# Globalization and the Rural Environment



*Edited by*
Otto T. Solbrig,
Robert Paarlberg,
and Francesco di Castri

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# The Impact of Globalization and the Information Society on the Rural Space: Conceptual Analysis and Some Policy Suggestions

*Otto T. Solbrig*

## Introduction

Nations are in the process of moving from the industrial society to the information society, also known—perhaps more accurately—as the post-industrial society. This shift can be equated with what happened two hundred and fifty years ago in Europe with the change from an agrarian to an industrial society. This socio-economic transformation of revolutionary proportions is impacting most communities around the world, albeit not always in the same way or at the same rate, nor are these changes necessarily seen as positive by all societies. As in any social transformation there are winners and losers. It is still too early to say whether eventually there will be more winners than losers, or vice-versa; yet in some quarters at this time there are more that are losing than not, which is creating resistance to the information society and its changes. However, a greater and more open flow of knowledge and information should represent an opportunity for gain and the expectation is that in the final analysis most individuals and societies will benefit. The industrial revolution was also preceded by a period in which poverty and misery increased significantly, especially among the urban proletariat, but eventually the situation was reversed (especially with the onset of the second industrial revolution at the end of last century, Deane 1979, Landes 1998). Yet for those that today find themselves trapped in poverty the promise of a better future is little consolation.

For three days in January 2000 –13 to 15—a group of 40 ecologists, agronomists, economists, and sociologists from universities, research institutes and the private sector, debated the impact on the rural environment of the economical and social changes that are currently taking place. The discussion centered on three areas with highly developed market agriculture: the southern cone of South America, the United States, and Western Europe. The general conclusion of the meeting was that industrial agriculture has been very effective in increasing production and helping alleviate hunger, but that questions remain regarding its environmental and social impacts. Nonetheless it is difficult to rigorously identify the extent and significance of these impacts and to design appropriate remedial policies. This chapter summarizes the conclusions of the meeting, and presents some policy proposals that were discussed.

## General Background

The information revolution is the result of the conjunction of three principal historical, but unrelated, events. First of all, great advances in science took place, particularly in two areas: microelectronics and biology. The invention of the transistor, of electronic computers on a chip, fiber optics, electronic switching and miniaturization, produced a large number of consumer and industrial products that increased the transmission of information, such as personal computers, transistor radios, and cellular phones. It also promoted a transformation in telephony and communications (fiber optics, electronic switches, satellite transmission, etc.) that very significantly reduced the cost of long distance communication and data storage and transmission (Hall and Preston 1988, Stephenson 1999).

The discovery of the structure of DNA in 1953 completely transformed the study of biology. Life systems that until then had been closed black boxes suddenly could be studied using the tools of chemistry and physics, and in the short span of fifty years biologists learned how to intervene in living system, from microbes and plants to human beings, to alter their properties. These advances are also creating a series of new products in pharmaceutical field (designer drugs), medicine (gene treatments), and agriculture (cloned sheep, genetically altered crops).

The second historical process was the restructuring of the world's economies (Drucker 1993, Friedman 1999). In response to the crisis of the welfare state and the economic stagnation of the 1970's, firms



reorganized and adopted a more flexible, networked organization. Simultaneously there was a movement to reduce the role that the state played in the economy, and a massive movement towards deregulation and privatization took place. Extensive reduction of tariffs, and especially the lowering of transportation costs, bolstered international trade (Yergin and Stanislaw 1998, O'Rourke and Williamson 1999). Markets for high value perishable products, such as flowers, are now global thanks to low air transport costs and reduced tariff barriers. Financial markets became integrated and now operate in real time worldwide, which dramatically increased the magnitude of financial flows. Every day one and a half trillion dollars are traded in the currency exchange alone (Friedman 1999). Money flows in and out of markets and countries in fractions of seconds and trade circuits that once took years to close now close in seconds. Stock markets boomed, and those with the skills needed to participate in the global economy enjoyed unprecedented gains in wealth.

The last historical transformation is in the social area. Following the student uprisings in Western Europe in the 1960's and similar simultaneous social upheavals in the United States in reaction to the Vietnam war, a diversity of lifestyles and social movements have sprung up especially in Europe and the United States. This phenomenon is increasingly spreading to the rest of the world (Castells 1996). Examples are the environmental movement, the human rights movement, and especially the women's movement, that is in great part a response to the incorporation of women into the workforce. In turn this change is related to the trend toward smaller families, longer life expectancies, and increased need for health services. New family styles, from single parent to same sex families have emerged. In the United States, for example, only 30% of families are traditional, i.e. father, mother and children under the same roof (Castells 1997).

These and other movements have attracted a great deal of activism and led to the formation of an enormous diversity of nongovernmental organizations (NGO's). For example, consumer movements, especially in Europe, are demanding certain characteristics in the food chain, such as humane treatment of farm animals, food grown without the use of pesticides, hormone free milk and meat, non-genetically altered crops, etc. The recent demonstrations against the WTO (World Trade Organization) in the name of opposition to child labor and environmental protection, is one example of mobilization by NGO's.

One of the greatest recent changes is in labor relations and the structure of the workforce (Drucker 1993, Castells 1997). The information society makes much more use of temporary and part time labor, and the subcontracting of specific tasks. Close to 50% of the labor force in some countries is now formed by part-time, temporary workers and independent contractors. The result is the individualization of labor and a decline of traditional labor organizations along with the traditional welfare state social safety net that has been weakened in many countries.

These and other changes are impacting all aspects of industrial and post-industrial society and creating a justified collective anxiety. Nowhere are these more evident than in the rural sector. By rural sector we refer not only to agriculture but also to all activities that take place in the countryside, including but not restricted to agriculture. Although these changes are not confined to regions with market agriculture, they are more dramatic and potentially more impacting there than in areas with self-sufficient peasant farming.

## The Impact of the Post-industrial Society on the Rural Environment

The rural environment, especially in areas where commercial agriculture prevails, has been affected significantly by the changes that are taking place. These have impacted the production process, the economy of farming, and the rural social structure.

### *The Production Process*

Didactically we can distinguish three sets of technologies that have affected the production process: (1) input technologies (also referred to as "green revolution" technologies), (2) process technologies, and (3) knowledge technologies (often encompassed under the broad umbrella of biotechnology).

In the early 1960's, in response to increased demand from a fast growing world population, new production technologies were introduced, commonly known as "green revolution" technologies (Ruttan 1977). Basically they consisted in the development of cereal varieties (wheat, rice, maize) that were very highly responsive to the addition of chemical fertilizers, especially nitrogen. The use of herbicides and pesticides and the use of tractors and self-propelled machinery complemented this technological production package. Green revolution technologies increased yields and production augmented at a rate that was higher than population growth. However they had some negative environmental effects primarily due to the significant increase of chemical inputs (fertilizers, herbicides, and pesticides). Yet their favorable effect on yields led to the wide adoption of these technologies.



A decade later, in order to reduce some of the negative effects of green revolution technologies and to conserve resources, management operations known as process technologies were introduced, such as measures to reduce soil erosion, integrated pest management (IPM), and drip irrigation (Loomis and Connor 1992). These technologies were designed primarily to reduce input use, but they also minimized some of the negative environmental impacts of the green revolution.

Knowledge technologies are a direct consequence of the advances in molecular biology in the last fifty years and their application to agriculture. The major impact comes from biotechnology, especially gene technologies (Marx 1989). In a first wave of biotechnological developments, new crop varieties were produced that are resistant to broad-spectrum herbicides (e.g. "round-up ready"). This permits the use of general herbicides with low toxicity that lead to a better control of weeds, reducing their negative effect. Since these general herbicides are toxic only to some plants and much less so to animals, and are readily decomposed by microorganisms, their use should have a reduced negative environmental impact compared to those in general use now. Furthermore, the number of herbicide applications is reduced from three to one. The introduction into crop species of genes that produce toxins that decrease insect damage (so far only taken from *Bacillus thuringensis*) reduces the use of insecticides. The effect of these toxins on vertebrates, especially humans, is not clear, and there has been social resistance to the use of genetically altered crops, especially in Europe (Rifkin 1998). Yet the use of these toxins as spray has been practiced since 1938 by organic farmers with no noted side effects. In a second wave of biotechnological techniques, crops are being designed to produce specific chemical compounds, from unsaturated oils to polymer molecules for use in the plastic industry (Moffa 1999). Although still in their infancy these developments are particularly interesting from an environmental point of view since these molecules are biodegradable

The number of genetically altered crops produced by biotechnological techniques is still small (as compared to genetically altered crops by conventional techniques) but is on the increase. These approaches are very promising. Yet there are also some unknown aspects to these crops of which more will be said later.

Biotechnology, the central knowledge technology, is not new. Cloning of favorable mutants using cell culture in horticulture and fruticulture is more than twenty years old and has allowed the rapid spread of new horticultural and ornamental varieties and a significant reduction in costs (Cocking 1983). Cell hybridization, fusion of cell nuclei, and other such techniques have also been in common use for some time. Transgenic technologies are widely used and accepted in the production of medicines today.

Information technologies have been introduced that promise greater efficiency in the use of inputs, especially fertilizers, that may reduce groundwater contamination. These techniques known collectively as "precision farming" consist of the use of GPS (Global Positioning Systems) that allow the precise calculation and correction of nutrient deficiencies on a point by point basis in a field. The resulting reduction in wasteful use of fertilizers should have both economic and environmental benefits.

Low or no till agriculture is a technology introduced to reduce fuel use, which significantly reduces soil erosion and also has additional significant economic and management benefits (McCalla and Army 1961, Crosson and Ostrov 1966). Economically, no-till agriculture reduces the use of agricultural operations, thereby reducing labor and fuel costs. From a management point of view, no till allows planting almost immediately after the harvest has been raised. This has made possible the introduction of double cropping in areas where such was not possible before.

Agroecology and its principles are another very promising change that has the potential to affect how both small and large farmers produce (Altieri 1995, Gliesman 1998). Agroecology is the application of ecological principles to farming in order to reduce soil erosion, increase diversity, and improve nutrient cycling and water management, so as to increase productivity without the use of chemical inputs. Particularly promising are various techniques to control insect pests biologically, or with a minimum use of pesticides, also known as Integrated Pest Management (IPM).



### *The Economy of Farming*

From an economic point of view the technological changes described in the previous section have three consequences.

In the first place the increase in productivity brought about by new technologies has continued to keep supply ahead of increases in demand, with the result that prices have continued their downward secular tendency. This situation may continue despite global income and population growth (Foster and Leathers 1999), although declining rates of investment in agricultural research, raises questions of whether productivity increases will be maintained. Because supply depends so much on weather conditions, prices vary from year to year, which is likely to continue. The market for agricultural commodities is now truly globilized and is very sensitive to climatic fluctuations, subsidies, and taxes. Government policies designed to stabilize internal prices, as in Europe, tend to increase the instability of international prices.

Secondly, in countries with scarce land and expensive labor, many of the new technologies are capital intensive. They show economies of scale and require better-educated personnel for their implementation. In the more developed countries there is great pressure to increase labor productivity to reduce costs. The result has been a shrinking farm labor force. In the United States, for example, the farm labor force is now only 2% of the total labor force, and even in a country like Argentina, the rural labor force is down to 7% of the national labor force. In societies where urban industrial growth is rapidly underway, this migration of labor away from farming helps income levels to rise throughout society. Yet if industries and services in cities cannot absorb this excess labor, it creates cordons of shantytowns, unemployment, poverty, and misery.

Farm labor intensity in Western Europe and the temperate region of the Americas is very different from that in Asia or Africa. While in North America the average worker tends some 300 acres, in Africa a farm worker takes care of only 15 acres and in Asia 3 acres (Foster and Leathers 1999). Yields per hectare in small plots with greater labor input are higher than in larger plots (Stevens and Jabara 1988). However labor productivity is in general low and so are wages. Adding labor will increase yield up to the point when no additional productive work is available. There is considerable evidence that the marginal product in agriculture is below the wage rate (Berry and Cline 1979, Foster and Leathers 1999). Demographic calculations project a slight increase in the rural labor force in Asia and Africa. Although it may result in an increase in yields, it is unlikely to increase rural welfare given the negative marginal productivity of labor.

As inefficient commercial farmers abandon farming and enter the industrial or service economy, they sell or rent their land to those who remain. Farming units are increasing in size and decreasing in number. This is a worldwide trend in areas with high industrial growth.

This situation contrasts with areas were peasant agriculture is predominant, where the picture is mixed. In terms of numbers, there are probably more peasant farmers in the world than commercial farmers but they feed fewer people. According to Petty (1995) in 1994, about 3.5–3.8 billion people depended on food produced by commercial agriculture with green revolution technologies, while the remaining 1.9–2.2 billion people depended on peasant agriculture using traditional methodologies. Peasants farm smaller plots, occupy more marginal lands, and have lower yields. Many peasant farmers however have adopted new technologies that have led to increased yields. In much of the world, –Latin America, south and eastern Asia—peasant farmers are increasingly producing for the local market (that in most countries of the world handles the bulk of the agricultural production), and are reaping both the benefits (higher income) and costs (greater risks and uncertainties). Over slightly half of the world population is now urban, and by necessity they depend on the market for agricultural commodities for their sustenance. In some parts of the world, especially Africa, and certain parts of Latin America, a truly self-sufficient sector, mostly mired in poverty still exists (Landes 1998, Foster and Leathers 1999). Efforts are underway to help this very important type of agricultural sector to improve its performance and also to rescue some of the knowledge acquired by them over the centuries. The conference did not discuss this aspect of rural development but concentrated on problems in the commercial sector.

Finally, a last consequence of globalization in the rural sector is a direct outcome of the technologies of the post-industrial society. In effect, new communication technologies and better distribution networks allow commercial farmers in developed and medium-income regions to by-pass the local agent and buy their inputs directly in the cities. Likewise these farmers are trying to become more in-



volved in the commercialization of the crop. Farmers operate either individually (the largest farmers) or through cooperatives and farmer's associations in buying inputs and selling the crop. This has reduced or eliminated the role that rural villages and small towns played in providing credit and services to farmers and in commercializing the crop. Consequently, many small rural towns are slowly disappearing. Around many cities, both in the developing and developed world, farmer's markets have sprung up. These allow small farmers to sell directly to consumers, particularly fresh vegetables and fruits.

In areas of primarily peasant agriculture, peasant farmers and peasant associations have formed for the transmission of technology and for asserting property rights to land. Peasants are mobilizing all over the world to try to improve their lot often aided more by local and international NGO's than by the governments or elites of their own societies.

### *The Social Consequences*

Some of the social effects of the post-industrial society on the rural environment, especially in areas with industrial agriculture, have already been mentioned: reduction in the rural labor forces and reduced rural employment; fewer and larger agricultural units; slow demise of villages and small towns.

European cities originated as centers of commerce and supply for the surrounding countryside, which in turn supplied the city with food. The countryside was also the locale of small cottage industries such as weaving (Deane 1995). With the industrial revolution, rural and urban activities started to diverge with the rural environment concentrating on agricultural activities yet retaining some of the pre-industrial values, such as better collaboration among farmers, and a greater sense of community. The rural space lost most of the cottage industries, especially weaving, that had been a source of employment during slack times. Today European agriculture is adopting industrial approaches to crop production, and the so-called "rural values" are slowly disappearing. Cars and highways allow many commercial farmers to live, or at least shop, in cities away from their farms in Europe and other areas with commercial agriculture such as the United States Midwest and the Argentine pampas. Some of these changes are strongly opposed by both urban and rural dwellers. This resistance to change has strong local and regional characteristics and is influenced by European history, culture, and economics (Bloch 1966, Braudel 1988).

A very worrisome problem is that of rural poverty and malnourishment. The problem is most serious in areas with a high proportion of self-sufficient peasant farmers, such as in Africa south of the Sahara where the modern transformation of farming is least advanced (Harden 1990, Reader 1998, Foster and Leathers 1999) yet poverty is not exclusively confined to those areas. Some of the causes of the problem are political instability, lack of land, overpopulation, high taxes, minifundia, low education and low agricultural yields. It is estimated that approximately 850 million people worldwide are malnourished, a majority of which are rural dwellers (Foster and Leathers 1999).

## Environmental Impact

For 10,000 years agriculture has been the human activity with the greatest impact on the environment. Farmers and ranchers transform the landscape, removing the existing vegetation that is replaced by crops, pastures, or orchards. The plants and animals that are raised are usually exotic species. In ecological terms, agriculture creates a major disturbance that moves the entire ecosystem to an early succession stage. These early ecological stages are more productive than later stages, and hence able to support larger and better-fed human populations. Yet they are less resilient and stable and will tend to degrade unless constant investments are made in new knowledge needed to keep operating despite the environmental changes they provoke. Agricultural ecosystems induce nutrient leaching and soil erosion. In a natural succession, the ground is quickly covered with vegetation that slows down soil erosion, and as longer lived vegetation replaces the early succession stages, nutrient losses are replaced by nutrient gains, and the stability and resilience of the system increases.

In order to keep the agricultural system in a permanent juvenile stage, the farmer has to invest energy by plowing and weeding (or herbicide applications), and has to replace nutrients by fertilization. To reduce instability further, even more energy is expended such as in irrigation or pesticide applications. These interventions increase stability but often at the cost of aquifer contamination, soil salinization, etc. Furthermore, the variations in yields brought about by the climate affect markets for agricultural commodities that are already



volatile, introducing a further source of instability. The instability of the system determines that yields are very dependent on weather and are unpredictable.

These effects are not restricted to high input agriculture. Low input farming can also have damaging environmental effects. Much of the Mediterranean Basin and the Middle East has been degraded by centuries of traditional agriculture (Paddock et al. 1986, Solbrig and Solbrig 1994). Babylon, Cartage, some of the Mayan areas of central America, to name just three examples, are witnesses to degradation brought about by traditional agriculture. The "dust bowl" in the United States in the 1930's and similar phenomena in Argentina in the 1940's occurred before high input agriculture was introduced (Hurt 1994).

Likewise inputs are also not new. Both organic and inorganic fertilizers such as marl and lime have been used for centuries (Evans 1956, Galloway 1989). Pesticides have also been applied to crops for a very long time, such as copper sulfate in grapevines. From an ecological point of view it can be argued that it is imperative that the nutrients removed with the crop be replaced if yields are to be maintained. The plant does not make any distinction between organic and inorganic fertilizer. The advantage of an organic fertilizer is that it contributes to maintaining the very important organic matter in the soil.

Yet the increased pace of technical developments in agriculture and the negative effects of the introduction of persistent chemical pesticides so eloquently described by Rachel Carson in *Silent Spring*, (1962) has created a much more dangerous situation. Better, more rapid communication and greater public awareness have lead to a much greater consciousness regarding potential problems. The consuming public –or at least a certain part of it—is also very aware of potential health risks and among the financially more accommodated public some are willing to pay higher prices for food grown without chemical inputs known as "organic products".

When DDT and other such toxic and persistent molecules were introduced, the fact that they did not decompose readily was seen as a great advantage, since it reduced the need for multiple applications. Soon it was realized that as the molecule moved up the food chain it became concentrated in the bodies of upper predators, both vertebrate and invertebrate, with negative consequences (Carson 1962). Furthermore, it soon was discovered that many pests acquired resistance to these molecules. One response to this situation was to develop new compounds with higher toxicity that could be used in lower doses. This approach created new problems, particularly for agricultural workers that handled these very dangerous products. Another approach was to move away from chemical warfare and to rely more on natural enemies to control the pests and to use process technologies, such as rotations and intercropping, to reduce insect damage (IPM). Demands by the consuming public and industry for fruits and vegetables with zero insect damage make it very difficult for farmers to wean themselves completely from using pesticides (Pretty et al. 1998)

In field crops, such as wheat or soybeans, there has been a greater effort to provide protection against pests and disease through traditional breeding techniques, and lately through biotechnology. Whenever possible this is of course the best approach since it protects the crop and eliminates the need for pesticides. Yet pests can and eventually do break the built-in resistance of the crop. The reason is that insects, and especially fungi and bacteria have much shorter life cycles and are present in greater numbers than the resistant crop. Through mutation and recombination, eventually a pest individual will appear that can break the host's resistance. Such was the case with corn leaf blight in 1970, when almost 15% of the US maize crop was lost. This requires that plant breeders be constantly on the alert to provide new and more resistant varieties. Planting mixtures of different varieties (i.e. increasing crop diversity) or interplanting more than one crop, is good insurance against catastrophic losses and slows down the rate at which resistant pests appear in the field (NRC 1989). Yet such strategies have additional harvesting costs and may require greater capital outlays, which hinder their adoption.

Resistance genes can be passed from the crop to wild growing relatives or ancestors through hybridization. They can also be passed to non-relatives through transduction, at a much lower rate. Especially if the genes that are transmitted confer herbicide resistance, the plant that acquires the resistance can become a so-called "superweed," i.e., one that is very hard to eradicate.

The use of chemical inputs in areas of intensive agriculture has created a number of externalities that have negative implications for human health. Aquifer contamination with nitrates, which is attributed to excessive use of nitrogenous fertilizer, is the best known of these externalities (NRC 1989). Eutrophication of lakes and estu-



aries is another externality of modern agriculture, as is the over utilization of aquifers. Yet, it is difficult to assess the exact costs of these externalities, or to pinpoint their causes.

The last issue is also the most troublesome, namely soil erosion. Although there is no precise measurement of the extent of soil erosion worldwide, existing estimations indicate a serious problem (Norse et al. 1992). Yet when economists try to assess the economic costs of soil erosion they find these costs to be small, which is in general agreement with the findings of a FAO study (Oldeman et al. 1990). This is in contradiction to what some soil scientists record (Paddock et al. 1986, Pimentel et al. 1995, Casas 1998). In part, the difference has to do with what is being measured. Ecologists document actual losses of soil. There is no question that soil losses of diverse magnitudes accompany agriculture. This will always be the case when the soil surface is exposed to the action of wind and water. The magnitude of those losses will depend on slope, the amount of time the soil is left exposed, the characteristics of the soil, and the weather conditions. Economists on the other hand measure income losses by farmers and the agricultural sector. These depend on crops, prices, and especially technology. New and better varieties, increased use of fertilizers, and the development of varieties adapted to growing in poorer soils can compensate for the loss of topsoil (Labbate 1997). There is also no rigorous way to establish what a reasonable soil loss is, i.e. one that will not reduce crop productivity. So far new technologies have compensated for the loss of topsoil, at a lower cost per unit of output every year. However, there may be a threshold, below which technology cannot compensate for soil loss. Ecological theory points in that direction, and it is prudent to try to reduce soil erosion as much as possible.

## How to Increase Sustainability

Modern industrial agriculture has been very successful in providing abundant and cheap food. Malnutrition, which is still widespread, is a consequence of poverty rather than insufficient supply. Yet this success has been purchased at the cost of lower ecosystem stability. The new challenge is to increase agricultural sustainability without sacrificing productivity. In this respect the conference discussed a variety of policies and techniques that are presented in greater detail in coming chapters. The aim is to:

- reduce the environmental damaging effects of agriculture,
- increase system stability,
- increase production to keep up with the increasing demand of a growing and wealthier population,
- maintain low prices so as to reduce malnourishment by making food more available,
- avoid excessive land concentration,
- maintain or increase farm profitability, and
- preserve traditional rural values.

From an ecological point of view, the way to reduce some of the environmental damaging effects of agriculture (such as loss of biodiversity, soil erosion, nutrient losses, loss of organic matter, etc.), is to manage the system so as to move towards a more mature successional stage. Techniques such as agroforestry, intercropping, and mixing perennial and annual crops, are designed to accomplish that end. They can also reduce the pest load, and encourage beneficial insects and insectivorous birds. Green manures can reduce the need for chemical fertilizers; they require a greater input of labor and management however. They work best in areas where there is an abundant labor supply and low wages. Yet these techniques are seldom a promising way to increase rural income since at today's crop prices and labor costs, profitability of these systems is very low. An exception is when the farmers can obtain a higher price for their produce, such as with organically produced food, for which there exists a market willing to pay higher prices. These approaches are more sustainable and increase yields in comparison to low yielding traditional agriculture. They may therefore be well suited for areas with peasant farming and large rural populations. They might also be viable if subsidized, as is the case in Western Europe.

In the last thirty years technologies such as no-till or minimum till, precision farming, drip irrigation, IPM, and genetically altered crops, have been introduced, which are attempts to increase profitability, stability and sustainability (Viglizzo and Roberto 1998). Yet given the nature of agricultural activities with the long lag between the time a farmer has to make the decision to plant and when the crop is harvested, uncertainty will always exist and the system will



always have a great deal of unpredictability. Because they are capital or management intensive, or both, but not necessarily labor intensive, they are best adapted to those areas of the world which already have intensified, but less so to areas with peasant agriculture, though this is not always the case. No-till has been adapted successfully for use by small farmers in Paraguay and northern Argentina (Pereira 1997, Peiretti 1999), and IPM is equally well suited for small and large farming (Dietze 1997).

There is at present a great effort to individualize and distinguish agricultural products by emphasizing quality over quantity and by producing specialty products in order to increase profitability (Solbrig and Vera 1997). Examples are organic produce, high protein wheat, corn high in unsaturated fats, dairy products with registered trademarks, quality wines with place of origin, special cuts of meat, and poultry fed special diets. All these products fetch higher prices in limited markets. By concentrating on quality rather than productivity farmers in affluent societies can produce on smaller acreage with increased labor and with higher profits per unit for limited and specialized markets. This approach can increase profitability and sustainability.

Another aspect of the problem is the intervention of governments in the production and marketing of agricultural products through the imposition of taxes, incentives and/or subsidies. On the whole, politically powerful farmers, especially in developed countries, influence their governments to provide subsidies and other monetary incentives, while politically weak farmers, including peasant farmers tend to be taxed (Paarlberg 1998). Both subsidies and taxes have a distorting effect on prices and the optimal allocation of resources and can be considered market failures. Yet it is very difficult to obtain an overall assessment of the exact impact of government policies on the environment. There is sufficient anecdotal and empirical evidence and studies of particular policies to accept the premise that government policies have often had a negative effect on the environment, yet no quantitative overall assessment is possible at this time.

A clearly positive type of government intervention is the sponsorship of agricultural research. All over the world, government experiment stations and agricultural institutes have contributed unmistakably to the increase in productivity and land conservation techniques. Yet there are critics that feel that government research has encouraged capital intensive technologies to the detriment of small farmers. Expenditures on agricultural research are in decline, which may affect future productivity.

Other government interventions such as the provision of education and health services, communication infrastructure, and information, including information on how to increase sustainability are also generally beneficial. Unfortunately, governments in many developing countries are unable or unwilling to provide these services. The private sector is increasingly asked to make up for the deficiencies, both non-profit NGO's as well as for profit agribusiness.

## The Impact of Globalization on the Rural Environment

The coming years will see great changes in agriculture worldwide. In areas with commercial agriculture productivity will continue to increase, the farm labor force will continue to decrease, farming units are likely to get larger, but total acreage is likely to be reduced, which will be good for habitat protection. Demand will continue to increase as the population expands, incomes will continue to increase especially in Asia and Latin America, and world populations will continue to urbanize. Peasant agriculture will become more marginalized and is likely to become irrelevant in the global market. The number of gentlemen farmers, city folks living in a rural environment but with city-based sources of income, is likely to rise. International trade in agricultural commodities, which is now only about 20% of global production will probably grow and become more important as a result of more globalized open markets and better cheaper communications.

Will these processes have a negative or a positive effect on the environment? This is an unresolved question. The authors of this volume provide a challenging variety of informed and well-reasoned assessments.

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