The Economist's Role in the Agricultural Sustainability Paradigm

Proceedings of the AAEA Preconference on Sustainable Agriculture

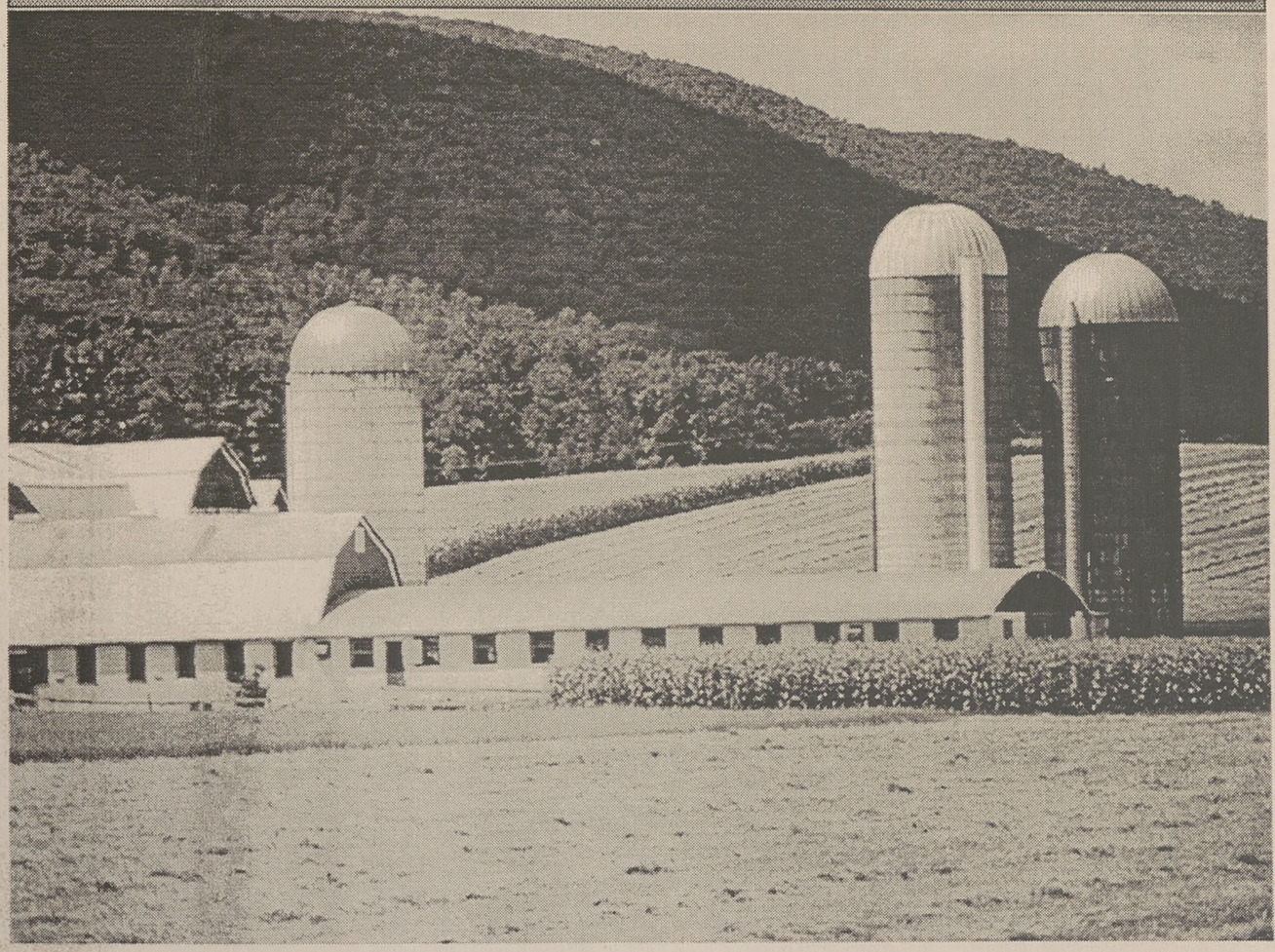

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Table of Contents:

Economics of Agricultural Sustainability

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What is agricultural sustainability and what can economists contribute to the debate and toward achieving more sustainable agricultural systems? Few will challenge the importance of sustaining agricultural systems that provide a plentiful and safe supply of food while maintaining or enhancing environmental quality. Understanding "agricultural sustainability" presents an important challenge. But having an appreciation of sustainability, we have several opportunities to assist farmers in developing sustainable production systems, to aid policy makers in devising policies that support agricultural sustainability, and to help consumers appreciate the nature and importance of sustainable systems.

Before we entertain a discussion of agricultural sustainability, it may be useful to attempt a definition of the concept. A frequently cited definition of sustainable development is contained in the "Brundtland Report" of the World Commission on Environment and Development:

> "Sustainable development is development that meets the needs of the present without compromising the ability of the future to meet their own needs."

Two more workable definitions specifically pertaining to sustainable agriculture are embodied in the Food, Agriculture, Conservation and Trade (FACT) Act of 1990:

> "an integrated system of plant and animal production practices having a site-specific application that will, over the long-term: satisfy human food and fiber needs, enhance environmental quality and the natural resource base upon which the agriculture economy depends; make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm operations; and enhance the quality of life for farmers and ranchers, members of rural communities, and society as a whole."

and in the Summary Report from the OECD Workshop on Sustainable Agriculture Technology and Practices:

> "Within the context of OECD discussions it is appropriate and misleading to impose a rigid definition of sustainable agriculture ... Nevertheless, within the diversity of objectives that countries set for agriculture and the environment, there is an emerging consensus that sustainable forms of agriculture are characterized by the adoption of practices and technologies that: • use integrated management techniques which maintain ecological

*The author gratefully acknowledges the assistance of Ron Fleming and the insights into and data supporting climate change in Iowa provided by Elwynn Taylor. All errors and oversights remain the sole responsibility of the author.

integrity both on and off the farm; • are necessarily site-specific and flexible; • preserve biodiversity, landscape amenity and other public goods not valued by existing markets; • are profitable to producers in the long-term; and • are economically efficient from a societal perspective.

These definitions are similar in many respects and quite flexible in interpretation. The common elements include: an integrated, systems approach, site-specificity, preserving and utilizing biological diversity, maintaining integrity of the environment and rural life, and private profitability and social efficiency.

The Extension paradigm for agricultural sustainability is even more general and is built on three components:

- Profitability
- Social Acceptance
- Environmental Compatibility

Although these definitions are flexible and workable, we really need to take a closer look at what assumptions are behind the concept of agricultural sustainability if we want to develop and implement useful programs.

It probably helps to put sideboards around the discussion by presenting the lines of thought regarding sustainability in the economics literature. Then we can discuss some of the tradeoffs and limitations of the two positions. An excellent summary of these positions is contained in Castle, et al., and my comments will draw from this summary.

The first school of thought begins with the premise that natural and man-made resources will not be highly substitutable in the future (Daly). Thus resource scarcity will become an important constraint on economic growth and activity (Castle, et al.). The implications drawn from this premise include (1) limiting human activity to the carrying capacity of the environment; (2) limiting non-renewable resource exploitation; (3) limiting the use rate of renewable resources to their regeneration rate; and (4) limiting waste emissions to the assimilative capacity of the natural environment.

The second school of thought is generally associated with the premise that natural and man-made resources are generally substitutable (Solow). Growing resource scarcity will be avoided by substituting man-made and human capital resources for natural resources in the future (Castle, et al.). Behind this premise are a number of implications that include (1) enhancing the system through technological and institutional innovation, human capital development, and realized economies of scale; (2) developing substitutes for scarce natural resources; (3) protecting unique natural resources if development would cause serious irreversibilities; and (4) using economic incentives to achieve more efficient and sustainable resource use.

There are many positions between these two schools of thought. In the historical literature Ciriacy-Wantrup proposed the "safe minimum standard". Castle, et al., propose recognizing the uncertainty that exists about the future, acknowledging the adaptability of our system to change, emphasizing the economic efficiency of the market system in allocating scarce and natural resources, and pursuing economic growth with caution. I will not attempt to reconcile the positions or determine which position has the stronger empirical support, but rather, recognize that the future is uncertain in many dimensions and that these dimensions of uncertainty should have a profound impact on how we interpret sustainability.

The sustainability literature also devotes specific attention to discounting and intergenerational equity/transfers (Howarth and Norgaard; Toman). Even though the treatment of future generations is an important issue, economists have debated this issue for over fifty years. In delivering outreach programming on agricultural sustainability, economists will probably do little to resolve the issue.

Iowa Illustration

I would like to use an Iowa example to illustrate and argue that agriculture operates in an environment that is continually changing, that mere static definitions of sustainability will not suffice, and that we need to adopt a more dynamic perspective on agricultural sustainability. This argument does not preclude using the Extension paradigm for agricultural sustainability, but rather, being flexible and adaptable in interpreting different definitions of agricultural sustainability.

What we will review is temporal and spatial corn yields and yield variability in Iowa. It is important to note that the yield patterns are not explainable by technology alone. Figures 1a and 1b present corn yields and variability for two crop production regions of Iowa from 1930 to 1995. First, note the different trends in corn yields with the South East region plateauing and the South West region continuing the upward trend. Second, note the increased variability in yields since 1970, as well as the reduced yield variability the preceding 20 years.

Why the differences in regional patterns of corn yields and in corn yield variability over time? Carlson, et al. hypothesize that it is explained primarily by climate change. They have linked these yield difference to changes in the Southern Oscillation and El Niño and the associated precipitation impacts in Southeast and Southwest Iowa. A closer look at rainfall in these regions is particularly useful and interesting. Figures 2a and 2b indicate what has happened. The South West, a region with historically more marginal rainfall for corn production, has witnessed significant increases in precipitation and corn yields. The South East, which more commonly receives sufficient rainfall for good corn yields, is plateauing in corn yield. Also, both regions display much greater yield variability since 1970. It is interesting to note that both rainfall and rainfall variability decreased in the early 1900's. These data lend support to the hypothesis of on-going climate change and a dynamic production environment.

At the expense of oversimplifying the exposition, it is important to remember that temperature and technology are also at play in explaining these regional corn yield trends. It is also important to mention that soybean yields exhibit different yield trends in these two regions of Iowa. Market forces and price signals are another cause of continual adjustment in this dynamic production environment (Miranowski). Given the definitions of agricultural sustainability, price changes impact profitability and thus sustainability.

Challenges and Premises of Agricultural Sustainability

Instead of trying to fine-tune the definition of agricultural sustainability, we need to add another dimension. Agricultural sustainability is and must be treated as a dynamic concept. Because the environment in which we are attempting to achieve sustainability is not static, but rather constantly changing, we need a dynamic definition of sustainability. To sustain agricultural production, farmers must be adjusting production practices, inputs, and systems over time and space.

Appropriate technology will be continuously evolving in response to the dynamic environment. New crop varieties, pest and nutrient management alternatives, equipment, and production practices will be adopted and integrated into the production system in response to changing prices, technology, and climate.

Because sustainability is characterized by constant change, it will also be accompanied by significant uncertainties. These uncertainties will create serious challenges, such as yield variability, pest resistance and outbreaks, and potentially irreversible environmental problems in maintaining agricultural sustainability. But these challenges also provide opportunities for new technologies, new management techniques, and new institutions. Castle, et al., argue for a flexible system coupled with adaptability to improved information as the preferred approach or response. In other words, agricultural sustainability is a moving target that we can never quite achieve but must always be moving toward if long run agricultural sustainability is to be maintained.

Implications of Dynamic Production Environment

Climate changes will continue to occur both spatially and temporally. More importantly, climate change, technology, and economic growth will continue to create disequilibria. Resource values (prices) will be responding. Changing resource values will be sending price signals regarding resource use patterns and policies to producers, consumers, and government decision-makers.

These new price signals will alter resource use through resource substitution. In the short run, concerns will revolve around intensity of natural resource use within the defined set of substitution alternatives and the sustainability of natural resource use. In the longer run, concerns will revolve around the development of substitute practices, technologies, and institutions to ensure sustaining use of renewable natural resources.

Climatic variability also has another important implications for the environmental component of agricultural sustainability. Environmental policies and regulations are typically designed for mean or "normal" conditions and "normal" episodic events. Yet in parts of Iowa during the heavier rainfall events of 1996, soil conservation structures such as terraces were seriously damaged. These structures are typically designed to handle a 25-year, 24-hour rainfall event, or about 4 inches in 24 hours, as opposed to the 12 inches received. Similarly, hog waste management facilities in North Carolina and Iowa have suffered spills during episodic rainfall events. In particular, the increased variability of rainfall and the associated increases in the magnitude of episodic events may require new conservation and waste management guidelines, or new market-incentive approaches coupled with standards (Baumol and Oates).

Challenges for Applied Research and Outreach

Operating in a more dynamic, sustainable, environment, requires flexibility, adaptability, and timely response.

- The response of various pests to climate and resistance requires substitute controls over time and space and a relatively rapid response.
- Waste handling requirements (BMPs) per animal unit require modification over time and space with changes in the magnitude of episodic events.

- Soil erosion control structures/practices (BMPs) require modification over time and space with mean rainfall and rainfall events.
- Location of production may change over time and space in response to long-term climate change patterns.
- If yields follow climate change and land values (prices) follow yields, then wealth and renewable natural resource use will adjust.
- Designing risk management and insurance schemes with changing yield trends, variability, and losses, will become more challenging and will require a more dynamic process.

The "environment" is always changing so we need to treat agricultural sustainability as a dynamic concept, do applied research to adapt and adjust, and provide information and alternatives to help the farmer maintain a sustainable, site-specific management system.

There are other factors that will continually require adjustments in the agricultural sustainability paradigm. The 1996 FAIR Act has been hailed as a measure that allows total freedom (flexibility) to the farmer in deciding what to produce, how to produce, and where to produce. Even though there are some flexibility gains, the potential price variability may introduce more uncertainty for some producers in achieving agricultural sustainability.

Similarly, added reliance on global markets may provide greater opportunities for American farmers to achieve sustainable agricultural systems, but they also need to be prepared for increased price variability and exchange rate movements.

Finally, the dynamic approach calls for expanded investment in agricultural research both of a maintenance and developmental nature. As Ruttan states, "Sustainable growth in agricultural production systems should be viewed as a research agenda rather than a package of practices that is available to producers..." Alternatively, the International Global Weather and Environmental Change Project (NAS) states, "Without climate change research, there can be no sustainability planning." To successfully pursue agricultural sustainability will require more investment in agricultural research. Change is inevitable, and a timely and sufficient response to change will require a strong research and development base to maintain sustainability.

Is investment in agricultural research related to sustainability being maintained near the socially optimal level? Fuglie, et al., provide data on public agricultural research expenditures by program area and by goal. Although the data are not disaggregate in a way that sustainability-related research can be easily identified, current public investment in research contributing to agricultural sustainability is likely underfunded. For example, Fuglie, et al., report that the share of USDA-SAES research expenditures for "managing natural resources" was 12 percent in 1973 and 15 percent in 1992. Likewise, the incentives for private research investment that is sustainability-related are small.

Economist's Role in Agricultural Sustainability

There are many roles that we can perform in pursuing agricultural sustainability. For the purposes of this paper, I am only commenting on those pertaining to production agriculture. There are six major roles that I would like to emphasize.

First, I have attempted to redefine the agricultural sustainability paradigm in a dynamic context. This redefinition is important in how we approach our applied research and outreach roles.

Recognizing that agricultural sustainability is not a static target that we can achieve, but rather, a dynamic concept that we are striving to foster over the long term is an important initial step.

Second, applied research and analysis are important in achieving more sustainable systems. In the market system, prices remain the critical signaling device. Given these signals, there is a continuing need to develop technology and practices that improve quality of land and water, and improve biological and human capital to substitute for chemical technology. At the same time, there is a need to explore what is biologically feasible without tight constraints on economic profitability under current conditions (e.g., precision farming) because these new technologies may be the sustainable technologies of the future. There is also a need to develop anticipatory and adaptive strategies for coping with the uncertainties of potential climate changes in the future.

Third, given the site-specific nature of sustainable agricultural systems, I am convinced that we have a limited role in delivering or prescribing such systems. Rather, we can facilitate the development and integration of such systems that the producers may adopt. Sustainability is an integrative concept that can synthesize information and research that is combined with human capital to produce a sustainable system. As Amigo Cantisano, a grower and consultant from California, emphasized (OECD): (1) technologies come from many sources, (2) growers combine information and technologies into a system, and (3) growers refine systems over time. Changes over time are in response to price changes, technology changes, climate changes, and experiences of other growers.

Finally, policy analysis should provide a critical role for economists. Farm, economic, and environmental policies impact the sustainability of agricultural production systems. The FAIR Act creates a more dynamic price environment and removes acreage allocation constraints. Does it provide incentives for sustainability? Environmental policies are critical to the design of waste management systems, location of production, pest management decisions, and soil conservation, all of which impact agricultural sustainability. Equally important, these policies need to evolve over time toward market incentives and performance standards and away from technology standards.

Economists frequently have a role in institutional reform (e.g., FAIR Act, HACCP, FIFRA) and in efforts to move the system in the direction of "getting prices right." In the broader context, we must find ways to include externalities in market prices so that market prices reflect full social costs. Not only will internalizing externalities improve the functioning of the market system but will enhance opportunities to achieve more sustainable agricultural systems.

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Agriculture's Impact on The Environment—What Is It?

Author: Fritz M. Roka, University of Florida

Introduction

Interest in agricultural sustainability has been motivated, in part, by a concern over agriculture's impact on the environment. I was asked to address this conference on agriculture's environmental impact. In doing so, my objective is to weave three thoughts together. First, I would suggest that the relevant question is not *what is* agriculture's impact on the environment but what is it's *perceived* adverse impact. Public policy is going to be motivated not just on the basis of scientific information, but also on how society perceives agriculture's relationship with the broader environment. As will be discussed later, the public's perception of agriculture's adverse impact on the environment has been changing. My second thought will suggest a reason why public opinion has changed -- economic development and rising incomes not only reduce the relative importance of agricultural production but also afford one the luxury of worrying about environmental quality. Finally, my third thought addresses the continual shift towards industrial style farming, the likely effect this shift will have on public perceptions, and how "sustainability" will mesh with factory farms.

A Historical Perspective

Agricultural production and environmental quality can be described as a two-handed relationship. On one hand, biological processes of agricultural enterprises depend on soil, water and air quality. On the other hand, agriculture is an act of systematic selection. In fact, agricultural success can be directly correlated with environmental control. We genetically enhance specific plant and animal traits. Chemical herbicides reduce competition from undesirable plants. Environmentally controlled indoor confinement facilities help hog producers increase the numbers of weaned pigs per sow-year and improve feed conversion efficiency. Irrigation transforms arid regions of California into salad bowls and drainage allows citrus groves to be planted in Southwest Florida swampland. The extent to which the environment in Southwest Florida has been altered can be more fully appreciated when one realizes that, despite citrus' intolerance of "wet-feet", over 20 percent of Florida citrus acreage has relocated to Southwest Florida.

While many have extolled the virtues of agricultural progress, others have voiced a concern that continual alternations of natural ecosystems may undermine the biological foundations of future agricultural production. Out of this debate, sustainability has emerged as a concept that is challenging agricultural producers to rethink how they do business.

Volumes have been written about sustainable agriculture. However, we still wrestle over its definition. Part of our problem in defining and bounding the concept of sustainable agriculture is that it has been, and will likely continue to be, an evolving concept. Sixty years ago public debate over agricultural sustainability focused on reducing soil erosion and linking long-term farming viability with preserving soil productivity. Today, agricultural sustainability incorporates water quality, endangered species, wildlife habitat, wetlands, and biodiversity. In short, sustainability has evolved into a concept of balancing the value of food and fiber production with an intrinsic value for "natural" ecosystems.

This evolution of thought has paralleled our growing awareness and changing perceptions of our natural environment. Without presuming to be an historian, I would like to share with you my view of how American public consciousness of agriculture's relationship toward the environment has evolved. I have defined three eras and thought it would fun to describe them in the context of a fairy tale.

The tale begins at the time of Creation. On the seventh day, God looked around at what He had created and was pleased. Being the prudent soul that He is, He took steps to insure that His natural world would be protected. So, He established the Agency to Protect the Environment (A.P.E.). Since Adam and Eve had not yet arrived, He decreed that the director of the A.P.E should come from the ranks of birds. Over the entire course of history, from the beginning to the modern era, there have only been three directors of A.P.E. And even though the directors have remained birds, each director has followed the collective consciousness of the human population.

The first director of A.P.E was Ostrich. Ostrich ruled A.P.E in accordance to our image of what an ostrich is -- a flightless bird with its head in the dirt (soil). This analogy is not to imply that the Agency was unaware or unconcerned about agriculture and its potential adverse impact on environmental quality. It was, however, only focused on environmental attributes that directly affected our ability to raise crops and livestock. Since biblical times, our agrarian ancestors were aware of the long-term deleterious effects of salt deposition from flood irrigation. Before the era of chemical farming, crop rotation was a necessary practice to avoid soil nutrient depletion and build-up of crop pests. In range country, hard lessons were learned when ranchers tried to stock animals beyond the carrying capacity of the land. In general, the loss of productive farmland through soil erosion was perceived as the greatest environmental threat. Out of this context, Ostrich ruled over the A.P.E. and can be credited with the first piece of U.S. agroecology legislation -- the Soil Conservation and Domestic Act of 1936.

During the 1960's there was a change in leadership at A.P.E. There are no written accounts of how the change took place, but Ostrich gave way to Penguin. We do, however, have a pretty good understanding of why a change was necessary. The United States was a the center of rapid technological progress. Rising wealth and increasingly efficient agricultural technology assured the American public of a constant supply of food and allowed Americans to spend a decreasing percentage of their household income on basic food purchases. They had the time, energy, and income to increase their recreational activities. Hiking, camping, fishing, boating and sunbathing at the beach proved to be favorite pastimes. However, Americans realized that full enjoyment of these activities depended on clean air and water. There also was some concern that dirty water and smelly air might be bad for personal health. For whatever reason, a change in environmental focus was needed.

Penguin was more in tune with this environmental perspective. Penguins like to play. They are aquatic birds, therefore sensitive to water quality. They also seem to have a good time on the ice and snow. So Penguin took control of A.P.E.

Penguin initiated a flurry of activity. The Clean Air Act, the Clean Water Act, and the Endangered Species Act were some of the major pieces of environmental legislation. At first, attention focused on point source polluters -- manufacturing plants that discharged their wastes directly into the air and water. However, bans on phosphate detergents and tightening discharge criterion on municipal waste treatment plants did not seem to significantly improve environmental resources such as the Chesapeake Bay. As environmental scientists probed deeper, degraded water

quality was traced to increased sediment, nitrogen, and phosphorus loadings. All three pollutants were linked to agricultural activities and with agriculture being the primary land use, it was sited as the principle source of these pollutants. Nonpoint Source Pollution(NPS) became a new buzz word.

Since the objective was to improve water quality, it seemed logical to conclude that if farmers changed their field and livestock management practices, water quality would recover. Therefore, the major thrust of public policy was to encourage the adoption of agricultural best management practices (BMPs) and the set of soil conservation practices remained a cornerstone. Complicating this effort was some evidence that refuted the long standing belief that soil erosion imposed high on-farm costs from the loss of productive farmland (Crosson). Measured on-farm costs were negligible. Instead, off-farm damages from soil erosion were considered to be more significant. This result removed much of the economic incentive an individual farmer once perceived for at least controlling soil erosion. However, public policy still encouraged a voluntary approach toward BMP adoption.

The voluntary approach fit with the popular notion that a "typical" farm was family owned and operated. Further, it was assumed that embedded within this farming structure was a set of environmental friendly attitudes. Once farmers were enlightened with the new information on how their operations affected their "downstream" neighbors, the environmental ethic of land stewardship could be easily extended to include minimizing these effects. As an adjunct to moral suasion, government agencies developed incentive programs by offering payments to defray some of the costs of BMP adoption. Of course, there were a few cases when a farmer perceived that a particular BMP was in his or her economic interest. As an example, minimum tillage was adopted rapidly not so much for its control over soil movement, but for the positive effect it had on farm income.

The rule of Penguin acknowledged a change in public attitudes toward the natural environment. It was affirmed that environmental quality was a public good and warranted public attention. Further, it was recognized that agriculture's adverse impact on the environment was significant and not confined to only farm resources. Despite its broadened environmental view, the reign of Penguin was short lived. Two emerging opinions eclipsed Penguin's perspective. These opinions were held by both anthropocentric and ecocentric individuals (humans first versus critters first). First, whether people chose to partake of them or not, environmental attributes have intrinsic value in their own right. Second, individual ecosystems were related and it was important to understand how these systems were biologically connected.

With these emerging opinions, Mr. Turkey became a more appropriate bird to direct the A.P.E. Mr. Turkey took over and remains in place today. Of course we are referring to the wild variety of turkey, not the butterballs we typically enjoy on Thanksgiving Day. The wild turkey has been described as a crafty critter (Main). His keen sense of sight and smell make him a formidable prey for hunters. While the turkey prefers to move along the ground, he can take flight and travel at great speeds for short distances. During these brief soaring experiences, the turkey can glimpse a different picture of the environment and appreciate a changing view on how agriculture impacts the environment.

The ideas that the natural environment has intrinsic value and that natural life is interconnected comes as no surprise to those who take to heart the writings of Muir and Leopold. To some extent, the American public acknowledged these sentiments by authorizing land purchases and committing resources to develop the National Park Service. Recently, however, public opinion began to give Mr. Turkey a mandate to trade agricultural resources for ecological diversity. The evidence is particularly strong in the case of wetlands where, government agencies have stopped subsidizing land drainage

projects and started encouraging landowners to restore wetlands. In the early 1900s, Florida's Governor Broward created drainage districts and granted special tax incentives to drain south Florida swampland (Tebeau). However, swampbuster rules today's political climate. In some cases, public funds have been used to purchase and restore wetlands. Today, 70 percent of Collier County, Florida, home of the Great Cypress Swamp, is being held in public trust (Anderson and Rosendahl). Further, federal and state governments have created a labyrinth of bureaucracy that imposes such high transaction costs, landowners have little incentive to convert existing wetlands into additional farmland.

The change in thinking is due in part to our heightened environmental awareness. Professor Thompson, in his book *Spirit of the Soil*, argued that agriculture does not have an environmental ethic. He views agricultural sustainability as a useful discussion toward formulating such an environmental ethic, the end result of which will define what we allow ourselves to do and provide us with a framework to evaluate various approaches to improve environmental quality. For example, productive estuaries may not be a *goal* of environmental quality, but a *result* of environmental quality. Perhaps fixing water quality cannot be achieved by simply tweaking the existing systems (i.e. adopting BMPs), but instead requires us to question existing environmental priorities (i.e. perhaps this land should not even be farmed).

Changing Style of Farming

Redefining agriculture's relationship with the environment to mitigate, or at least lesson adverse effects, invariable leads us to a discussion of how a farm should be organized. Sustainable agriculture invokes images of small diversified farms with integrated crop and livestock enterprises. In the minds of many people, a sustainable farm is equivalent to a low-input farm. That is, a farm which supplies its crop nutrient requirements from on-farm organic sources and buys little, if any, synthetic pesticides from off-farm vendors. Low-input farming is perceived to be more environmentally benign.

Unfortunately these images of sustainable agriculture are contrary to the images of industrial style farming toward which current agricultural operations seem to be heading. Hog production is the latest agricultural commodity whose farming structure has changed. The independent farrow-to finish farm is being replaced by large specialized facilities that directly supply packing houses with market hogs.

As Mr. Turkey scouts the landscape, he is slightly confused. Is industrial/corporate style of farming compatible with environmental goals, or are there inherent conflicts? Restricting our focus to just environment concerns, I would like to offer a couple of reasons for concern and a couple of reasons for optimism about factory farms.

First, on the negative side, concentrating production into larger units amplifies the consequences of accidents, caused either by natural events or by bad management. For example, one can not experience a 20 million gallon swine effluent spill unless you first house over 10,000 hogs at one site. And while someone might counter that larger units amplify good management as well, assuming that our risk adverse attitudes carry over to environmental quality, the expected disutility from making a mistake will out weigh the expected utility from not making a mistake. In addition, the public would perceive, 20 million gallons of effluent dumped onto the landscape at one spot to have a harsher environmental consequences than if that same volume were spread over a wider area.

A second concern is land tenure. As Professor Breimyer points out, current farming operations are leasing an increased number of acres. It is likely that corporate farming will increase the detachment between land owner and farm operator. This is one concern where social issues may have an environmental impact. A prevalent view is that absentee ownership does not foster personal stewardship and, given the usual short-term nature of lease contracts, the tenant farmer has little economic incentive to invest in environmental technology.

More work, however, is needed to answer the question of how absentee ownership effects environmental stewardship. What we may perceive as harmful environmental land tenure arrangements may actually turn out to provide some benefits. For instance, it may be easier to implement environmental standards through rental land tenure by enforcing regulations through the rental contract. By example, contract hog farming is a form of rental tenureship. We can think of integrators as "renting" space at a growers farm. In North Carolina, contracts between growers and integrators are contingent on an approved manure management plan being in place at the grow out site.

Another positive aspect of larger production units are that they are in a better economic position to hire specialized labor. A specialist is likely to start with more knowledge and be able to keep abreast of any changes in technology or policy regarding how the operation is meeting environmental standards. Consequently, there is a greater chance that a specialist can be a better manager of environmental resources. For North Carolina, the large hog farms have hired "organic resource managers" to oversee manure handling practices.

Economy of scale also provides an argument in favor of larger production units. Investment in environmental technology can be spread over more productive units, thus making it less expensive for larger farms to adopt environmental technology.

Another argument in favor of corporate farms rests on a perspective that environmental quality is a luxury good. If factory farms are a result of economic evolution toward greater efficiencies, then this structural shift in farming should generate additional income, either directly to farmers or to consumers through lower food prices. More income affords more resources to be devoted to environmental research and management.

Characterizing environmental quality as a "luxury" good is not completely accurate. The context in which it is used here does not fit an economist's definition of a luxury good, and if we degrade our environment to the point where it becomes unhabitable, the word "necessity" becomes a more appropriate adjective. "Luxury" is used to emphasis the reality that food and fiber requirements to insure human survival will take precedence over environmental quality. Dr. Bernard Yokel, past director of the Rookery Bay NEP and current president of the Florida Audubon Society, commented that you can't expect people to become environmentalists on empty stomachs. Conversely, full stomachs allow people the "luxury" to look around, think, and contemplate.

The prospect of "empty stomachs" increases as we approach the next millennium. Within our children's lifetime, world population is expected to increase by 4 billion people (Avery and Avery). Much of the population growth is taking place in areas that are already economically depressed. Agricultural producers will face even greater challenges to increase global food production without unduly impairing environmental resources. Avery and Avery propose intensifying production on existing farmland to save remaining natural habitats from being converted into farmland. If factory farms represent a more efficient utilization of agricultural resources, then from a global perspective, factory farms could be viewed as a part of a sustainable solution.

Whether factory farms help or hurt the environment, they will likely snuff out any warm and fuzzy feelings the general non-farming public may have reserved for family owned and operated farms. Public perception will regard a factory farm as simply another business. As a result, agriculture will not be likely to enjoy any deference it once had. When the general public asks for new environmental policy actions, which run counter to agricultural interests, voluntary compliance may no longer be an option.

When many advocates of sustainable agriculture debate issues of farm structure, they include sociological arguments about the importance of rural communities and how small independent farms are vital to the health of rural communities. Maintaining and enhancing the economic viability of rural communities are important issues and the development of factory farms may significantly disrupt those objectives. However, given that farm income and environmental quality sometimes work at cross- purposes, I believe it is important to clearly separate environmental issues from sociological issues. Imposing objectives that solely promote an agrarian way of life may defeat, or at least complicate, the mission of maintaining (improving) farm profits and improving environmental quality. Further, as previously mentioned, the corporate, factory style of farming may offer some environmental benefits that we do not yet fully appreciate.

So What

In this presentation, I have proposed that we are attempting to define agriculture's impact on the environment in the mist of changing environmental perceptions and emerging industrial farming technology. I would like to conclude with a "take-home" message that is applicable for the audience attending the 1996 AAEA preconference on sustainable agriculture.

All of us attending this conference are involved with agricultural extension. Either our job title defines us as an extension agent or we are engaged in research projects that directly apply to production issues. If we are prepared to change and adapt our orientation, there exist some exciting opportunities for the Cooperative Extension Service to play an even larger role in the agricultural landscape.

My concern is that when Ostrich left the A.P. E., he assumed directorship of the Extension Service. Ostrich's perspective fit the traditional role of the extension service -- to be a conduit of information between agricultural producers and agricultural scientists. However, today agricultural producers only comprise two percent of the American public. More importantly, the social distance between farmers and non-farmers has increased with time. Consequently, fewer and fewer people appreciate the economic and environmental realities associated with agricultural production. The 98 percent have continued to demand a constant supply of affordable food. At the same time, they have expressed an increased demand for improved environmental quality. Disputes have already arisen over how to achieve the dual objectives of affordable food and quality environment. Through its mission of providing researched-based information, the Extension Service is in the best position to build bridges between the diverging agricultural interest and the general public. The traditional conduits of information need to include the non-farming communities. The general public needs to relearn the economic and environmental realities of agricultural. The Extension Service has the opportunity to expand its role and provide the non-farming public with agricultural production information. In turn, the Extension Service needs to convey the public's concern about environmental quality to agricultural producers. With the cooperation of scientists at the land grant universities,

solutions could be found which are acceptable to a majority of people and which allow food and fiber to be profitably produced with enhanced environmental quality.

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Emerging Demands on Our Food and Agricultural System: Developments in Environmental Labeling

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Society's demands for a more environmentally sustainable economy are increasingly coming from a new source—the market. The market is a new source because environmental demands have traditionally been expressed through the political system and communicated to industry by government regulations, taxes, subsidies, and the like. However, over the last decade, a growing number of consumers have been demanding more environmentally friendly products, and manufacturers have been meeting that demand by voluntarily including a growing number of environmental claims on their product labels.

The growing use of environmental labeling has created two controversies. One is over the potential for consumer deception. For example, a label claiming that a product is "environmentally friendly" is vague and hard to substantiate. The key issue is what types of environmental labels are or are not deceptive. The second controversy is about whether environmental labels should also serve environmental policy objectives. In other words, some people believe that environmental labels should not only be truthful, but reduce the environmental impacts of consumption.

To see how these two controversies differ, consider the following example. Labels of some agricultural plastic mulch films claim that they "will break down into small pieces if left uncovered in sunlight." This is a truthful claim, but the claim does not result in less solid waste in the environment because the small pieces of plastic do not compose into natural soil particles or humus (U.S. EPA 1993a, p.112).

Attempts to make environmental labeling serve environmental goals have given rise to the concept of ecolabeling. Ecolabels are seals of environmental approval awarded by public or private organizations. More than 20 countries and the European Community have adopted ecolabeling programs.

The objective of this paper is to describe developments in environmental labeling and ecolabeling and to explore marketing and policy implications for the food and agricultural system. The first section describes developments in environmental labeling policy in the U.S. Section two describes ecolabeling developments. The third section assesses key issues, implications for the food and agricultural system, and research needs. The final section summarizes major themes.

Environmental Labeling

The main issue over truth in environmental advertising concerns voluntary claims made on products, not mandatory claims. Mandatory environmental labeling on U.S. consumer products dates back to the 1970s when several laws and regulations were adopted requiring specific types of environmental labels on products. The household appliance energy guide was mandated by the 1975 Energy Policy and Conservation Act (U.S. EPA 1993b, p. 176). In 1977, the Food and Drug Administration (FDA) and the Consumer Product Safety Commission (CPSC) required products that used a CFC propellant to carry a warning that use of the product may harm public health and the environment by reducing

ozone in the upper atmosphere (U.S. EPA 1993b, p.173). The Toxic Substances Control Act (TSCA) enacted in 1976 required toxic chemicals to be labeled for hazards to humans and the environment (U.S. EPA 1993a, p.160). The Federal Insecticide, Rodenticide, and Fungicide Act (FIFRA) of 1947, as amended, has long required pesticides to be labeled for hazards to humans and the environmental (U.S. EPA 1993b, p. 152).

Voluntary environmental labeling of products in the U.S. also dates back to the early 1970s, but it was a relatively rare phenomenon compared to today. For example, Ex-Cello Corporation advertised that its Pure-Pak milk cartons were biodegradable, and Standard Oil of California claimed that its gasoline additive reduced emissions (Grodsky, p.154). However, the U. S. Federal Trade Commission (FTC) found these labels to be deceptive and issued consent orders against both companies.

Voluntary environmental labeling increased substantially in the late 1980s in response to a sudden growth in "green consumerism." By 1989, marketing surveys in both Europe and the U.S. were reporting that the majority of consumers wanted to purchase green products (U.S. EPA 1993a and 1993b; Cairncross, 1992, Ch. 9). In 1991, 13.4% of new products were classified as "green" compared to only 0.5% in 1985 (Peattie, p.171). The surge in green consumerism has been attributed to the heavy news coverage of global warming and ozone depletion, and the publication of books (e.g., Makower et al.) in the U.S. and Europe informing consumers of how to purchase green products.

A study prepared by Abt Associates for the U.S. Environmental Protection Agency (U.S. EPA 1993a) found that the percentage of new products with voluntary environmental labeling increased from 5.9% in 1989 to 11.4% in the first half of 1992. The product categories they found to have the largest number of voluntary environmental labeling claims were foods and health and beauty aids (p.29). The most frequent type of environmental claim they found on any new product was about nonuse of certain chemicals in production or product formulation (e.g., organic, no pesticides, no phosphates, no fluorocarbons).[1] The second most common claim related to solid waste (e.g., recyclable, degradable, recycled).

Most environmental labeling in the U.S. focuses on the environmental impacts associated with consumption, not production, of a product. For example, consumption of some products requires use of inputs such as energy or water. Thus, products may advertise energy or water conservation features. Similarly, consumption of some products results in emission of harmful chemicals or the creation of significant noise during product use. Thus, products may advertise may advertise the lack of certain ingredients that cause pollution. Disposal of a product and its packaging create sold waste problems. Thus, products may advertise that they are recyclable, refillable, weigh less, or use less packaging.

However, a few voluntary environmental labels pertain to the environmental impacts of the process used to produce the product. Perhaps the most widely known is the organic label on food, beauty, and clothing products. For the last several years, some brands of canned tuna have been labeled as "dolphin safe." Some wood products are advertised as made without chlorine or as coming

[1]It is interesting to note that the study classified "organic" and "no pesticides" as examples of environmental labeling since they could be interpreted as health claims as well. They report that six times as many health claims as environmental claims were made for new food and beverage products over the same period, not including the "organic" and "no pesticides" claims (U.S. EPA 1993a, pp.35-36).

from sustainably harvested forests. Production-related claims have the most potential to affect agriculture

The growth in voluntary environmental labeling has caused several types of consumer confusion (U.S. EPA 1993a, 1993b). One source of confusion is the lack of a common definition of voluntary environmental product claims. Some voluntary environmental labels are general, such as "environmentally friendly" or "eco-safe." Some are very specific, such as "50% post-consumer recycled content" or "100% recyclable packaging." Others are somewhere in between, including terms such as "recyclable," "recycled," "biodegradable," "ozone friendly," and "source reduced." The more general the claim, the more likely a consumer will misunderstand its meaning. Consequently, general claims may deceive consumers about the amount or type of environmental improvement that comes from purchasing labeled rather than unlabeled products.

A second source of consumer confusion is that the environmental improvement resulting from use of a product depends on the context in which it is used or disposed. For example, recyclable products are not environmentally useful if there is no recycling collection available to a consumer. Similarly, biodegradable products are not environmentally useful if products are disposed of in incinerators or sanitary landfills. These kinds of environmental claims can deceive consumers who are unaware of the context in which they use a product.

A third source of consumer confusion is that most environmental labeling claims are not easily verified by consumers either before or after purchase. For example, the ozone friendliness or recycled content of a product cannot be directly verified by a consumer. Private enforcement of voluntary environmental claims is impractical because proving damages is difficult (Grodsky).

A fourth source of potential consumer confusion is that environmental labels may obscure other environmental harms associated with consuming or producing a product (Grodsky). The problem is that by focussing on a single environmental attribute of a product, a consumer may unintentionally do more environmental harm than good. For example, a cosmetic product may be advertised as ozone friendly because it does not contain CFC propellants, but the same product may contain harmful volatile organic compounds. Batteries may be advertised as mercury free, but contain other hazardous chemicals. Fluorescent bulbs may be advertised as energy efficient, but emit harmful mercury vapor when disposed. Cloth diapers may be advertised as reducing solid waste compared to disposables, but they also require more water and waste water treatment.

Surveys of U.S. consumers in 1990 and 1991 found that they did not know what many voluntary environmental labeling terms meant and were questioning their credibility (U.S. EPA 1993a, 1993b, 1994). For example, a marketing survey done in 1991 found that more than 40% of respondents did not believe that products labeled as environmentally friendly were actually better for the environment. However, at the same time, other surveys were reporting that almost half of U.S. consumers had recently purchased a more expensive product because of environmental concerns.

Section 5 of the U.S. Federal Trade Commission Act makes unlawful deceptive acts and practices in or affecting commerce. The FTC has brought more than 50 consent orders against companies making false or deceptive environmental marketing claims. However, this case by case approach became unwieldy as the number and type of voluntary environmental marketing claims grew. At the same time, a number of states were developing their own environmental advertising standards and calling for the development of federal standards (Grodsky; U.S. EPA, 1993b).

In 1992, the FTC promulgated a guide for the use of voluntary environmental marketing claims (U.S. FTC 1992). The guide does not have the force of law, but provides a "safe harbor" in the sense that if a company adheres to the guide, the chance of subsequent legal action by the FTC is reduced. The guide does not address the issue of whether environmental claims should be allowed on products. Rather, it is limited to resolving the issue of what constitutes a truthful or deceptive environmental claim.

The FTC guide lays out general principles that apply to all types of voluntary environmental claims about products. These principles state that claims must have a reasonable basis for substantiation, be clearly communicated to consumers, distinguish between a product and its packaging, not overstate environmental benefits, and provide a clear basis for comparison when a comparative claim has been made.

The substantiation principle is particularly important because it requires companies to maintain credible, objective proof supporting their claim. Such proof may include product testing or observation of production practices by a third party certifier such as Underwriters Laboratories. Note that certification services improve the credibility of the claim, but do not determine what the nature of the claim should be.

The FTC guide makes an important distinction between general and specific environmental marketing claims. General claims refer to the overall environmental benefit of a product. Specific claims refer to a particular type of environmental benefit. The meanings of seven types of specific environmental claims are discussed in the guide: (1) degradable, biodegradable, or photo degradable, (2) compostable, (3) recyclable, (4) recycled content, (5) source reduction, (6) refillable, and (7) ozone safe or ozone friendly.

The FTC guide discourages the use of general and encourages the use of specific voluntary environmental claims (Grodsky, U.S. EPA 1993b). The guide states that unqualified, general claims of environmental benefit such as "eco-safe" are "difficult to interpret" and "may convey a wide range of meanings to consumers." The guide does not rule out such general claims if they can be adequately substantiated, but the means of doing so are not discussed. In contrast, the guide encourages the use of specific environmental claims by giving examples of several types that the FTC would or would not deem to be deceptive.

The examples of specific claims in the guide refer mainly to consumption-related environmental impacts, but not production-related claims. Thus, production-related claims do not have as safe a harbor as consumption-related claims. Moreover, general claims related to the process used to make the product are almost certain to be ruled as deceptive. For example, a label bearing the claim "sustainably harvested" would most likely be considered deceptive because it currently has no commonly accepted meaning.

Despite the fact that "organic" labels are one of the most frequent forms of environmental labeling (U.S. EPA 1993a), the "organic" claim is not addressed in the FTC guide. Presumably, the reason is that "organic" has a commonly understood meaning within the law. The 1990 Organic Foods Production Act establishes a national standard for defining and substantiating organic claims. That Act authorizes the U.S. Department of Agriculture (USDA) to develop specific organic production and handling standards and permits use of a USDA seal on products that have been certified by a federally accredited certifier to meet those standards.

The FTC guide addresses all but one of the sources of potential consumer confusion described above. It addresses the problem of unclear claims by discouraging general claims and requiring qualifications on the label to clarify the meaning of specific claims. It addresses the problem of context by giving examples of deceptive use of specific environmental claims. It addresses the problem of verification by requiring companies to maintain evidence that may be used to reasonably substantiate the claim. It does not address the problem that specific claims may obscure other, unrelated environmental harms associated with producing, consuming or disposing of a product. It is exactly this latter source of potential consumer confusion that ecolabels seek to address.

In many respects, the FTC guide is similar to environmental labeling guidelines being developed at the international level. The International Standards Organization (ISO) has proposed and will soon adopt international standards for environmental labeling known as ISO 14020, 14021, 14022 and 14023. These labeling standards are part of the broader set of standards on environmental management systems and environmental audits known as ISO 14000 (Kuhre). These standards will probably facilitate further development of environmental labeling.

Like the FTC guide, the ISO standards state that environmental labels should not be deceptive and should be accurate, based on credible scientific evidence, and verifiable. General claims such as "environmentally friendly" are discouraged. Companies are advised to maintain information that can substantiate the environmental claim. The ISO standards go a bit further on this point of substantiation by stating that this information should be made available to any interested party upon request.

The main point of contrast is that the ISO standards encourage production-related environmental claims. The draft guidelines state as a general principle that the development of environmental labels should, wherever appropriate, take into consideration the life cycle of the product or service. The life cycle of a product is defined to range from extraction of raw material for manufacture to final disposal.

In summary, this section has distinguished mandatory versus voluntary, consumption-related versus production-related, and general versus specific environmental labeling claims. U.S. policy includes both mandatory and voluntary environmental labeling, but the voluntary claims are the main source of controversy. Most environmental labels focus on environmental impacts of consuming a product, but a few relate to the process used to produce a product. U.S. policy on voluntary environmental labeling discourages general and encourages specific claims related to the impacts of consumption. It also provides more of a safe harbor to consumption-related than to production-related claims. The exception to this rule is organic claims, which are treated under a different legal framework. In contrast, international policy encourages production-related claims in environmental labeling.

Ecolabels

The growing demand for green products has given rise to the development of a new environmental policy tool. More than 20 countries and the European Community have initiated programs that award seals of environmental approval to consumer products, commonly known as "ecolabels" (U.S. EPA, 1993b, 1993c, 1994). The main objective of these ecolabeling programs is to reduce environmental impacts over the entire life cycle of a consumer product including its manufacture, consumption, and disposal. Ecolabels are believed to achieve this objective by changing consumer purchasing behavior,

thus, creating incentives to producers to produce less environmentally harmful products and develop cleaner technologies. Another objective of ecolabel programs is to prevent deceptive environmental advertising by providing expert objective assessment of the environmental benefits of a product.

The U.S. federal government has not initiated a government ecolabeling program, but has proposed government procurement guidelines on the acquisition of environmentally preferable products and services using life cycle criteria similar to ecolabeling programs (U.S. EPA, 1995). Two private companies in the U.S. have launched ecolabel programs (U.S. EPA, 1993b, 1993c). However, concern about the potential for false and deceptive private ecolabels has prompted the introduction of legislation on ecolabeling in Congress (Grodsky).

Within the framework of the previous section, ecolabels would be classified as voluntary, general claims about consumption-related and production-related environmental impacts of a product. Thus, it would seem that ecolabels are discouraged by U.S. policy.

However, an ecolabel has an additional characteristic that addresses the FTC concern about unqualified general environmental claims being difficult to interpret. An ecolabel claim is defined by a set of publicly available, uniformly applied environmental standards that products must meet. The key task of the agent awarding the ecolabel is setting these standards, more commonly referred to as award criteria. It is the standard setting task that addresses the question of which environmental standards are desirable, and, thus ecolabels may be used as a policy instrument.

Ecolabeling programs also address the FTC concern that environmental claims on products are backed by reasonable evidence to substantiate the claim. This is done by either providing, contracting out for, or requiring a company to acquire certification that products meet the ecolabel award criteria.

It is crucial to distinguish the standard setting task from the certifying task of ecolabeling programs because they are confused in the existing literature. For example, a series of EPA studies on environmental labeling equates ecolabels with environmental certification programs (EPA 1993a, 1993b, 1993c, 1994). Certification does not involve standard setting. Rather, it involves product testing or observation of production practices to determine whether a product meets a given set of standards. The standards to be met could be government standards, industry standards, the company's product standards, or an ecolabeling organization's standards. Certification determines whether an environmental claim is factual, not whether it is desirable.

In contrast, standard setting determines what constitutes a desirable environmental claim, not which claims are factual. Thus, it is probably more accurate to call an ecolabel an environmental endorsement or seal of approval rather than an environmental certification program. An ecolabel is like an endorsement or seal of approval because it is a signal of high standards as well as a signal that products meet standards.

An ecolabel organization may be a governmental agency, a quasi-governmental body, or a private entity. This organization owns its environmental endorsement symbol or trademark. It licenses the use of its mark for a specified period of time, usually two or three years.

For example, Green Seal is a private ecolabeling program operating in the U.S.. Green Seal concentrates on developing the environmental standards for products within a particular product category. The certification task is contracted out to Underwriter Laboratories. If a product is

certified to meet its standards, Green Seal licenses its mark to manufacturers, subject to various contractual terms such as periodic monitoring (US. EPA 1993b, pp.72-76).[1]

The other private ecolabeling program in the U.S. is offered by Scientific Certifications Systems (SCS). Rather than licensing a mark or seal, SCS licenses an "Environmental Report Card" that gives a product scores on several different types of "environmental burdens" incurred over the entire life cycle of a product. These include energy use, depletion of seven types of renewable and nonrenewable resources, nine categories of air emissions, three categories of water emissions, and two categories of solid waste. The scores for each type of environmental burden are displayed in a bar chart that ranges from low to heavy burden (U.S. EPA 1993c, pp.41-44).

Unlike the U.S., ecolabeling programs in other countries are run by or on behalf of a governmental agency. Often these are independent nonprofit organizations or councils operating under guidance of the country's environmental ministry. These organizations often involve representatives of citizen, environmental, labor, and industry groups, as well as panels of scientific experts, in the standard setting process.

The oldest ecolabeling program is Germany's Blue Angel seal which was established in 1977. As of 1993, the program certified 3,503 products in 75 categories. According to a 1988 survey, the Blue Angel is recognized by 79% of German households (U.S. EPA 1993b, p.44). Canada's Environmental Choice program was founded in 1988. During its first four years of operation it awarded its EcoLogo to over 750 products. A 1992 survey found that 42% of consumers recognized the logo (EPA 1993b, p. 50). Japan's EcoMark program was established in 1989. As of 1992, it had issued awards to 2,300 products in 49 categories. A survey in 1990 found 22% of the public was aware of the program (U.S. EPA 1993b, pp.56-57). Many other government ecolabeling programs have been established since 1989 in Europe, Scandinavia, Asia, South America, and the South Pacific region.

In most programs, private or public, the standard setting process is very lengthy and usually involves some variation of the following steps.[2] First a product category is identified by the ecolabeling organization, typically through proposals from industry or environmental groups. The next step is to develop a description of the stages of a product's life cycle and the kinds of environmental impacts associated with each stage. This might include extraction of raw materials, manufacturing, distribution, product use, and disposal. The next step is to identify the kinds of environmental impact associated with each relevant life cycle stage. In practice, it is impossible to examine all impacts, so most programs try to identify those impacts which differ the most across different companies' products. Standards are then proposed for reducing these environmental impacts. These standards are made available for public review and comment. The standards are revised to reflect public comment and then finalized. A scientific review panel and an appeals process may also be part of the standard setting process. Finally, periodic review may be included to ensure that standards reflect technological progress.

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[1]Further information on Green Seal in available at their web site (http://www.greenseal.org).

[2]This description of the standard setting process is a highly condensed summary of detailed information on ecolabeling programs described in a series of four reports commissioned by the U.S. EPA (1993a, 1993b, 1993c, 1994).

Most ecolabeling organizations describe their assessment process as based on the product life cycle concept, and several use a streamlined version of life cycle assessment methods (LCA). LCA is defined as involving four sets of tasks (U.S. EPA 1993c). In the context of ecolabeling, the first task is to define what constitutes the life cycle of a product. This is necessary because some relevant bounds must be put on when the life cycle begins and ends. The second step involves an inventory of environmentally significant inputs (e.g., energy, water) and outputs (emissions to air and water, solid waste) throughout the various life cycle stages. The third step is to assess the impacts of environmental inputs and outputs on ecosystems, human health, and natural resource stocks. Of all these steps, this is the most controversial because there is still great scientific uncertainty about the fate and effects of various pollutants. The final step is to evaluate options for reducing environmental impacts throughout the product's life cycle.

The LCA method reflects concerns about the piecemeal approach of current environmental policy and the desire to take more of a systems approach to environmental improvement (Arnold; Allenby and Richards). The piecemeal problem arises because most environmental regulations focus on controlling one pollutant at a time in one particular media. For example, EPA develops regulations for each type of pollutant emitted into water. The overall effects of all pollutants in all media are not considered under this approach, nor is it feasible to consider them all. As a result, it has been suggested that government should also focus on encouraging the development of "clean technologies." Ecolabeling that is based on the LCA concept is one way to provide the encouragement.

Currently, there is a great deal of variety in the award criteria of ecolabeling organizations worldwide.[1] The main difference is the extent to which a program focusses on all the stages of a product's life cycle and which environmental impacts in each stage are actually considered (U.S. EPA 1993c). None perform a complete LCA partly because of the extremely data intensive nature of LCA, but also because there is still no scientific consensus on what constitutes a valid and reliable LCA.

Several organizations are working toward harmonizing ecolabeling programs. The Global Ecolabeling Network (GEN) is a voluntary organization of national and multinational "Ecolabel Licensing Organizations." One objective of GEN is to examine the establishment of an ecological criteria databank.[2] The United Nations Task Force on Environmental Labeling is facilitating discussion of principles of equivalency in ecolabeling environmental criteria and potential international trade issues such as mutual recognition of ecolabeling schemes. Because the concept of LCA is central to many ecolabel programs, the U.S. EPA, the Society for Environmental Toxicology and Chemistry (SETAC), and other organizations have been working together to produce a scientifically acceptable and policy relevant version of LCA.

Economists are beginning to question the validity of LCA. Arnold argues that, aside from being extremely difficult to do, LCA cannot provide one right answer about which products are the most environmentally benign. He argues, for example, that cloth diapers are more environmentally benign

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[1]A detailed description of the award criteria of different organizations world-wide can be found in U.S. EPA 1993b.

[2]Further information about GEN and its ecolabeling members can be obtained at the GEN web site (http://www.interchg.ubc.ca/ecolabel/gen.html).

if a consumer lives in an area with adequate water and energy supplies and limited landfill space, while disposables are better in the reverse case. Cairncross (1995) argues that putting bounds on the life cycle of a product is arbitrary and the method provides no way of making tradeoffs between different categories of pollution. For example, LCA does not provide a way to compare a product that creates less air pollution, but more water pollution than another product that has the opposite environmental impacts.

In summary, the purpose of ecolabels is to encourage consumption and production of more environmentally benign products, thus reducing environmental impacts. Unlike environmental labels, ecolabels embody environmental standards. Products must be certified to ensure that these environmental standards are being met Thus, ecolabels are essentially an environmental endorsement or seal of approval. Because they are based on stringent environmental standards, ecolabels may be used as an environmental policy tool for encouraging the development and adoption of clean technologies. The most controversial aspect of ecolabeling is setting the environmental standards. Most programs apply the concept of a product life cycle when setting standards, so ecolabels involve standards on both production-related and consumption-related environmental impacts. Scientific and policy consensus has not occurred yet on the particulars for performing life cycle assessment, but many organizations are working to make it an acceptable analytical tool.

Implications for the Food and Agricultural System

Agricultural products are not currently being addressed in ecolabeling programs. This is probably partly due to the fact that there are national and international standards for organic agriculture. However, organic standards are based on a different philosophy than ecolabel standards. An ecolabel standard is expressed in terms of environmental improvement throughout a product life cycle, but production practices are not specified. A company that can demonstrate that its practices provide more overall environmental improvement than practices used by others producing the same product may qualify for the ecolabel. In contrast, organic standards specify or prohibit certain production practices and input use, but do not require proof of environmental improvement.

Ecolabels and LCA provide potential vehicles for defining sustainable agriculture. Sustainable agriculture consists of many practices that are environmentally beneficial, but are unique to the ecological conditions of a particular farm. Since ecolabels are defined in terms of potential environmental impact rather than in terms of specific production practices, they are more flexible than organic certification programs. Perhaps lessons can be drawn from the definitions of sustainable forestry that are emerging in ecolabeling programs.

It is possible that other kinds of specific environmental labels could be used in agriculture, but they would require substantial industry efforts to ensure they met the FTC guidelines. For example, it may be possible to develop labels relating to the use of integrated pest management practices. However, FTC rules would require that such labels have a common meaning and be backed by credible evidence to substantiate the claim. This would no doubt require special record keeping and product testing. However, some of this record keeping is already being practiced on farms.

While it may be possible to use ecolabeling or environmental labeling in agriculture, it is less clear whether such efforts would be worthwhile. From a marketing standpoint, the question is whether labeling would increase market share and yield price premia sufficient to cover the extra costs of labeling. The answer to this question is unknown. From a policy perspective, the question is whether

such labeling is potentially deceptive and whether environmental improvements would actually result. The answer to this question is also unknown. There are also other troubling policy questions such as whether ecolabels may violate antitrust laws or become barriers to international trade (Grodsky).

From a marketing standpoint, the demand for "green" products presents potential opportunities and threats to the food and agricultural system. The opportunities may arise in at least three areas. One potential opportunity is that consumer product companies may eventually seek to enhance their market share by using ecolabeling. Since ecolabeled products favor the use of sustainably produced products, there may be a new demand for sustainably produced agricultural outputs. Ecolabels also give preference to renewable resources over nonrenewables, so there may be new demands for using agricultural products as feedstocks or inputs in the production of more consumer products. Ecolabel programs can provide a new kind of direct marketing tool. For example, Green Seal has established an Environmental Partners Program which organizations can join by pledging to use more environmentally benign products. The program provides members with information about environmentally preferable products. This may be a potential opportunity for fresh market producers and cooperatives on the cutting edge of sustainable agriculture. Ecolabeling of agricultural inputs may also improve a firm's reputation to government regulators as well as buyers.

The threats arise from the hurdles that have to be met to qualify for a label and to ensure an environmental label is worth the cost. Markets may be too thin to generate sufficient sales volume. The costs of certifying may be too steep. The presence of ecolabeled products in the market may have negative effects on the price and sales of unlabeled products. Companies may lose control over their own production process and marketing decisions. Private ecolabeling agents and certifiers may not be stable, credible or honest. Ecolabels may be ruled as a barrier to international trade.

From a policy standpoint, it is not clear whether green consumerism helps or hinders environmental progress. While there has been much economic analysis of other environmental policy tools, there is almost none on environmental labels, ecolabels, and life cycle analysis (Arnold; Mattoo and Singh). Economic analysis of the traditional environmental policy tools has revealed many unintended consequences. No doubt the same will be true of environmental labels and ecolabels. For example, the specific environmental labeling approach advocated by the FTC may cause consumers to optimize on a single environmental attribute, leading to an increase in other types of environmental harms. Similarly, an ecolabeling program may cause consumers of less resource intensive goods (e.g., brooms) to switch to more resource intensive goods (e.g., vacuum cleaners) because versions of the latter goods are ecolabeled. Possible unintended consequences of this sort need to be investigated.

Summary of Key Points

There are two key policy issues related to the growth of environmental labeling. One is how to ensure that such claims are truthful. A second is whether such claims should result in environmental improvements. U.S. policy addresses the first of these policy issues and basically considers the second question moot. The rest of the world has come to regard ecolabels as a new tool for achieving environmental policy goals.

In the U.S., policy favors the development of environmental labeling that involves specific claims related to the environmental impacts of consuming, but not producing products. In the rest of the world, policy favors ecolabels that seek to reduce the environmental impacts associated with all stages

of the life cycle of a product from cradle to grave. U.S. policy does not rule out private labeling of this sort, but it does not encourage either.

Future development of ecolabeling is likely. More than 20 countries have ecolabeling programs and they have formed an international organization to facilitate harmonization across programs.

Ecolabeling presents both opportunities and threats to agriculture and the food system. Perhaps the most important opportunity is that the life cycle approach of ecolabeling provides a potential framework for clarifying the definition of sustainable agriculture and showing how it differs from organic agriculture.

From a policy perspective, it is not clear whether we are better off with either environmental labeling or ecolabeling. Economic analysis is needed to find whether there are unintended consequences of these new policy tools.

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Maintaining The Profitability of Agriculture

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Sustaining Profitability

Over most of the past century, profits from farming have gone primarily to those who found ways to reduce costs first and expand production the fastest. However, each new round of cost cutting technology has resulted in increased production and lower prices, erasing initial profitability. Late adopters have been motivated by survival rather than profitability and chronically declining prices have forced the laggards out of business. A relentless, never-ending search for new sources of profits has been a necessity of survival.

This paper deals with profits from farming, not profits from the whole of agriculture from input suppliers to retailers. However, American farmers have utilized the same basic model as American industry, including agribusiness, in their pursuit of profits. That model is commonly referred to as the industrial model. The fundamental characteristics of the industrial model are simplification, specialization, routinization, and mechanization. Profits through industrialization are associated with such economic concepts as division of labor, opportunity cost, comparative advantage, and economies of scale.

Adam Smith's *Wealth of Nations*, the foundation for modern economic theory, was published in the early stages of the industrial revolution. Its ultimate wide acceptance among economists was no coincidence. The economic world view of Adam Smith fit perfectly with the world view of the industrialists. The promise of greater profits provides a powerful motivation for change. The idea that an "invisible hand" would automatically transform individual greed into public good freed decision makers to pursue their narrow self interests, confident they were serving broader public interests as well. Each person could be rewarded most and contribute most by exploiting their individual comparative advantage, whether on farms, assembly lines, or boards of directors. Mechanization removed the drudgery of the most routine tasks by eliminating the economic opportunity for people to pursue such work.

Industrialization of agriculture has consistently lagged behind industrialization in most other sectors, but the process accelerated dramatically in the early 1900s. At that time the potential societal gains from continuing the industrial revolution in the larger society were undeniable. We were still an agrarian society. More than half of the people of this country were either farmers or lived in rural communities, and it took about half of our total resources—money, time, and effort—just to feed and cloth ourselves. If we as a nation were to realize the emerging opportunities of the industrial revolution—to become the modern society we know today—we had to accomplish two things. First, we had to free people from the task of farming to go to work in factories and offices of the emerging industrial economy. Second, we had to free up income and other resources spent on food and clothing so people could buy the things these new industries were going to produce. In short, American agriculture had to become more efficient. We had to make it possible for fewer farmers to feed more people better at a lower real cost.

Industrialization allowed agriculture to fulfill its public mandate. Through specialization, mechanization, simplification, and routinization nature was bent to serve the needs of humanity. Farmers gradually harnessed the vagaries of nature and transformed their farms into factories without roofs. Fields and feed lots became biological assembly lines with inputs coming in one side and commodities coming out the other. Economies of large-scale, specialized production were achieved as the principles, strategies,

and technologies of industrialization were applied to farming. Publicly funded research and education developed many of those new industrial technologies and strategies and transferred them from the experiment station to the farm.

Through industrialization, American agriculture became the most efficient agriculture in the world, at least in terms of the dollar and cent costs of production. This in turn made it possible for this nation to build the strongest economy in world. The agricultural sector takes just pride in its past successes. But the objectives of industrialization have been achieved. The things that industrialization could do for America have already been done.

Today, less than two percent of the people in this country today are farmers. Today, as a nation, we spend only about ten percent, or a dime out of each dollar, of our disposable income for farm produced food. Equally important, the farmer gets only a single penny out of that dime, while nine cents goes to the marketing and input firms. We now pay more for packaging and advertising that we pay the farmer to produce the food. Future societal gains from the further industrialization of agriculture must be squeezed from the farmer's penny. Food would cost only ten percent less on average if the farmer got nothing. It simply doesn't make much difference to society any more whether there are more or fewer farmers or whether farmers are more or less efficient.

Future profits of farmers must also be squeezed from the "farmer's penny," if they continue to use the industrial model. And, the more they squeeze out, the less there is left to squeeze. Thus, farm profits simply cannot be "sustained" through continued industrialization of agriculture. In fact, farming cannot be sustained if we continue to industrialize agriculture. Stewart Smith points out that if past trends were to continue until the year 2020, there would be no farming sector remaining in agriculture (Smith, 1993). The farming sector would be totally absorbed into the input and marketing sectors.

American farmers must shift to a model or paradigm other than industrialization if there is to be any hope of sustaining profits from farming in the future. Agricultural economists must adopt a model or paradigm other than the traditional economic model if we are to be of any use to farmers in making this transition. The profit maximization model has succeeded in virtually eliminating the potential for future profits from continued use of that model by farmers.

The Great Transformation

There is hope for sustainable farm profits. Continued industrialization is not inevitable. Peter Drucker, a time-honored consultant of twentieth century industrial managers, believes were are in the middle of a great transformation from an industrial to a post-industrial society. In his book: *The Post-Capitalist Society*, he states: "Every few hundred years in Western history there occurs a sharp transformation. Within a few short decades, society rearranges itself – its worldview; its basic values; its social and political structure; its arts; its key institutions. Fifty years later, there is a new world.... We are currently living through just such a transformation." (1994 p. 1). Drucker contends the current transformation began in the early 1970s.

A potential new paradigm for farming profitably in the post-industrial century is emerging from the search for a more sustainable agriculture. Sustainable agriculture has no universally accepted definition. However, one thing is becoming increasingly clear. Agricultural sustainability will require changes far more significant than simply fine tuning the environmental and social constraints of the profit maximizing model of economic efficiency. History will quite likely reveal the most significant aspect of the sustainable

agriculture movement to be the emergence of a new mental model, mind set, or paradigm for decision making.

This new sustainable agriculture paradigm demands that we economists rethink some of the fundamental assumptions of our discipline. For example, the assumptions that all rational decision makers maximize profits and thereby promote the public good are obsolete if not outright erroneous. Such assumptions form the foundation for traditional economic analysis of agriculture, whether related to farms, markets, or public policy. The sustainable paradigm is about "balancing" rather than "maximizing." Utility, in terms of quality of life, is viewed as a product of healthy relationships, not just something achieved through acquiring more things.

The fundamental question of economics is the same for the new paradigm as for the old. How can people, individually and collectively, best allocate scarce resources to meet competing ends? The competing ends are the same: alternative sources of satisfaction, utility, or quality of life. It's the conceptual leap from utility to profitability that causes problems. The fundamental economic law of diminishing marginal returns – in consumption and production -- are unchallenged. However, the nature of causality between price and quantity and the feasibility of "holding other things constant" are questioned. In short, the new economic paradigm for sustainability is being build upon the same conceptual ground as the old paradigm of economic efficiency. But the foundation of our old economic paradigm is crumbling. Remodeling is not the answer. Sustainability dictates that we rebuild from the ground up.

Evidence of emergence of a new paradigm abound in economic sectors outside agriculture. While agricultural economists debate the characteristics of future stages of industrialization, much of the rest of society is already moving into a new post-industrial era of human social and economic evolution. This post-industrial era in not just an extension of industrial age thinking with new biological and information technologies. It is not about producing more things more efficiently. It is about producing different things, in different ways, for different reasons.

The industrial model of specialization, mechanization, simplification, and routinization seemed appropriate for meeting the needs of its time. Adam Smith's "invisible hand" seemed to guide market economies toward ever greater economic efficiency during the industrial era. However, the industrial era is giving way to a new era of human progress. The profit maximizing model for economic efficiency likewise must give way to a new paradigm—a paradigm adequate to meet human needs during the post-industrial century.

The industrial model made it possible for societies to rise above subsistence living. It removed much of the drudgery from work and made possible increased leisure time for pursuit of entertainment. But, industrialization appears fundamentally incapable of sustaining human progress. The economic benefits of industrialization have declined as its ecological and social costs have risen. The goal of sustainability reflects a new world view of sustainable human progress. Sustainable agriculture is just one little piece of something far greater that is literally transforming human civilization.

Agricultural economists have much to offer during this great transformation. The fundamental question is whether we help develop a new economic paradigm capable of meeting the challenge agricultural sustainability or continue to drift toward increasing irrelevance as we tinker with ideas whose time have past.

The End Of The Industrial Era

No trend goes on forever. A couple of scientists recently proposed to the world scientific community a list of their "Top 20 Great Ideas of Science." Some of the ideas on their top 20 list were the first and second laws of thermodynamics and the universal laws of motion. But, also on that list was the proposition that "Everything on earth operates in cycles," physical, biological, economic, and social (Science, p.1309). If this proposition is valid, the industrial era will end. The question is not whether but when.

Paradigms, such as industrialization, become dominant because they are found to be capable of exploiting new opportunities or solving problems that previous paradigms could not solve. The industrial era was fostered by a host of interrelated and complex developments, but among the most important was accessibility to large supplies of fossil fuels. However, those fossil energy supplies are being rapidly depleted by an expanding global economy. In addition, industrialization has generated a whole new set of unanticipated environmental and social costs.

Industrial systems historically have degraded their environment and depleted their natural resource base. For example, industrialization has transformed an agriculture created for the purpose of converting solar energy to human-useful form, into an agriculture that uses more non renewable fossil energy than it captures in solar energy from the sun. In addition, commercial fertilizers and pesticides, essential elements in a specialized, industrialized agriculture, have become a primary focus of concerns for environmental pollution.

Industrial systems also degrade the human resource base. Henry Ford is quoted as once saying the biggest problem in running a factory is that you have to hire whole people when all you need is two hands. Factory farms transform independent decision makers, into farm workers, people who know how to follow instructions or directions, but not necessarily how to think. Dee Hock -- founder, president, and former CEO of VISA -- states it very bluntly: "Newtonian, mechanistic, command and control pyramids of power were an anachronism of the Industrial age. They were not only increasingly archaic and irrelevant, they were a public menace" (Hock, p.10).

Industrial agriculture, like industry in general, is management extensive rather than management intensive. It allows fewer farmers to farm more land and produce more livestock by using more capital equipment, hiring more laborers, and purchasing more off-farm inputs. The new agricultural mega-farms and feed lots are no less mechanical and hierarchical in organization than are those deemed by Dee Hock to be anachronistic, archaic, irrelevant, public menaces.

The focus of industrialization is on production rather than people. As farms have grown larger and more specialized, agriculturally dependent rural communities have withered and died. Larger farms meant fewer farms and fewer farm families to support local schools, churches and public institutions, and retail businesses. In addition, larger farms tend to bypass local communities in purchasing production inputs and in marketing their products. The fundamental purpose of agricultural industrialization was to make it possible for fewer people to produce more. It takes productive people, not just production, to sustain local communities.

The industrialization of agriculture made sense as long as displaced farmers could find more productive employment in the larger economy. However, the days of good paying factory jobs are gone. American industries are reducing employment at all levels. Robots and computers are replacing people and eventually will do anything and everything that can be done without thinking. American industry simply doesn't need any more displaced farmers.

The growing environmental and social costs of industrialization may have more than offset its declining benefits as far back as two to three decades (Drucker, Hoval). Great transformations take time. But there is growing evidence that the industrial era is drawing to a close.

The Post-Industrial Era

Alvin Toffler—a futurist quoted by people with views so different as Speaker, Newt Gingrich and President Bill Clinton—points out that many forecasters simply present unrelated trends, as if they would continue indefinitely, without providing any insight regarding how the trends are interconnected or the forces likely to reverse them. The professional and popular agricultural press is filled with such forecasts for the future industrialization of agriculture.

Toffler contends that the forces of industrialization have run their course and are now reversing, that the industrial models of economic progress are becoming increasingly obsolete, and that old notions of efficiency and productivity are no longer valid. He contends that mass production is no longer a symbol of "modern" business operation. The new "modern" model is to produce customized goods and services aimed at niche markets, to constantly innovate, to focus on value-added products and specialized production. Toffler contends that mass production of basic commodities were the trends of the past, not the trends of the future.

Some contend that large industries will simply tailor specialized products for niche markets and continue the industrial trend. But the primary advantages of industrialization comes from being able to produce large quantities of the same basic things rather than from producing small quantities of lots of different things. Large firms realize that the profitable markets of the future are in the niches, but most also realize that as they target these markets, they become increasingly vulnerable to competition from small firms and independent producers. Thus, we see large industrial firms begin to decentralize, downsize, outsource, and otherwise begin to dismantle themselves to forestall their eventual competitive destruction by more flexible, innovative, creative, dynamic, smaller competitors.

Toffler goes on to state in his book *Powershifts:* "the most important economic development of our lifetime has been the rise of a new system of creating wealth, based not on muscle, but on the mind" (Toffler, p. 9). He contends that "the conventional factors of production—land, labor, raw materials, and capital—become less important as knowledge is substituted for them" (Toffler, p. 238). "Because it reduces the need for raw material, labor, time, space, and capital, knowledge becomes the central resource of the advanced economy (Toffler, p. 91). Toffler also states that separate and sequential systems that characterize industrial production are being replaced with synthesis and simultaneous systems of production. Synergism is replacing specialization as the primary source of new productivity.

Dee Hock states that "The most abundant, least expensive, most under-utilized, and frequently abused resource in the world was human ingenuity: the source of that abuse was the archaic, Industrial Age institutions and management practices they spawned" (Hock, p.10). He believes the era of knowledge and information-based human progress will be fundamentally incompatible with the industrial model or organization.

Drucker, in his book: *The New Realities*, talks of the "Post Business Society." He states, and I quote: "the biggest shift—bigger by far than the changes in politics, government or economics—is the shift to the knowledge society. The social center of gravity has shifted to the knowledge worker. All developed countries are becoming post-business, knowledge societies. Looked at one way, this is the logical result

of a long evolution in which we moved from working by the sweat of our brow and by muscle to industrial work and finally to knowledge work" (1989, p. 173).

Robert Reich, U.S. Secretary of Labor, addresses future trends in the global economy in his book, *The Work of Nations*. He identifies three emerging broad categories of work corresponding to emerging competitive positions within the global economy: routine production service, in-person service, and symbolic-analytic services.

He calls routine service workers the old foot soldiers of American capitalism in high-volume enterprises. These workers typically work for large industrial organizations and live primarily by the sweat of their brow, or their ability to follow directions and carry out orders, rather than by using their minds. In-person service, like production service, entails simple and repetitive tasks. The primary difference is these services must be provided person-to-person.

Symbolic-analysts are the "mind workers" in Reich's classification scheme. They include all the problem-solvers, problem-identifiers, and strategic-brokers. He points out that symbolic analysts often work alone or in small teams, which are connected only informally and flexibly with larger organizations. Like Toffler and Drucker, Reich believes that future human progress will result from symbolic-analysis, from mind work, rather than routine production or in-person services.

Drucker points out an important, fundamental difference between knowledge work and industrial work. Industrial work is fundamentally a mechanical process whereas the basic principle of knowledge work is biological. He relates this difference to determining the "right size" of organization required to perform a given task: "Greater performance in a mechanical system is obtained by scaling up. Greater power means greater output: bigger is better. But this does not hold for biological systems. There, size follows function. It would surely be counterproductive for a cockroach to be big, and equally counterproductive for the elephant to be small. As biologists are fond of saying, 'The rat knows everything it needs to know to be a successful rat.' Whether the rat is more intelligent than the human being is a stupid question; in what it takes to be a successful rat, the rat is way ahead of any other animal, including human beings" (Drucker, 1989, p. 259).

He concludes that differences in organizing principles may be critically important in determining the future size and ownership structure of economic enterprises. Other things equal, the smallest effective size is best for enterprises based on information and knowledge work. "'Bigger' will be 'better' only if the task cannot be done otherwise" (Drucker, 1989, p. 260).

But if all this is true, why are we currently seeing rapid industrialization in some sectors of the agricultural economy, specifically in hog and dairy production? In Joel Barker's book: Paradigms, he points out that new paradigms tend to emerge while, in the minds of most people, the old paradigm is doing quite well. Typically, "a new paradigm appears sooner than it is needed" and "sooner than it is wanted." Consequently the logical and rational response to a new paradigm is rejection (Barker, p. 47). New paradigms emerge when it becomes apparent to some people, not necessarily many, that the old paradigm is incapable of solving some significant problems of society. Aging paradigms may also be applied in situations where they are ill suited, creating major new problems while contributing little in terms of new solutions.

American agriculture provides a prime example of over-application of the industrial paradigm. The early gains of appropriate specialization in agriculture lifted people out of subsistence living and made the American industrial revolution possible. But the potential societal benefits from agricultural industrialization were probably largely realized by the late 1960s. More recent "advances" in agricultural

technologies may well have done more damage to the ecological and social resource base of rural areas than any societal benefit created by more "efficient" food production.

Industrialization of agriculture probably lagged behind the rest of the economy because its biological systems were the most difficult to industrialize. Agriculture by nature doesn't fit industrialization, it had to be forced to conform. Consequently, the benefits were less and the problems were greater. It is becoming fully industrialized last, and likely will remain industrialized for a shorter period of time.

Sustainable Agriculture: The New Paradigm

Joel Barker, in his book *Paradigms*, defines a paradigm as a set of rules that do two things: (1) defines standards of success and (2) establishes or defines boundaries and defined rules for behavior within the boundaries. He uses the game of tennis as an analogy to illustrate these concepts. Tennis courts are standard in size and out-of-bounds are clearly marked. The ball must hit within these bounds to "stay in play." The ball must be struck with a tennis racket, not the hand or anything else, and the ball is allowed to bounce only once before it is returned over the net. Success is achieved by consistently returning the ball over the net while making it difficult for your opponent to do likewise.

In the sustainable agriculture paradigm, a sustainable human society is the standard of success. A sustainable agriculture must be capable of maintaining its value to human society forever, or at least for as long as the sun continues to shine. One cannot prove empirically that one system of agriculture is sustainable and another is not. It would take forever to collect the necessary data. Thus, the science of sustainability must be build upon logic. Logic, and common sense, leads to the conclusion that to sustain human life on earth agriculture must be ecologically sound, economically viable, and socially responsible.

Any system that degrades or depletes the productivity of its resource base will eventually lose its ability to produce, and thus, is not sustainable. Likewise, any system that pollutes or poisons its environment in the process of producing will eventually lose its net value to society and likewise is not sustainable.

Economic viability is necessary to maintain control over resource use, regardless of the economic system employed. A system that lacks economic viability eventually must sacrifice control over its resources to some economically viable alternative. In common sense terms, if farmers cannot stay in business, their farming systems are not sustainable. However, economic viability and profitability are not synonymous. Economic profits imply that returns exceed opportunity costs -- that resources are put to their "highest" economic use (Levins, 1996). Economic viability requires that only returns to resources are sufficient to maintain control over their use in an ever-changing, dynamic environment.

A sustainable agriculture must also be socially responsible. The fundamental purpose of agriculture is to provide for the basic needs of people. Thus, an agriculture that fails to provide an adequate supply of safe and healthful food and fiber and a reasonable cost is not sustainable. However, people also must be provided opportunities to participate as productive members of society. We must produce something to earn money to buy the things we want and need, but we should also have an opportunity to realize satisfaction from the productive employment of our abilities. Quality of life is as much a function of working and contributing as it is of loafing and consuming. Employment in any given sector of an economy need not be proportional to its production. But displaced farmers with no alternative employment are no less a cost to society than is an aquifer polluted by agrochemical or a sediment-clogged stream. A socially responsible agriculture must do its part to provide opportunities for people to contribute as well as consume.

Finally, sustainable systems must be ecologically sound, economically viable, *and* socially responsible. All three are necessary and no one or two of the three is sufficient. A system that lacks ecologically soundness cannot sustain its productivity over time, no matter how profitable or socially supportive it may seem in the short run. A system that is not economically viable will not be employed, no matter how ecologically sound or socially responsible it may seem. And a system that is not deemed to be socially responsible will be discarded or destroyed by the society it must support, no matter how profitably or environmentally friendly it might otherwise seem to be.

These are the standards of success. The sustainability game is like old-fashioned pinball. The only thing we win is the privilege of playing another round. We can judge how well we are playing the game, but success is a process rather than an outcome—a direction rather than a destination.

The traditional paradigm of economics is fundamentally incapable of addressing the issue of agricultural sustainability. The standards for success are different. The boundaries and different. The rules of behavior within those bounds are different. Different standards, different bounds, and different behaviors imply different paradigms.

Traditional economic models are based on the assumed goal of profit maximization. The environment and society are external to the decision unit. The sustainable agriculture model treats ecological soundness, economic viability, and social responsibility as three inseparable dimensions of the single goal of objective of long run sustainability. All three are "inside" rather than "outside" the bounds. The bounds of sustainability are the laws of nature, including human nature.

Sustainability is a function of balance as much as level. This concept becomes apparent if one assumes a theoretical long run, dynamic global equilibrium situation. Ultimately, global quality and quality of human life must be balanced with global resources, and global economic activity. Any attempt to increase one without enhancing the other two will create an unstable and less sustainable situation. When the three are out of balance, enhancing the performance of one relative to the others may increase sustainability. But when the three are in balance, one cannot increase without decreasing the others. Increasing one but not the others makes the system unstable and less sustainable.

Traditional economic models clearly consider the natural environment and larger society to be "external," or out of bounds. Externalities are internalized by demands of society—imposed by decree—not by choice of the decision maker. Success in the traditional economic model is measured in terms of profits and growth. Within the limits allowed by nature and society, the economically rational decision maker may take a wide range of actions. Almost anything that is possible and legal is encouraged if it leads to profits and growth.

The rules of behavior are different for the sustainable paradigm. Sustainability requires thoughtful, purposeful human intervention in the development process. The earth cannot sustain the level of population and per capita consumption that might result from the thoughtless pursuit of narrow self-interests. The natural ecosystem must be "managed," not simply treated as a mine or a sink, in order to sustain its productivity. Sustainability requires that we make decisions collectively for the collective good of society as a whole. Dignity of work may affect our quality of life as much or more than how much "stuff" we are able to buy and the leisure time we have to use it. Quality of life is the product of how we relate to each other—economically, politically, and socially within and between generations. The quality of human life cannot be sustained without caring and sharing in addition to working and making "stuff."

Willard Cochrane, a pillar of the agricultural economics profession, states that "we must replace the philosophy of extreme individualism with a philosophy of community responsibility," if we are to reverse the current slide toward economic collapse and social chaos. By community responsibility "we mean the

willingness of each individual to consider the needs of *all* other members of the community; we mean the willingness of each individual to support the actions designed to meet the needs of *all* other members of the community; we mean that individual members must recognize Mother Earth as an integral part of the community and to respect her nurturing role in it; we mean that each and every child must be taught in the home, the church and the school what his or her rights in the community are *and what his or her responsibilities to the community are*; we mean, finally, that the Golden Rule must be our guide to human conduct in the community" (Cochrane, p. 36).

The Challenge To Agricultural Economists

Barker points out that successful old paradigms often collect a host of avid, but unwitting, advocates. Advocates of traditional economic thinking tend to spontaneously apply their paradigms to any issue that arises. We fall back on the paradigms we were taught as if they were based on irrefutable truths of the universe. However, Donald McCloskey, in an article "The Rhetoric of Economics," argues convincingly that the official methodology of economics is modernism. He further contends that "Modernism is influential in economics, but not because its premises have examined carefully and found good. It is a revealed, not a reasoned, religion" (1984). The post-modern era is begging for a post-modern paradigm of economics.

The traditional economic model of functional separation, profit maximization, and economic efficiency is consistent with the principles of Newtonian physics (see Capra, 1982). The community, farm, and farmer are modeled as a machine with many complex and interrelated, but separable parts. If a part breaks, you have to fix it or replace it, but the machine can be made to function again. The direction of cause and effect are definite, if not readily discernible. The objective is to achieve maximum output relative to input through purposeful tinkering with causes and effects.

The sustainability model is much more consistent with the principles of quantum physics. The community, farm, and farmer are modeled as living biological organisms, each a whole in itself, but also made of a complexity of inseparable wholes" (Savory, Kirschenmann). If a critical part "breaks" the organism gets sick or dies. If it gets sick, it may heal itself if the illness is corrected in time. If it dies, it cannot be revived and made to function again. The nature of cause and effect is never completely definable. Everything is connected to everything else. Cause and effect are circular rather than one way. Purposeful change requires thoughtful intervention rather than tinkering. The objective is to sustain the health and productivity of the system over time. Continual change, regeneration, is a fundamental part of that process.

In biological models, individual elements must conform to their ecological niche. Big farms will be sustainable only if their "niche" is equally large. It is readily apparent that many of today's large farms are degrading both the natural and human resource base as they have expanded beyond their ecological and societal niches. It will take "mind work," not physical or economic muscle, for farmers of the future to find a niche where they can carry out their function by means that are ecologically sound, economically viable, and socially responsible. The vast majority of those niches will likely be smaller than today's large, "industrial-sized" farm.

The sustainable agriculture paradigm is consistent with the visions of Toffler, Drucker, Reich and others of a post-industrial era of human progress. Sustainable agriculture is management intensive, rather than management extensive. Sustainable systems must be individualistic, site-specific, and dynamic. Thus, sustainable farming is inherently information, knowledge, and management intensive.

The future will require not only more thinking, but will require new ways of thinking as well. In the *Post Capitalistic Society* Peter Drucker states: "In the knowledge society into which we are moving, individuals are central. Knowledge is not impersonal, like money. Knowledge does not reside in a book, a databank, a software program; they contain only information. Knowledge is always embodied in a person, carried by a person; created, augmented, or improved by a person; applied by a person; taught by a person, and passed on by a person. The shift to the knowledge society therefore puts the person in the center."

Productive people are clearly the key to sustaining human progress during the post-industrial era. The ability of farmers to think for themselves, to shape their own destinies -- not just apply technologies and strategies developed by others -- will be the key to sustaining agricultural profitability. Agricultural economists are social scientists -- people scientists -- thus, we clearly have a potentially important role to play in developing the new post-industrial paradigm for farming. As social scientists we at least should be willing to question whether we have a responsibility to the people who farm and live in rural communities as well as to the consumers of food and fiber. The post-industrial paradigm of sustainable agriculture will continue to evolve over decades, if not centuries, into the future. The fundamental question is whether agricultural economists will help develop a paradigm capable of sustaining farm profitability, or instead will become irrelevant as our logical role is assumed by others who are less bound to paradigms of the past.

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Nutrient Management/Integrated Pest Management

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Nutrient Management (NM) and Integrated Pest Management (IPM) are multi-faceted programs designed to: 1) improve profitability of cropping operations through more efficient use of nutrients or pesticides, and 2) reduce on-farm and off-farm environmental impacts of nutrient or pesticide use. NM is oriented towards the management of soil fertility, matching nutrient application rates and timing of such applications to correspond with crop uptake, thus improving nutrient efficiency and minimizing environmental consequences. IPM is an ecology-based pest control strategy, employing crop rotations, tillage practices, biological controls, pesticides, and other measures to achieve effective pest control. As measures which enhance the sustainability of the food and fiber system, these programs have temporal, spatial, quantitative, and normative dimensions (Crosson) concerning which economists can provide analysis and educational insights.

Both nutrient and pesticide pollution are serious public safety and environmental concerns. In terms of U.S. nutrient applications, 7.4 and 2.9 million metric tons of nitrogen (N) and phosphorus (P) are supplied to crop and pasture land in excess of that taken up by plants (National Research Council). In many regions of the U.S., ground and surface water quality has been damaged by nutrient pollution from agriculture. Surface water suffers from the affects of nutrient enrichment, leading to eutrophication and damage to fish and plant life as well as diminished opportunities for water recreation. Ground water with high N concentrations poses a direct danger to human health.

U.S. pesticide applications are greater than 337 million kilograms per year, of which 195 million kilograms are herbicides (National Research Council). Such applications also pose a potential danger to ground and surface water, as well as a potential danger to food safety if pesticide residues remain on food products. Pesticides have been detected in drinking water in several regions of the U.S., and have been detected in ground water in at least 26 states.

Focus Group Discussion Areas

Nutrient Management and Integrated Pest Management as part of 'sustainable agriculture.' There was disagreement whether a focus should be maintained on the broader philosophical/ethical concepts of sustainable agriculture, or whether reducing nutrient or pesticide losses to the environment was sufficient to define NM/IPM programs as contributing to a sustainable agriculture. At a general level, it is necessary to build incentives for producers to behave sustainably.

Producer awareness and knowledge of environmental effects/decision support. Producers often do not recognize the effects of nutrient or pesticide pollution. Instances have been reported in which producers do not know that atrazine is leachable, or that it can impact human health. Similarly, producer opinion surveys show that there is little recognition of the contribution of one's own farm to nutrient pollution. It is not clear that farmers can effectively use decision support procedures and software which integrates the multiple objectives of sustainable agriculture within the context of NM and IPM. The information needs of farmers are growing very rapidly, and small to medium sized operations may not have the information gathering and decision making capacity to use more complex multi-objective planning tools.

Multidisciplinary/physical models. It is ever more imperative to encourage and participate in multi-disciplinary research and educational efforts. However, funds available are limited, and it is difficult to obtain adequate funds for each disciplinary partner involved in such efforts. Better economic research and educational tools are needed to reflect the complexities of decisions involving economic/environmental objectives in temporal, spatial, quantitative, and normative dimensions. The reliability of physical models of runoff/leaching and transport processes is limited by the quality of underlying research data. The results of economic research models which integrate with less-than-perfect physical models or which use such physical model results may be questioned. However, it is considered that economic comparisons of policy alternatives will retain their ranking even if the underlying physical data are incorrect. Targeting NM/IPM programs and a watershed system approach are also important, but the lack of fundamental physical research is an obstacle.

Working upstream from the farm. Focussing on producers is not necessarily the most efficient way to accomplish NM/IPM educational goals. Alliances should be sought with farm management consultants, bankers, integrators, and other players in the system. Bankers may wish to learn more about NM/IPM in order to advise their producer/clients how to avoid environmental liability lawsuits, or to avoid such lawsuits themselves. Integrator firms may also be key to achieving more economically efficient and environmentally viable nutrient and pest management. Such 'upstream' participants in the food/fiber chain are more sensitive to customer preferences, and can enforce specific production practices if they find that 'eco-labeling' is a valuable marketing tool. Local and state governments have an increasing role in defining acceptable agricultural practices within their jurisdictions, but they have little economic expertise. Economists can play a key part in providing research and education which estimates the economic impact of agriculture within states and local communities, and in showing the economic impact of policies on farm profitability.

Economists should be more proactive. The federal government no longer bankrolls big programs in the NM/IPM area or other agricultural programs. The federal government role is increasingly that of facilitator of local and state policy initiatives. Economists should become more proactive in defining what is known and what is not known relative to NM/IPM.

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Agricultural Alternatives & Enterprise Selection

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Introduction

Our discipline is filled with static and dynamic models of firm behavior. Discussions and articles on enterprise selection have considered management goals, inputs available, micro-climates, and societal/institutional barriers as ends and means. However, in the context of agricultural sustainability, we have been unable to identify best alternatives as they relate to measuring environmental impacts or quality of life issues. This has left some of our clientele with a negative view of our discipline. Other paradigms have been proposed, including heuristics and experience. These methods are generally considered to be suspect in our community, allowing us to readily dismiss those who apply them. As a scientific community, we do and should have a continuing stake in discussions related to what are acceptable data and paradigms and what are not. However, ag. sustainability requires that consideration be given to alternative points of view. As our discussion progresses, please consider the temporal, spatial, quantitative and normative aspects of ag. alternatives and enterprise selection. But, please also consider the impacts on and linkages between government, farming, industry, society and the ag. economics profession, each of which are likely to have differing points of view on agricultural sustainability.

Discussion

Group discussion opened by considering the usefulness of ag. economic tools for assessing alternatives and for enterprise selection. The following text reflects a summary of this discussion.

It was considered that economic methods, such as enterprise budgeting, can be used to facilitate information exchange and to educate users to identify relevant problems, costs and returns. However, the individual producer must make the final choice on what's best for his or her operation. It's our job as educators to make clientele aware of the consequences of choices and this can be done with the methods available.

For economic analysis tools in general, results may not pertain to any single individual but can still be used for education purposes. However, the general nature of the results requires that a continual monitoring and updating of inputs and recommendations take place. No widespread recommendations should be made.

From an alternative methods standpoint, holistic range management was viewed as being based largely on experiential results and yet was considered to be a valuable education tool to teach consequences. Social ends are also tied back to choices through this method.

Case studies can be used to develop generalized snapshots of farm operations. These studies can be adapted by others to use in analyzing their own specific situations. The ag. economist's role should be to act as educators to teach people to analyze their own production situations, and not to make specific recommendations as to the best alternative for any individual. This view was held despite the fact that production scientists and consultants are making specific recommendations and are looked upon favorably by producers. Our role with production scientists and consultants should be to train the trainers and to take part in a mutual education process between producers, production scientists, consultants and others.

Research and Extension linkages were discussed. Multiple goals and single indexes as methods for selection may be futile. Case study comparisons which examine impacts, quantify, and estimate "best" results were seen to be of more use as education/extension tools. Research is best used to identify missing variables or what has been obviously missed.

Societal goals and the structure of agriculture issue was seen as being relevant to the question of resources use. In terms of society and agriculture's interaction, the question of what we want to preserve must be assessed. Do we want to preserve the "family" farm? Perhaps some individuals would be better off out of farming but would society?. Who's value system do we use to determine what should be done concerning the structure of agriculture? The costs to society must be assessed. In order to answer questions such as these we must be able to quantify the results. Solving a problem involves determining who is gaining financially and who is losing.

Discussion generated the question, "Must all things be quantified?" In addition: "How do we determine implicit value, as opposed to explicit value?" "What are sustainable agricultural practices?" "How do you design a framework to identify sustainable ag. problems?" "What are the benefits of sustainable ag. and how do you value them?"

Actions occur which may impact your neighbors. "How do you quantify an odor?" The court system quantifies impacts and assigns values in the form of compensatory damages. However, the courts were seen as being not very accurate in assigning these values. If we allow the legal system to measure and assign value, what are their definitions of quantity?

Community and environment may have a negative correlation. The ag. economist's role should be to help identify the trade-offs. Producer's should be helped to identify what should be measured. To identify problems and solutions, ag. economists must adopt an interdisciplinary approach, working with relevant experts and production and social scientists. This allows the education process to flow through the system, educating educators, researchers, producers, etc.

Disagreement occurred on whether computer based solutions with optimization models was a necessity for assessing alternatives and selecting alternative enterprises. Computer generated solutions were seen as being able to evaluate a lot of alternatives. It was pointed out that with many alternatives comes the problem of determining what to manage and where to focus.

Non-numeric solutions were seen as being appealing to some integrated management types because there is no ability to dispute or test results. Care must be taken to apply the concepts of our discipline and not to focus on the dogma.

Is sustainable agriculture long term wealth protection or sustaining family farms? Resources necessary to achieve a sustainable farming operation are large. Balance in a sustainability sense may not be possible for small farms. The earnings capacity of resources in agriculture may require that farms become large multi-family, multi-generational, or integrated commercialized ag. operations.

To impact the environment the owners of the resources must be impacted. Group solutions are not workable in this context.

With regard to alternatives and enterprises, some patterns do emerge that will allow the generalization of analytical results to the farm population at large. However, care must be taken. Most cases will require an assessment of the individual situation. The tools of our discipline as they relate to the sustainability paradigm are best applied for education purposes. By doing this, individual producers can be taught to assess alternatives and to select the enterprises that are most sustainable for their individual farms.

The Economist's Role in the Agricultural Sustainability Paradigm: Summary of Discussion Concerning Linkages among Sustainable Agriculture, International Trade and Food Safety Issues

Author: Edmund A. Estes, North Carolina State University

The Case for Linkage

In our limited-resource, policy-free world, farmers, agribusinesses, and nations would tend specialize in the production and export of products in which they have a comparative cost advantage and import those items for which they have a high relative cost. For a variety of reasons, however, governments tend to intervene in markets and enact policies designed to restrict and regulate both agricultural production and international trade flows. Popular barriers to trade often utilized by policy makers include imposition of tariffs (import taxes), seasonal and/or annual quotas (limits quantities), export subsidies (payments made to reduce the effective cost for exporters), requiring sanctioned import/export licenses, and imposing health and safety regulations on imported items. While "public benefit" arguments are often cited as justification for the existence of trade barriers, several writers (Fairchild, et al,; Runge; Gardner; and Daly and Goodland) have noted that environmental and ecolabeling concerns have become intertwined with international trade discussions. During NAFTA discussions, U.S. negotiators explicitly linked reductions in trade barriers with reduced pollution by Mexican firms along the U.S.-Mexican border. It seems likely that future trade agreements will examine linkages between reduced trade barriers and mitigation of environmental degradation. For many sustainable agriculture (SA) supporters, agricultural programs and policies are designed to expand trade, to enhance economic growth, and to create new jobs. Programs and policies with these goals result in unsustainable use of natural resources and result in irreversible harm to local and global resources. Thus, many sustainable agriculture (SA) supporters argue that the basic tenets of SA and international trade goals are simply incompatible.

Additional linkages between SA issues and trade likely will be reinforced by acceptance and use of system-wide food or life cycle assessment evaluations. Examples of life cycle assessment programs include the ISO14000 voluntary certification scheme and the ecolabeling programs used by selected German, Japanese, and Canadian firms. Life Cycle Assessment programs, as noted by van Ravenswaay in her general session comments, examine both specific (pesticide-free) and general product (environmentally friendly) claims. Industrial Standards Organization (ISO) 14000 certification is a multi-year rigorous examination of all phases involved in the manufacture, production and distribution of an item. While compliance with ISO14000 certification processes will be voluntary, will not be officially implemented before 1997, and its applicability to and effect on production agriculture is unknown, its potential impact on terms of trade could be substantial. ISO14000 differs from earlier evaluation processes in that it examines all stages of the product life cycle for its impact on the environment and its consistency with label claims. To receive ISO14000 certification, a product must satisfy ISO standards concerning its specific label performance claims (for example, pesticide free or organic) and general ecolabel claims (container is recyclable, environmentally friendly, etc). The producer or manufacturer of a product desiring ISO14000 certification must provide beginning-to-ending documentation to an ISO review committee in order to support its specific and general label claims. Prior to development of ISO standards, bilateral and

multilateral trade agreements tended to focus only on an evaluation of the final product, that is, did the end product meet minimum health and safety requirements? In the future, could an European Union member or Japan ban the import of Smithfield pork products because Smithfield Foods, Inc. did not receive ISO14000 certification for its pork products because one or more of its pork processing plant discharged untreated waste into a nearby river (note this is a hypothetical question)? ISO14000 certification and life cycle assessment programs exist because they tend to make agribusinesses, freight forwarders, and traders very "comfortable" in the uncertain world of international trade. Thus, trade discussions have evolved from primarily focusing on elimination or reductions in tariffs to include global and national environmental policies.

Is Linking International Trade with SA and Food Safety a Problem?

One level of understanding in exploring linkages between SA and international trade involves resolution of the question "Are SA and international trade competing or complementary activities"? If they are mutually exclusive and competing activities, then trade-offs between them must be made. When SA and trade goals and objectives diverge, which philosophy dominates? Will the desire for short-term profits and economic growth come at the expense of resource overuse and long-term sustainability? SA proponents argue that the basic tenets of international trade are mutually exclusive with SA goals and thus support policies and actions that limit trade and strengthen local production and local marketing efforts. Alternatively, if SA and trade are complementary activities, then profits and economic growth will increase as sustainable activities increase. Many economists (Hoag and Skold; Fairchild, Benson, Seale, and Moulton) argue that free trade allows specialization so that world food suppliers can produce more items with the same or fewer resources. Hoag and Skold argue that when profits and economic growth must be traded against one or more environmental goals, then how are various environmental goals valued? Which is more important, control of chemical leaching into groundwater or soil erosion mitigation? How much income should be foregone to purchase clean water or to mitigate erosion? Does technology adoption and industrialization of agriculture hinder or help sustainable resource use? For SA supporters, the objectives of food production must include the multi-dimensional goals of using resources to create agricultural production and marketing systems that are holistic, economically viable, environmentally sound, and socially just.

Local and world SA leaders argue that economic growth and trade concerns tend to focus agricultural interests on monocropping practices which are neither socially nor environmentally sound. Emphasis on expanding trade also usually leads to an emphasis on maximum yield, high tech solutions to food shortages (for example, Avery & Avery arguments in support of traditional AG approaches to trade). The focus of local production, local consumption, and economic self-sufficiency should take priority over policies and programs designed to expand economic growth through trade. Activities such as Community Supported Agriculture formats can diminish the need for trade and promote healthy food consumption while also minimizing use of distributional resources. Simply put: For many SA advocates, trade and its concomitant economic growth are simply unacceptable and are inconsistent with many SA aspects even under full acceptance of ISO14000 and life cycle assessment concepts.

Challenges to Extension and Applied Research Economists

First challenge: Is it wise to continue to use primarily on-farm profit indicators and output-to-input measures (that is, conventional financial indicators such as returns, income, cost margins) as reflections of sustainability? Dick Levins (University of Minnesota) and the Land Stewardship Project developed a guide to assist SA farmers evaluate their overall progress (financial, quality of life, land stewardship, etc) toward their SA goals. However, measurement of SA profits, income, and other conventional indicators of success needed to be evaluated using scientific approaches and scientific analysis. Reliance on anecdotal examples and unproven claims simply confuse critics and frustrate supporters. Of central importance is the need to incorporate externality and intertemporal resource allocation considerations into shorter-run production and marketing decision making. In essence, for the hog farmer or processor who discharges untreated waste into rivers, his/her actions are sustainable because it lowers on-farm costs and allows continuation of his/her livelihood. However, these actions are not sustainable to general society or to SA advocates. Because of externalities, farmer and processor actions (survival and profits) conflict with societal desires for environmental preservation and/or enhancement. Can we accurately quantify and include social costs and benefits into farm management evaluations?

Second challenge: Does the tendency toward intensification and industrialization of agriculture lead to unsustainable agricultural systems and greater international trade? Intensification and industrialization are often associated with specialization, fewer but larger farms, and greater economic efficiency (Hoag and Skold). SA proponents argue that societal needs would be better served through production diversity, numerous smaller acreage farms, and greater emphasis on environmental and resource protection. It seemed clear that specialization and industrialization, driven by market forces and current farm policies, are changing the traditional structure of agriculture. Indeed, one might define nonsustainability as the simple extrapolation of the current industrialization trend into the future. Are SA supporters visionaries who believe that a decentralized agricultural structure is the best way to preserve social and environmental resources or are they guilty of wishful thinking and an inability make hard choices among competing goals? SA is a useful concept if for no other reason than it forces farmers, agribusinesses, industry suppliers, and extension economists to think about balancing short-term and long-term resource use as well as identifying new ways of achieving multiple goals which may include conflicting goals of increasing on-farm profits while also enhancing the quality of life for farmers and society as a whole.

Third Challenge: Should the extension economist play the role as mediator, detached analyst, and/or information provider, or simply jump into the fray and encourage farmers to balance environment, trade, and broader societal equity issues? Are too many of us guilty of having an "I don't care" attitude so we can avoid a difficult-to-resolve problem? Can the issues of expanded growth and trade include an environmental preservation dimension as well? The market place is the arena where society balances competing objectives and prices are the bridge that can close or eliminate the gap between economic and environmental solutions. Internalizing externalities at least raises the issue of social costs and benefits and can provide better balance between economic and environmental interests.

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Policies for Sustainability

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The mission of this breakout group was to identify policy options associated with sustainability issues. The group focused on identifying options, consequently, less time was spent on discussing the consequences of these options.

From a policy perspective, the options identified cover the gamut from primary reliance on the market to regulatory action designed to internalize the social costs of externalities. Alternatively, from a government cost perspective, the options range from taxes on inputs, which raise revenue, to potentially costly green payments.

Market Option

The market option relies on consumer expression in demand for the products of sustainable agriculture. Effective demand expression requires the combination of consumer sensitivity to issues of sustainability, an ability to identify the products of sustainable agriculture and a willingness to pay for those products at a level that will cover their production and marketing costs. On the supply side, the market option requires farmer sensitivity to issues of stewardship. Yet, it seems unlikely that farmer sensitivity alone will suffice, since rewards for any higher costs associated with sustainable systems must be covered for competitive reasons. The same reasoning applies as the product moves through the market channel.

Accordingly, it would appear that the primary determinant of whether the market option could succeed in fostering sustainability lies in consumer willingness and ability for the higher cost products to pay. Sensitizing communications/advertising could be a critical component to the success of the market option.

Information Option

The information option relies on transmitting objective information that is of sustainable/environmental significance to producers, market intermediaries and consumers. As noted previously, the market option requires that market participants be sensitive to sustainability concerns.

Information could be provided either voluntarily or pursued as a matter of public policy. Voluntary examples might include provision for public service advertisements, civic organization activities, or articles written by freelance writers for inclusion in newspapers or magazines. Voluntary information systems suffer from free rider problems along with inadequate coverage issues.

Public information could be sponsored through USDA, the Extension Service, public television grants from the government, compulsory product labeling or through a requirement for educational programming. With the latter examples, the potential exists for a heavier hand of governmental influence. This governmental guidance may be interpreted strictly as an expression of the consumers' right to know as just another form of regulatory activity. Governmental influence might be characterized by others as an infringement on free speech.

Research and Education Policy

Governmental support can be utilized for research and education policy to advance the science of sustainability. Just as science has been utilized to advance yields and reduce costs in chemical agriculture, it can be used to advance progress in sustainable agriculture. In fact, it can be argued that this has happened through targeting sustainability research and extension funding. Arguably, a significant share of the increased emphasis on biotechnology research results from environmental and health concerns associated with agricultural chemicals. Having said this, sustainability advocates certainly are not of one mind on the products of biotechnology research.

Three types of research were identified as being particularly important from a sustainability policy perspective:

- A redirection of research funds toward the applied arena. This would be a marked reversal of policy which, since the advent of biotechnology, has placed greatly increased emphasis on basic research.
- Increased policy research designed to evaluate the consequences of alternatives for achieving a more sustainable system. Such research would include the time dimensions for achieving alternative end objectives.
- Increased research designed to determine the full economic costs associated with alternative policy/management strategies.

Green Payments

Green payments reimburse producers for at least a portion of the costs associated with engaging in sustainable/environmentally friendly practices. Participation in a green payment program is generally voluntary. In practice, some programs may be mandatory such as setting up animal waste management regimes or fencing off riparian zones. Therefore, green payments may be a means of reducing the pain of regulation or of making regulation politically acceptable. This makes the definition of what constitutes a green payment challenging. For example, the 1985 Farm Bill required that a farmer have a conservation plan designed to achieve specific soil erosion goals. The plan was a condition for receiving deficiency payments. Did that effectively convert deficiency payments into green payments? If so, are the transition payments made under the 1996 Farm Bill really green payments because conservation plans are required? Extending this line of reasoning, is the Conservation Reserve Program (CRP) a green payment program because it takes highly erodible land out of production? The switch in terminology may have the effect of making subsidies to agriculture more acceptable.

Green payments have the potential for being quite costly. This is particularly the case if they are made available for practices that are engaged in on an annual basis. For example, the CRP program is costly because participating farmers are paid annual rental payments to keep their land out of production. On the other hand, green payments for the construction of animal waste lagoons or for fencing off riparian zones involve one-time lump-sum outlays resulting in the potential for lower public costs over time.

Green payments may be targeted to achieve social objectives other than sustainability. For example, the Environmental Quality Incentive Program (EQIP) limits both the total level of payment and the size of farm that may receive payments. Such limitations may reduce the effectiveness of the program in

achieving environmental objectives which may not be consistent with any social objectives embodied in sustainability.

It is important to note that there are many unsuccessful examples of targeting to achieve social objectives. For example, limits on payments under the target price program have been notoriously unsuccessful. The same lack of success might be anticipated under the transition payment program. This lack of success results from the innovativeness of farmers and their lawyers in wiring-around the intent of the legislation. Those who are intended to be excluded by the targeting are often the most innovative and have the most resources to retain the required legal expertise.

Tax Option

Taxes on inputs deemed harmful to the environment can be used to reduce input use, pay for the social costs imposed by the input and/or generate revenue to carry out programs designed to achieve sustainability objectives. Taxes are sufficiently unpopular that it is becoming increasingly difficult to get them enacted. If enacted, the revenue may be used for unintended purposes simply because of the budget pressures that exist. Alternatively, the revenue generated may be used as an offset against that which would have been appropriated. Therefore, substantial care needs to be taken in writing legislation designed to capture tax revenue for specific purposes.

Unfortunately, taxes increase costs, the effect of which is to increase consumer prices and reduce our competitiveness in export markets. To the extent that product demand is price sensitive, which is more likely to be the case for export markets, producers may be substantially worse off. At the same time, not much may have been gained environmentally because producer demand for the input may be so inelastic that reductions in use are nil. The result is the need for caution when applying the tax alternative.

Regulation Option

The regulation option is designed to internalize the social/environmental costs imposed by externalities. Use of the regulatory option appeared to have reached the zenith of its acceptability in the 1970s or perhaps the early 1980s. It has been downhill since. The Clean Water Act required that industry internalize the costs of externalities but treated agriculture as nonsource pollution except for large-scale farms.

The future of the regulatory option is unclear. At times, there appears to be a tendency to treat agriculture more like industry in the sense that all of its pollution could be treated as point source. Yet, the unpopularity of the regulatory alternative makes it more likely that green payments would be added to make regulation politically acceptable.

Concluding Remarks

If it is to be successful, the sustainability movement needs to avoid being caught with a single goal. Single goal politics seldom work. CRP was renewed in the 1996 Farm Bill because it embraced multiple constituencies including farmers. Sustainability policies must do the same if they are to be sustainable.

Agriculture And Rural Economic Development

Author: Lee Meyer, University of Kentucky

Four questions were raised for this group to discuss.

1. Is the "emerging" industrial agricultural system compatible with sustainable agriculture and rural communities?
2. Is there a conflict between sustainable agriculture/rural communities and a sustainable national and international food system?
3. Sustaining rural communities is an advocacy position—what is the role of an extension economist in this situation?
4. Who, other than economists, should be involved in the work related to sustainable agriculture and rural economic development?

Most of the discussion focused on questions 3 and 4, and also included a focus on the types of contributions that economists can make in the area of the relationship between agriculture and the sustainability of rural communities.

It was the general consensus of the group that work styles need to be changed if extension economists are going to become more effective in helping to provide sustained economic development for rural communities. The traditional paradigm associates distance with objectivity. In this model, the economist studies communities and strategies, researches relationships between the community's level of development and hypothesized causal variables and then draws conclusions and makes recommendations. This approach tends to be quantitative and thus focuses on more easily measured variables.

This research paradigm approach was criticized by the group as being unable to provide the breadth and depth of assistance needed by rural communities. It was suggested that the anthropological model, of immersion into the community, needs to be used by some economists to complement the traditional paradigm of arms-length analysis. This approach could entail a variety of changes in work approaches and strategies. For example, loss of neutrality is a risk of working closely with a particular organization. This can be controlled by working with several organizations with different agendas rather than just one. Advocacy groups can be supported in this way without giving up the balance needed by extension educators to remain effective. A specific example of this approach and supporting policies is North Carolina State's role in conflict mediation, an approach which encourages participants to reframe issues in order to develop win/win outcomes as an alternative to win/lose choices.

Other efforts being led by extension economists following this alternative model build on facilitation of small groups and working on issues deliberation. There are also efforts (for example, "Future Search") to assist communities to developing visions, based on a common ground of interests. The economists can help not only in the process, but also by using economic tools to help make rational decisions to achieve the goals of the community. It was noted that economists can help with decisions related to a spectrum of goals, not all of which are financial. For example, land use planning may be built on an aesthetic vision. And while the community may not be able to or even want to place a financial value on this attribute, economists can help the community evaluate the tradeoffs entailed in maintaining the scenic characteristics of its area.

Another model that was helpful in dealing with community sustainability and development issues emerged from the farm financial crisis of the early 1980s. Extension economists developed programs to respond to not only the financial components, such as debt repayment and cash flow, but also the psychological traumas impacting on many farm operations. Extension workers brought psychologists into their work groups, established help lines and other non-traditional modes of assistance. As one participant pointed out, "these were not tools learned in graduate school." This points out the divergence between graduate education (and some research-oriented programs) and the needs of extension economists.

While the participants of the session noted that the more involved one is, the more likely he/she is to find an appropriate solution and that solutions depend on multi-disciplinary team efforts, they also warned that multi-disciplinary efforts are no excuse for poor economics. Even techniques like budgeting can be modified to incorporate non-quantifiable parameters by conducting sensitivity analysis under different scenarios.

It became apparent during the session that there still are not enough means of communication of approaches and ideas. Even though the purpose of this focus session was on the roles of extension economists, there was interest in sharing facts and specific approaches used in different areas. For example, in Wisconsin, some communities have instituted local taxes to support farms in their communities (a form of compensation for giving up or limiting development rights). Community Support Agriculture groups ("CSAs") or subscription agriculture groups are another idea that is having an impact on community sustainability which was discussed.

While this group did not try or even intend to reach a final conclusion on the extension economist's role, the general thought was that we must be open to new approaches and take the risk of working closely with groups, even if that may be viewed as advocacy. It is difficult to change paradigms and some reward systems push economists away from the approaches which are most effective.

Farm Management of Soil And Water Resources

Author: Darrell Bosch, Virginia Polytechnic Institute & State University

Soil erosion reduces productivity on the eroded site by impairing soil physical properties including soil water-holding capacity. Farmers incur additional expenses when commercial fertilizer is purchased to replace nutrients carried away with eroded soil. Off-site damages from erosion include sediment accumulations in surface waters which destroy aquatic habitat, reduce storage capacity of reservoirs, and interfere with transport capacity in waterways. Nutrients and pesticides transported with eroded sediment are also a threat to aquatic life. Dust from wind erosion poses a threat to human health and may make breathing difficult. Wind-blown dust reduces visibility and causes traffic accidents as well as other property damage such as stripping paint from buildings and vehicles.

On-site Erosion Damages

Economic studies concerning on-site productivity damages from soil erosion usually discount the costs of future yield losses due to erosion. Models of soil erosion and crop production are used to predict future impacts of soil erosion on yields. However, model predictions often fall outside the range of experimental data used in building the model. Crop yield reduction may be a nonlinear function of soil depth. If the crop's response to soil erosion becomes highly nonlinear outside the range of experimental data, costs of soil erosion may be underestimated on some soils. Given that soil restoration is slow and costly, soil erosion and its associated productivity losses could pose significant costs to future generations.

One rationale for discounting future losses from soil erosion is that funds not invested in soil conserving measures can be invested instead in research and education on new agricultural technologies. These technologies may increase crop productivity in spite of soil erosion. However, some economists argue that there is limited substitutability between new technologies and natural soil properties. Thus, current levels of soil erosion may threaten the ability of society to provide for food needs in the future. In their view, discounting future losses understates that threat and is unfair to future generations.

More general measures of soil quality and the damage to soil quality resulting from erosion and other cultural practices are needed. For example, research suggests that soil microorganisms which affect the health and productivity of soils are damaged by inorganic fertilizer. The biological activity in the soil of such microorganisms can be measured. Unfortunately there is no national data base measuring levels of such activity by soil microorganisms across soils, locations, and farming practices.

Off-site Erosion Damages

Off-site damages from soil erosion are severe and perhaps costlier than on-site damages. However, researchers have difficulty relating sediment deliveries to upstream agricultural practices. The path of sediment delivery from the site over intervening land and through waterways to its ultimate destination is uncertain and frequently subject to unpredictably long lags. Pathways of sediment eroded by wind from site to ultimate destination are more uncertain than water erosion. Thus, the benefits of reducing soil erosion are likewise uncertain and may require years to be realized. In some cases, dredging sediment from

waterways and reservoirs or intercepting sediment with grass and tree buffers along waterways may be more cost effective than reducing erosion.

The uncertain timing and pathway of sediment erosion and deliveries underscores the need for a systems approach to evaluation of soil conservation practices. This approach should consider on and off-site opportunities to reduce erosion damages. In some cases forest or grass buffers along waterways which intercept sediment may be more cost effective than programs to reduce erosion at the farm level. A whole package of on- and off-farm practices should be evaluated. The effects of practices on other nutrient and chemical losses should be considered. Costs to farmers according to farm size should be evaluated.

More work is needed to document the off-site costs of sediment erosion. Off-site sediment costs vary greatly according to watershed characteristics including population, uses of surface water, and the effect of sediment on surface water quality.

Soil Conservation Policy

Policy instruments to encourage soil conservation include economic incentives (taxes or subsidies), regulations, subsidized research and education, and moral suasion. Real public expenditures for soil conservation are likely to decline given current political and budgetary constraints. However, public demand for clean water will continue or increase. Thus, the cost effectiveness of policy instruments must increase if the public demand for clean water is to be satisfied.

Declining budgets may require a smaller Conservation Reserve Program in the future. Some early evidence indicates that lands coming out of CRP are being put into corn and soybeans with few or no conservation practices. Such evidence puts in question the long-term conservation benefits of land retirement programs. Alternatives to increase the long-term conservation benefits of land retirement programs should be considered. For example, ways of targeting land retirement programs to increase the soil conservation benefits per dollar of public expenditure should be evaluated. Such targeting of Conservation Reserve Program lands is required in the 1996 FAIR farm bill. Partial permanent easements which involve purchasing from the farmer the right to grow row crops or use highly erosive cultural practices should be considered.

Shrinking federal budgets may imply a change in the federal role relative to soil conservation. Local governing bodies will reflect local preferences regarding soil conservation and water quality and will provide much of the funding for conservation initiatives to reduce off-site impacts. A role for the federal government is to facilitate local efforts by providing expertise on technical, management, and policy issues related to soil conservation efforts.

Soil Conservation Research Tools

Better decision support tools will be needed for soil and water conservation decisions. The continuing trend in agriculture to vertical integration and to larger farms will mean more management resources are available at the farm level to evaluate financial and environmental impacts of alternative soil conservation decisions. Companies may wish to show that their products are grown in an environmentally safe manner for labeling and advertising purposes. Farm level decision support systems with environmental components may be one method of documenting these claims.

Size, Structure And Location of Agricultural Operations

Author: John D. Lawrence, Iowa State University

The trend across most of the agricultural sector is to fewer, larger, and more specialized firms. Land based commodities (grains, oilseeds, and beef cows) are less consolidated than enterprises that are more mobile and less land dependent (beef feedlots, hogs and dairies). Often the new investment in larger livestock operations has shifted to "non-traditional" grain deficit regions. Communities where these operations choose to locate and producers, agribusinesses, and communities that lose economic activity to these emerging regions face an array of environmental, economic, and social decisions. Consolidation occurring in traditional regions and enterprises also changes the make up of a community and has implications for its members. Economists can help individuals and decision makers in both regions better understand the reasons why the changes are occurring and what the impacts may emerge from such changes.

The group that participated in this secession offered relatively few suggestions on how economists should respond to the size, structure and location issues impacting agriculture. Our group felt that the economists role should be limited to educating and informing decision makers and in facilitating discussion among parties with a vested interest in this public policy debate. In particular, economists can help identify the trade-offs of alternative size, structure and location scenarios. They may also be able to quantify the relative size and magnitude of the costs and benefits resulting from feasible alternatives. It was agreed that we did not currently have the answers to many of the important questions surrounding size, structure and location issues.

More research is needed to help identify and explain the expected outcomes of continued consolidation that frames public debate. Current research that looks purely at the economic efficiency of production is not sufficient to address the multifaceted issues that arise regarding producers, consumers, neighbors, allied industries, and communities. Specific research issues identified by this group include:

- Economic and environmental impacts from firms of alternative size and ownership form on operations, neighbors, communities, and state economies should be more clearly defined.
- Models should incorporate a systems approach to economic and production efficiency incorporating inputs, production, processing, distribution, and output as well as alternative objective functions.
- Examine the impact of regulation on size and structure of firms and industries, i.e., cost of compliance and regional shifts in production to avoid regulation.
- Quantify why producers exit an industry and under what conditions would they remain or return to producing and identify barriers to entry and their significance.

It was also believed that size, structure, and location of agricultural operations is a public policy debate. Economists can facilitate the debate by bringing parties with vested interested to the table and by providing them with research-based unbiased information on which to make decisions. Economists, with the help of other social scientists, may also be able to educate decision makers on how to frame the question and reach a conscious. This includes helping decision makers more clearly define the areas of concern and how to formulate effective policy.

In addition to facilitating debate among stakeholders, human capital and leadership development is needed to better equip individuals with the skills to effectively develop a vision for their future, define realistic goals, weigh the trade-offs, and maker better decisions toward obtaining their goals.

Marketing–Niche Markets and Niche Management

Author: James C. Hanson, University of Maryland

There are a wide range of practices for raising vegetables and fruits sustainably in the Mid-Atlantic, however, many of these farmers are organic producers on smaller acreage[1]. On these farms, crops are divided among patches and rows rather than fields and acres. Grass alleyways abound to allow workers access and prevent erosion. It is difficult to measure yields per unit of land because of the irregularity and small scale of crop plantings. Since these growers do not use synthetic pesticides and fertilizers, as a general rule, the crops are rotated through the season and spaced around the field to obtain nutrients and protect against pests. Also, since direct marketing is important to these farmers, they need a lot of different crops and varieties to meet the needs of their consumers. As a result, their labor needs are greatly increased; labor, not land, tends to be the limiting factor to expansion.

Marketing is very important to sustainable vegetable farmers; one farmer stated that he cannot survive by selling produce, he must market it. Most pursue direct marketing opportunities which are available in the Mid-Atlantic region due to the proximity of large metropolitan populations. A Virginia family sells at 15 different retail markets throughout the season (in 1992, they went to *market* 342 times). Much of their hired labor force is devoted to staffing these markets. In general, sustainable farmers can spend between 20 and 40 hours per week marketing their produce depending on the strategy they have chosen. There are other creative marketing strategies. Some of the farmers practice Community Supported Agriculture (CSA). Two Western Maryland brothers sold to 95 people who live in Cumberland, Maryland who paid $325 per family per season. Another variation of CSAs is a subscription service operated by a couple at their former place of employment. Eighty bags of prepackaged vegetables are delivered every week between early June and late September. Others farmers have formed organic marketing cooperatives. For example, a Pennsylvania organic growers cooperative is grower-owned and managed business specializing in wholesale marketing of certified organic fresh fruits and vegetables. It strives to support small-scale, family-run, regionally-based sustainable farms and encourage cooperation and mutual aid among farmers. Farmers map out the season's production to meet projected market needs and divided "crop commitments" among themselves.

When direct marketing at a farmers' market, most of these sustainable farmers did not think that being a certified organic grower was particularly advantageous, in and of itself. The advantage of being organic was that consumers tended to associate organic production with good growing habits, i.e., farmers take pride in their work and deliver a quality product. One farm family, who apply only a few pesticides and as a result are not organic, hand out brochures describing how their vegetables are grown. In particular, they apply only those pesticides which have a toxicity that does not exceed organic pesticides (Class III) and only at stages of plant development where the edible portion has not yet formed. They think that consumers are more than satisfied with this 'near organic' approach in which chemicals are only applied when absolutely necessary. Most of the direct marketers talk with their consumers, explaining how the

[1]The information on the Mid-Atlantic farmers is taken from "Sustainable Agriculture in the Mid-Atlantic Region by J. Hanson, L Weber, M. Davis, and K. Kroll; Department of Agricultural and Resource Economics, University of Maryland at College Park, Working Paper 96-13, March, 1996.

vegetables were raised and the benefits of their sustainable practices. A Pennsylvania farmer provides a newsletter with the weekly produce bag to people in his CSA. In general, sustainable growers did not feel the price they received was any higher or there was a price premium for their produce over conventionally grown vegetables at farmers' markets; the one advantage was that their truck came home empty. More specifically, it seemed that there is a faithful customer base who loyally purchase from sustainable farmers because they believe that sustainably grown fruits and vegetables are of higher quality. Organic certification was much more important to farmers who wholesale. Retailers/grocers of organic produce need to demonstrate to their consumers that what they have purchased was organic; consequently, farmers must present an organic certification to them. The connection between sustainable vegetable producers and innovative marketing strategies in the Mid-Atlantic is strong.

There are two major trends in livestock production and marketing by these sustainable farmers -- natural or organic beef production and management intensive grazing (also known as rotational grazing). Often natural beef producers will intensively graze their animals, however, many more farmers are practicing intensive grazing and selling their animals or milk in conventional markets. An environmental advantage of intensive grazing is that it reduces the amount of feed obtained from row crops. In particular, the small dairy farms that are located throughout the Mid-Atlantic in the Piedmont area or in the foothills of the Appalachians, have problems with erosion on their cropland. Permanent pasture is far preferred to row crops on hillsides in these situations. Also, pasture based livestock systems reduce the need for manure storage facilities such as lagoons, slurry-stores, or other expense alternatives and, in general, make manure management easier. Intensive grazing is a sustainable technology which farmers have developed and are practicing for largely, financial reasons.

A Maryland couple sells "natural" beef to local consumers There is not any certification for natural beef at this time, so they and others typically will say that the beef was fed on hay and grass grown on organically certified land. Also, if the animals were given antibiotics, then the consumers are informed. Sustainable producers generally will not withhold antibiotics from animals if they are sick, but will not put it in the feed as matter of routine. However, most of these farmers feel that their animals are healthier because of the organic feeds and increased grazing practices. A Pennsylvania farmer also raises natural beef. In addition to hay and grass, he provides more feed such as barley, oats, speltz, and raw soybeans. He sells his beef, two animals per month, to an organic restaurant in Washington, D.C. at 1,250 pounds live weight. His price per pound in that city is double what conventional beef would bring. Locally, his beef gets 30 to 50 cents per pound over the conventional. The farmer raises his own organic feed. He has a problem buying organic soybeans, if needed, because much of that market is going to the Japanese who will pay a high price.

Our break-out group at the Pre-Conference in San Antonio noted that many farmers in the U.S. and Canada are participating in markets to sell directly into their nearby urban communities. In Vancouver, British Columbia, there is an early morning auction for local cut flower producers. In Southern Maryland, there is an auction market for fruits and vegetables. In Kentucky, farmers have joined together to sell their products cooperatively. In general, these are diversified producers with small acreage selling to similarly sized buyers. The farmers represent a continuum from organic growers to those who use modest amounts of pesticides. Organic production does not seem to be as of as much importance as the buyers' perception that these growers care about their production and the goods that they are selling have high quality. Also, buyers like making a connection with local producers rather than purchasing produce from distant markets. These niche markets can be quite profitable. These farmers are more skilled in marketing than the average farmer.

In terms of our Extension work, we need to facilitate farmers working together to break into these local, urban markets. Farmers need to switch from a commodity mode, in which they sell a particular product, to a mode where they are selling a package of products that their consumers want. Extension can help them practice target marketing -- to identify their customers, determine what the customers' needs are, and how the farmer can meet these needs most successfully. Another role, Extension can play is to provide entrepreneurial advice, on how to write business plans, and proceed into these new markets. We need to encourage farmers to understand that niche markets change rapidly, and that today's success may not be tomorrow's.

Influencing Local Government Policy: Discussion Notes

Author: Timothy Kelsey, The Pennsylvania State University

Local governments primarily are involved with service provision (such as roads, police, sewerage, and water), developing and enforcing institutional rules to further residents' general welfare, safety, and health (such as building and zoning regulations, and nuisance ordinances), and planning. These decisions help create the local business and community environment within which farms operate, and can have an impact on the long-run sustainability of local agriculture.

Discussion focused on several key questions. The questions and participants' thoughts follow.

Why Should Local Governments be Concerned?

Agriculture plays an important economic and social role in many rural communities. Impacts include employment and economic base, and community identity. Maintaining an agricultural presence in the community can be important for helping maintain supporting jobs and bringing money into local economy.

Is Local Government the Appropriate Jurisdiction for Decisions about Sustainable Agriculture?

Whether they want to be or not, local governments are involved because their policies influence the actions particular stakeholders can take. Local governments should consciously think about the implications of their decisions on local agriculture, instead of just letting decisions occur without regard for their impact.

It is unclear whether local governments have the capacity to understand and respond appropriately to agricultural issues.

Jurisdictional issues are important to consider. Spillovers from surrounding municipalities (such as flies or odors from a farm on the municipal border) can have important influences on residents' quality of life. Economic spillovers are equally important to consider, because rural economies are interlinked. Municipalities cannot necessarily go it alone: a broader response might be appropriate.

Each jurisdiction is unique. It is impossible to have one plan fit all. Policies need to be site-specific. The local government input is essential.

What Are Appropriate Local Government Actions with regard to Sustainable Agriculture?

If local governments decide to maintain a sustainable agriculture in their community, they should rely upon positive incentives to encourage that agriculture instead of punitive measures to discourage other forms of agriculture. Examples of positive incentives include land or water banking, and tax incentives.

Preferential taxation (either assessments or tax rates) might also be used to encourage sustainable practices, but the feasibility depends upon state guidelines.

Zoning may be the best answer to helping sustain agriculture, but it is also imperfect. Changes in political power or local leadership can change the rules over time, removing protections. In addition, a given zoning code may be appropriate for current farm methods and organizations, but be inflexible and

thus (inadvertently?) prevent farms from changing over time in response to market signals and new technologies.

Building permits may also work.

What Can Agricultural Economists Add to Local Government Decision-Making?

A potential role for agricultural economists is to help local communities understand the potential impact of alternative local policies, so those communities are not surprised with resulting changes in their local agricultural economy or overall employment resulting from policy initiatives (or inaction).

Major Research Question:

Through local policy tools, can local governments influence the type of technology used on farms? Possible policies to consider include ordinances affecting the scale of operation, waste management, and specific practices (such as burning sugar cane). If so, how does this impact the local farms' abilities to survive in a global economy?

Consumer Education About Agriculture

Author: Kate Smith, The Pennsylvania State University

Conversation was lively among the five discussants. We first reviewed communication links between consumer and farmer in the past. Discussion then turned to the present and finally to the future. The summary is divided by these perspectives. The following is a summary of the discussion:

Past

Food Linkages. In the past, farmers directly consumed some of the product they produced. Further, consumers grew some of what they ate. Now of course, nearly everybody gets all their food from a store.

Partnership. Land grants had more of a partnership with agriculture. "We" had a hand in the "design" and helped create the agriculture of today.

Long-Term Consequences. Blindly influencing agriculture with our expertise, without thoughts of long-term consequence was and is dangerous.

Extension. Extension was more involved with on-farm demonstrations and this included stakeholder tours. The various stakeholders (bankers, processors, policymakers, input suppliers, etc,) were part of the educational effort.

Farmer Focused. Agricultural economics was much more farmer focused. Consumers were the realm of home economists.

Society's Support. Agriculture was well treated by society in terms of the resources allocated to support and develop it.

Present

Removed From Farm. Consumers have lost the sense of where their food comes from. The percent of the population that is two generations from the farm is large.

Bad Guys. Agriculture has the growing reputation as being a negative for society. The farmers are being called polluters and people that do not value animal welfare. Good will is diminishing with the increasing scale of agriculture. The farmers caught cheating on commodity programs have tarnished the good name.

Reassurances. Now agricultural economists are mostly there to explain price movements. We act like reassurers that all is well at the macro level--price moves according to our models. We have the reputation of just doing analytic activities with little creativity.

Social Agenda Changes. Allocation of resources from society is more food focused rather than on production agriculture. Issues on top of the social agenda are kids and personal health. Ag. extension agents are working with youth at risk and answering horticultural questions.

Complex System. Agriculture (food system) is so complex that few understand and can describe it. People eat whatever they want at anytime of year. The concept of seasonality is lost. People don't worry about food availability.

Changing Landgrants. Land grant services are changing. We still continue to offer education to farm children and social mobility to society in general. This has an effect on the "supply" of farmers in that the opportunity cost of farming is higher. In addition, with the explosion of specialization, farmers do not need extension in the same way. Production agriculture as a result is not as supportive of agricultural economics and may walk away from the land grant in a political sense.

Future

Opportunities. There are opportunities with social change. The Delaney Clause is out, we have a role in understanding the consequences. College of agricultures have a future with the commercial agriculture because they will want the applied science.

Educate. We will continue to educate. We train ourselves and our students to measure with a caliper but in the real world, decisions are made with an ax.

Bleak. Agricultural Economics has a bleak future because we are more dependent on farm policy than many realize. As the government moves out of regulating the farm sector, our use to society will decrease.

Uniqueness. Society must recognize that the biological process of producing food and fiber is fundamentally different than other endeavors.

Site Specific. Land grants will have site specific focus and will find niches. But change is definitely coming.

Number Crunchers. Agricultural Economics will merge with applied economics departments. We will continue to market ourselves as number crunchers.

Ensuring Economic Rationality in the Sustainable Agriculture Debate

Author: John Holt, University of Florida

"Sustainable Agriculture" would be unlikely to make the top ten "most important issues" list in most agricultural economics departments, so we can start the debate with our colleagues at home. Our argument is not about defining it: it is about needing help in analyzing the changes in our agriculture being wrought by technology; by changing comparative advantage; by societal concerns about the environment, food quality and safety. When we get results, we can then debate their rationality.

Professionals complacent about agriculture's ability to feed this nation so cheaply are unaware of the impact of changing regulations; of how international competition is changing most marketing patterns and price ratios; and of the diverse ways the new farm bill increases price volatility. Besides that, bio-engineered cultivars and GIS systems are re-shaping farming, and farmings' ancient adversary—the weather—also seems to have come unstuck.

The up-shot? Agriculture is a brand-new game, and none of us now understand it very well. We need all the help we can get; both from our colleagues, and from the other disciplines in the land-grant system.

We can try and convince our colleagues of the importance of adding a social science dimension to the work of other land-grant scientists, and hence capitalize on our own, and our system's, comparative advantage.

Even without other scientists, economists can analyze systems being tried by producers. We can help identify systems that are profitable; that preserve as much as possible of our natural environment; systems that, if sustainable long-term, might be helpful in feeding a growing world population. Young professionals seeking a niche may be assured this is an enduring problem set; one that can only increase in importance.

The human capital base in U.S. land-grants; our wonderfully diverse and dynamic agricultural production and marketing systems; and our evolving regulatory environment offer us the world's best laboratory for developing more sustainable agricultural systems.

The question to be answered is: "How are imperatives of production and imperatives of preservation balanced?" (Thompson, p. 166) With us as team-members, land-grants are well suited to answer that question. The U.S. and the world will be far poorer if we answer it poorly.

For starters, we need economic analyses of various systems that are being tried. Only producers can test the full set of conditions that systems must survive in order to be truly sustainable, so case studies should be, and are, playing a larger role in our research.

Sustainable systems are site-specific. So local work needs to document the current and likely long-term profitability, and the full set of environmental and social impacts of various systems. Published information can then be grist for both public and private decision-making.

The public's perception of what is expected of our agriculture is dynamic, and that perception can rapidly be reflected in regulations. Hence, analyzing the actual and potential impact of regulations is a continually challenging agenda.

We should not be quick to abandon work on systems, including small ones, that may offer environmental benefits but appear to fail current economic tests. After years of languishing, rotational grazing dairies are making a come-back, driven by rapidly changing input prices and environmental regulations. Re-modeling old houses is a simple task, compared to modifying agricultural systems which

have worked for years, so carefully done, future-oriented, financial analyses are needed to support decisions about adapting or modifying current systems.

Nor should we be quick to denigrate work on large-scale agricultural systems. Large operations' environmental sins are lightning rods that attract punitive regulatory and media attention. But design flaws can be cured, and large operations can afford investments in environment-saving technology that may be beyond the economic reach of smaller operations. On the people side of large systems, all the larger successful operations I know have active training programs which increase the skills, and hence the mobility, of their people.

Much is written about niches. Consumers create them. Among the more fascinating questions are the extent to which consumers' concern for quality, safety, and diversity in food will stimulate alternative production and marketing systems.

One robin doesn't make a spring, and anecdotes aren't convincing—even to me—but there is a small three-store chain in our area that undersells our "major" food retailers by 30 percent or more on meat, and features locally-grown produce at competitive prices. Is this small chain the first robin of a new food-marketing spring? Will it be sustainable? Are there others like it in your area? Do agricultural economists analyze such things anymore?

When I was a boy growing up on the south bank of the Clear Fork of the Brazos river, it was neither clear, nor a river. Now it is both. Bigger equipment, improved farming techniques, and better management mean that more rainfall soaks in, and so ancient springs run again. Not, perhaps, as full as they did in my Dad's day, but the Clear Fork is a river again. There are ducks on that river, now, and deer in the thickets. There were none when I was a boy.

Maintaining the productivity of agriculture, and improving the natural environment is indeed a huge task. But it can happen. I have seen it.

The will to tackle huge problems is also helped by knowing huge progress is being made by many people taking small steps to improve other huge social problems. In "The Tipping Point", Gladwell tells how New York City went from being a crime center to ranking a hundred and thirty-six among American cities in violent crime. New York City is now on a par with Boise, Idaho.

As social scientists, we can explain how incentives matter. If, for example, we want wolves in the West, we could pay ranchers for anything less than, say, a 90 percent calf-crop, if they could prove they had wolves, since wolves are known to eat some calves.

Doing so would create a new consulting niche for wild-life biologists who could document the presence of wolves on a ranch. It would also likely be far cheaper than present re-introduction programs. Paying ranchers for calves not sold might also encourage sloppy management, but economists can document the full set of likely impacts of incentives, whether they come from policies or prices.

All the stake-holders in agriculture need our help in analyzing the smorgasbord of systems being proposed by a collage of crackpots, scientists and producers. Some of them are being tried, and all of us want to know which of them will be more sustainable --in all the dimensions of the word. The environment needs all the help we can give it. Producers need our help, as do policy makers and regulators. So too does the rest of the world.

We have the expertise. We have the team. Let us do our small part. Let us get on with analyzing the impacts of what is going on in agriculture now and be as objective as we can about the full set of likely future impacts. Publish our results and let the chips fall where they may; let the people decide what systems they want, based on the best information we can provide.

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Westra, John, *University of Minnesota*
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