Economic Sustainability in the Evolving World: Implications for American Agriculture and Economists

Steven C. Blank[]

American agriculture continues to evolve in response to both natural and social change. Both natural and social scientists respond by evaluating "what is" at any point in time, but each group also contributes a unique piece to the eventual solution. In the simplest terms, natural scientists identify and/or create "what can be" while economists (as a subgroup of social scientists) help identify "what will be" by providing decision-makers with the information and analysis needed to select among the available alternatives. In agriculture, the last few decades have been astonishingly dynamic as science has greatly sped up the industry's evolution, thus creating the need for change in larger scale and scope. However, recent changes have brought agriculture into conflict with the environment in policy debates.

As natural and social scientists, agricultural producers, and policy-makers have become aware of the expanded scope of change, a new debate is focusing on an old issue: "sustainability." Both natural and social scientists are now focusing much attention on this issue, yet those efforts are rarely coordinated because the underlying problems and components are not yet well understood because they reflect complex systems and phenomena. As a result, progress toward sustainability has been very limited. This article offers a brief perspective on how agriculture evolved into its current status as a competitor with environmental conservation as alternatives for land and other resource uses. Suggestions how this conflict might be turned into a complementary coexistence is an important step toward sustainable agro-systems. It is argued here that economists need to take a leading role by working with other social scientists in defining the targets for natural scientists as the goal of sustainability is pursued.

Turning Different Perspectives Toward a Single Goal

The term "sustainability" itself has not been defined universally by natural and social scientists, thus each group has a unique perspective of what it means and, therefore, how it should be studied (Common and Perrings). In a natural science perspective, "sustainability" generally focuses research on identifying the balance and renewability of natural systems. In economics, however, "sustainability" is viewed as a temporal constraint on decision-making.

Economic studies of "sustainability" focus on the "fairness" of outcomes between time periods (Foy). For example, the simplest of these economic models evaluate outcomes between the present and future generations. One outcome of economic assessments of sustainability has been the development of the "sustainability criterion." The criterion suggests that, at a minimum, future generations should be left no worse off than current generations (Tietenberg, p 94). Combining the perspectives of natural and social scientists, and especially economists, means that, together, these groups must identify/create and help the industry select agricultural production systems that satisfy present and future needs.

[] Steve Blank is an extension economist in the Agricultural and Resource Economics Department at the University of California, Davis and a recipient of the WAEA's Distinguished Scholar Award.

What is Sustainable Agriculture?

The definition of the term "sustainable agriculture" is still evolving. A computer search for the definition generates at least one statement for each of the natural and social sciences trying to address the challenge. Even on the campuses of the numerous universities with "centers" or "institutes" or "programs" focusing on sustainable agriculture, there are multiple definitions being used by different groups or departments. Unfortunately, scientists tend to focus narrowly within their discipline and sustainability requires a broad, multidisciplinary view.

Congress tried to come to the rescue in 1990. They defined sustainable agriculture in the 1990 Farm Bill. Given that federal funding is a substantial source for agricultural research at present, it would be wise for all natural and social scientists to become familiar with the specifics of that definition. Under that law (U.S. Congress), "the term sustainable agriculture means 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 agricultural 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 society as a whole."

Two things should catch the eye about this definition of sustainable agriculture. First, the five bulleted points outline tasks that require both natural and social scientists to accomplish. The first point requires social scientists to identify the "needs" and natural scientists to create the systems necessary to produce the output sustainably. The second point is nearly all natural science, except that environmental and resource economists might contribute in the discussions of regulatory and market frameworks. The third point involves economists to identify "efficient" uses and natural scientists to fulfill the remainder of the tasks. The fourth point is all economics. The final point is again a combination of natural and social science tasks. Thus, no scientific discipline has a monopoly on finding a path to the goal, it must be a multidisciplinary effort.

The second theme is that "economic viability" (or sustainability) is a subset of the definition. Economic sustainability is key in identifying what *will* happen: it is a necessary, but not sufficient, condition for achieving the goal of a sustainable agriculture. This means a significant contribution to be made by economists is to evaluate the profitability of agricultural operations, not only in dollar amounts, but more importantly in terms of return on investment so as to facilitate comparisons between alternative systems developed by natural scientists. Part of this contribution will be analyzing the markets in which profitability is determined. The structure of markets for agricultural outputs is critical in the search for a sustainable agriculture, as explained later in this article.

Agriculture's Evolution, In Brief

A quick summary of the evolution of agriculture helps identify some of the key problems needing to be addressed to achieve a sustainable future. In general, Figure 1 illustrates that over the history of mankind there have been three general types of agriculture, with a sustainable agriculture being the next type to evolve. In the beginning man was a hunter-gatherer. Agriculture followed as a more-stable system for meeting the food needs of people and, as it

became established, agriculture enabled people to develop villages and become less migratory. Traditional agriculture, the first type to develop, was "sustainable" in that people could use only what natural resources were available within a short distance and that system did not harm the environment over time. In essence it was a system of raising plants and animals in a convenient place. The only real improvements in this first type of production system compared to what was naturally occurring in the area was the human input that assured water availability and, gradually, the elimination of competing plants from the area being cultivated (although "slash and burn" systems prove not to be sustainable). Thus, productivity levels for traditional agriculture were only slightly higher than the yields offered by Nature. Eventually, the current total output capacity of an area would become insufficient to meet the demands of the expanding population, thus forcing a change in the production system in use.

Figure 1. The Evolution of Agriculture

Agriculture type	Description	Concerns forcing change
Sustainable	An evolving goal	
Organic	Reduces some harmful inputs	Non-renewable resources, lower yields
Industrial	Higher productivity, inputs not sustainable (renewable)	Ecology, "quality of life"
Traditional	"Sustainable", low productivity	Total capacity within trade regions

For most of mankind's history the only real change needed to meet higher levels of demand was to expand the total area being cultivated. However, in the late 19th and early 20th centuries, population growth in many regions made it difficult to keep up with demand for food, even with trade between people within the region. As a result, people began to seek higher productivity levels from the available farmland by adopting "industrial" production methods. This involved applying many man-made inputs. This began the second type of agriculture, which was viewed as an improvement upon traditional production systems. (Hence, the vertical arrow in Figure 1 indicates an upward movement in the development of agriculture, as producers shifted from "traditional" to "industrial" methods – as shown on the bottom of Figure 1.) Industrial agriculture has included mechanical, chemical, biological, and managerial revolutions that continue, in varying degrees, to this day. The rate of industrialization in American agriculture increased rapidly during and immediately after World War II when, first, large numbers of men were pulled off farms for the war effort and, next, large amounts of capital flowed into farming. The third type of agriculture to evolve, "organic," has been slowly transitioning into favor as concerns over (1) industrial agriculture's effects on the environment and (2) "quality of life" have increased in recent decades. Whereas industrial production systems in agriculture have much higher levels of productivity than did earlier systems, they use many inputs that may be harmful and are

certainly not sustainable. Organic production systems reduce the use of some harmful inputs, but many of the systems in use currently have lower yields than the industrial systems they are replacing (Blank and Thompson) and, thus, cannot sustain the world's population at current levels of demand for food. As a result, "organic" agriculture is viewed by many production scientists as an interim stage between "industrial" and "sustainable" production systems in wealthy nations only. The arrow in Figure 1 points upward to the ultimate goal of achieving a sustainable agriculture.

In this brief sketch of agriculture's evolution it is clear that the productive capacity of each system is the key concern causing society (including farmers, natural and social scientists, and policy-makers) to search for alternative systems. Traditional agriculture is sustainable with regards to its effects on the environment and it is still practiced in many less-developed parts of the world. It is being abandoned by those developing countries as soon as they can afford to shift to industrial production systems because additional volumes of food are needed for their growing populations. Thus, one reason developing countries move from traditional to industrial agricultural systems is in response to short-run needs for food. This is the first step up the simple development ladder depicted in Figure 1. Conversely, wealthy countries are moving up, slowly leaving some industrial systems for organic production methods, because of concerns for the long-run effects of industrial production on the environment and the health of their populations. Ultimately, both concerns must be faced by all countries and, it is being argued by increasing numbers of advocates, the final solution to both problems must combine the productivity of industrial systems and the environmental neutrality of organic systems to create a truly sustainable agriculture.

The Economics of American Agriculture

The current state of profitability in American agriculture is very mixed. Many producers across the country are quite profitable, so much so that the summary data published by the U.S. Department of Agriculture appears to indicate that production agriculture is a viable industry. However, a closer look finds that a majority of farmers and ranchers are not truly profitable and that the industry as a whole is far from sustainable (Hoppe and Banker).

In a detailed analysis of the many questions related to American agriculture's current level of profitability and its struggle for long-term sustainability, Blank (2008) presents three general results that illustrate the challenges facing the industry. First, he notes that economic theory clearly shows that perfectly competitive commodity markets average zero profits over time, thus agricultural producers are always struggling to find more profitable niches as competition squeezes agricultural investment returns below the levels offered by alternatives. Second, the "technological treadmill" (Cochrane) keeps American agriculture in the increasingly global markets for commodities by creating new technology that lowers unit costs, but the treadmill is not truly sustainable because it views Nature as a competitor to be overcome. And the third general result is that government agricultural policies try to help American producers, but most policies currently focus on subsidizing market profits – especially for Midwestern grains – rather than making those crops more competitive so as to *solve* the underlying problem.

The first of Blank's results can be summarized by saying that there is a profit squeeze on agricultural producers. Output has outpaced demand for most commodities over the past century, thus leading to falling real prices for the outputs of most producers. On the other hand, the prices of inputs used by agricultural producers have increased dramatically, especially in recent decades. The result is that profit margins are falling, making commodity production less

profitable over time and, therefore, a less attractive investment for family farm owner-operators. The decline in profit margins over time is evident in Figure 2. The gross profit margin of American agriculture was about 50% from the beginning of the 20th century through World War II (the margin is the share of "total sales" represented by "net income", shown in Figure 2), but it gradually declined to about 10% by 2002. Additionally, Blank (2001) shows that average net returns on equity in American agriculture declined from 2.5% in 1960 to 1.5% in 2000.

Blank's (2008) second result is a natural response to the first result: farmers constantly strive to improve their incomes by adopting new technologies. As explained by Levins and Cochrane (p. 550), "early adopters make profits for a short while because of their low unit production costs. As more farmers adopt the technology, however, production goes up, prices go down, and profits are no longer possible even with the lower production costs." In this era of global markets for most commodities what is often driving the adoption of new technologies by American producers is the need to compete with foreign suppliers – especially those in less-developed countries – who have lower production input costs. This competition is resulting in increased output, but lower profit margins for producers as they continually search for a profitable niche. That search has mostly involved seeking production methods that give higher yields, despite the long-run effects on the environment – i.e., in the past the environment has been viewed by many as an obstacle to be overcome in the search for greater output.

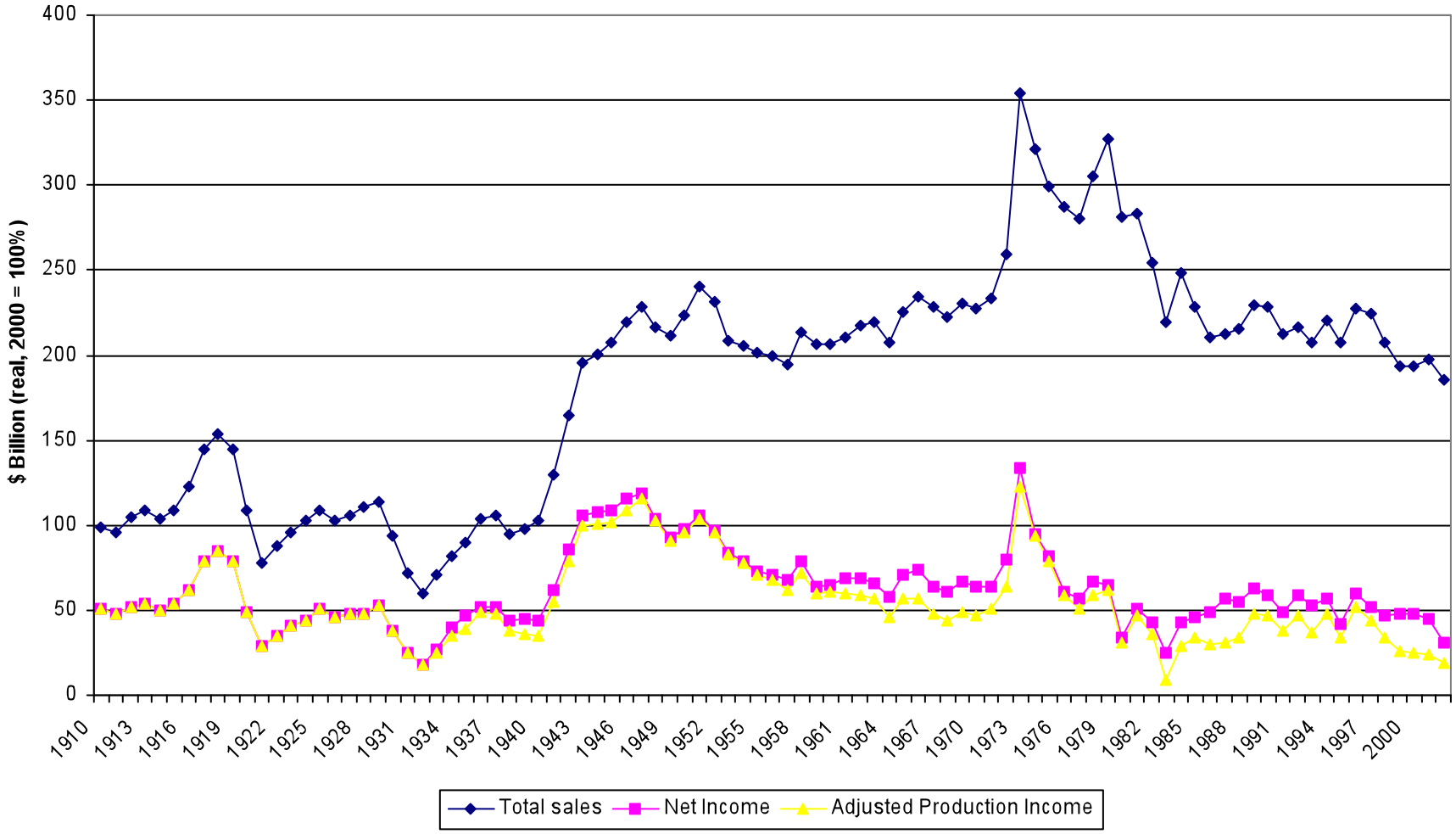
Blank's third result is spelled out (pp. 434-9) as he shows which farms receive government payments and where those farms are located. He argues that subsidizing market profits for commodities was a reasonable approach to achieving the goals of aiding the farm economy during the Great Depression of the 1930s and lowering food costs for consumers during the 1940s and 1950s. Unfortunately, those policies led directly to the surplus production that depressed commodity prices and profits over the last few decades thus hurting farmers to the benefit of domestic and foreign consumers of American agricultural commodities. Clearly, a change in focus is needed in American agricultural policy.

In light of these results concerning the profitability of American agriculture, the question arises: "how can economic viability be established so the sustainable agriculture goal can be achieved?" This is probably the most important question facing economists and the agricultural industry itself at this point in time. Natural scientists continue to work toward new alternative biological and production systems, but the value of their efforts is not fully recognized. It is economists who can and should lead the effort to help industry resolve this obstruction in the path to a sustainable agriculture, as explained below.

A Modest Proposal

Economists can help advance progress toward the goal of a sustainable agriculture by becoming more active in the pursuit of the piece of the goal's definition which has received almost no attention thus far. The fifth bulleted point in Congress's definition of sustainable agriculture asserts that agriculture affects "the quality of life for farmers and society as a whole" yet "quality of life" attributes have largely been ignored by economists. Although the help of other social scientists is needed to identify and define what those attributes might be (both negative externalities and positive amenities), economists can contribute by applying our understanding of markets. Specifically, the most likely answer to the question of how economic viability can be established for a sustainable agriculture is that government policies can assist markets in establishing the value of "quality of life" attributes, and the assistance of economists will be needed for that to happen.

Figure 2. Real U.S. Agricultural Sales and Income, 1910-2002



Quality of life attributes, such as agriculture's effects on health issues and environmental quality, do not yet have values determined in markets. This "market failure" justifies government intervention. Such interventions are beginning to happen in Europe and it is being discussed by some U.S. agricultural groups as a new approach to agricultural policy. Examples of indirect attempts to recognize agriculture's contributions to, and effects on, the quality of life in the U.S. include the Conservation Reserve Program, laws limiting agricultural pollution, and local ordinances recognizing and protecting the amenities provided by a rural landscape.[1]

"Multifunctionality" is the label being used for the new theme in agricultural policy debates. The term refers to the existence of multiple commodity and non-commodity outputs that are jointly produced by agriculture (Randall). Cahill (p. 36) noted that "food security, food safety, animal welfare, cultural and historic heritage values, environmental quality, landscape, biodiversity and rural development are just some of the outputs claimed to belong to the multifunctionality of the agricultural sector." Proponents argue that government intervention is needed because markets do not exist for all of these outputs, especially the non-commodity. If economists can work with policy makers to establish markets for all of the outputs of agriculture, and those markets can establish values for each output, the long-run economic viability of agriculture is sure to change for the better (Randall; Smith; Paarlberg, Bredahl, and Lee). For example, Bennett, van Bueren, and Whitten found Australian urban dwellers are willing to pay some positive amount to maintain rural populations because of the environmental stewardship function performed by rural residents.

Blank (2008, p. 450) suggests "America needs to shift the focus of policy from viewing 'agriculture as factory floor' to 'agriculture as neighborhood.' This change is needed because the farm factory is not always profitable, and taking the 'neighborhood' view helps us realize that agriculture affects everyone." With this new view, and a multifunctionality perspective, farmers and ranchers can be seen as "stewards of the land" that are performing a public good that should be valued because it is essential to achieving a sustainable future. Many farmers already view themselves as a steward in a limited sense. A broader notion of stewardship is based in Blank's call for a new policy perspective. A multifunctional view would encourage and empower farmers and ranchers as they are formally recognized as stewards of the land/environment, communities, human health, and rural vitality.

Such a policy shift would give market values to each alternative identified and/or created by natural scientists (which is not happening at present), such as plant varieties; production methods; systems for improving air, land, and/or water quality; to mention a few. This would point "what will be" toward an agriculture and an environment that are viewed as seamless components of a single world, rather than as competitors for attention and resources. As economists, we should probably argue to policy makers that this is a fair way to balance the needs of present and future generations in our evolving world.

[1] A host of environmental protection and/or conservation programs have been introduced in farm bills since Congress defined "sustainable agriculture" in 1990. The examples listed here demonstrate the wide range of issues addressed and approaches used by government.

References

Bennett, J., M. van Bueren, and S. Whitten, "Estimating Society's Willingness to Pay to Maintain Viable Rural Communities," *The Australian Journal of Agricultural and Resource Economics* 48, 3 (2004): 487-512.

Blank, Steven C., *The Economics of American Agriculture: Evolution and Global Development*, M.E. Sharpe: Armonk, New York, 2008.

_____, "The Challenge to Think Big as American Agriculture Shrinks," *Journal of Agricultural and Resource Economics* 26, 2 (2001): 309-325.

Blank, S. and G. Thompson, "Can/Should/Will a Niche Become the Norm? Organic Agriculture's Short Past and Long Future," *Contemporary Economic Policy* 22, 4 (2004): 483-503.

Cahill, Carmel, "The Multifunctionality of Agriculture: What Does it Mean?" *EuroChoices* 1 (Spring 2001): 36-41.

Cochrane, Willard W., *Farm Prices: Myth and Reality*, University of Minnesota Press: St. Paul, 1958.

Common, M. and C. Perrings, "Towards an Ecological Economics of Sustainability," *Ecological Economics* 6, 1 (1992): 7-34.

Foy, George, "Economic Sustainability and the Preservation of Environmental Assets," *Environmental Management* 14, 6 (1990): 771-8.

Hoppe, R. and D. Banker, "Structure and Finances of U.S. Farms: Family Farm Report, 2010 Edition," Economic Information Bulletin No. 66, Economic Research Service, U.S. Department of Agriculture, July 2010.

Levins, R. and W. Cochrane, "The Treadmill Revisited," *Land Economics* 72, 4 (1996): 550-3.

Paarlberg, P., M. Bredahl, and J. Lee. "Multifunctionality and Agricultural Trade Negotiations," *Review of Agricultural Economics* 24, 2 (2002): 322-335.

Randall, Alan, "Valuing the Outputs of Multifunctional Agriculture," *European Review of Agricultural Economics* 29, 3 (2002): 289-307.

Smith, Katherine R., "Public Payments for Environmental Services from Agriculture: Precedents and Possibilities," *American Journal of Agricultural Economics* 88, 5 (2006): 1167-1173.

Tietenberg, Tom, *Environmental and Natural Resource Economics*, Sixth Edition, Addison Wesley: Boston, 2003.

U.S. Congress, "Food, Agriculture, Conservation, and Trade Act of 1990," Public Law 101-624, Title XVI, Subtitle A, Section 1603, Government Printing Office, Washington, D.C., 1990.