comes from the one-sixth of agricultural land that is irrigated. Some 250 million hectares are irrigated globally, nearly a five-fold expansion in the 20th century. While irrigation is an indispensable source of food output, it is not a promising conventional investment to expand food

supplies in the 21st century. Rosegrant et al. (2002, pp.5-7) project all non-irrigation uses of water to rise by 62 percent between 1995 and 2025 while irrigation use is projected to rise by just 4 percent—only 0.1 percent per year.

Irrigation of crops accounts for 80 percent of global water consumption and for an even higher proportion (86 percent) of water consumption in developing countries. Because of rapid population and income growth in urban areas, low-value agricultural uses cannot compete economically with urban uses of water. While water and land are available for irrigation development in Africa and other regions with pressing food demands, costs of irrigation development are high and are prohibitive in poor countries at current farm commodity prices. Erection of dams to supply irrigation water is no longer environmentally and socially acceptable in many parts of the world. Major opportunities to improve water-use efficiency in irrigation will be exploited, but expansion of irrigation cannot be expected to accelerate historic crop yield trends.

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