Comparative Regional Economic Impacts from Agriculture
A Literature Review

January 16, 2002
Mara Krinke
Land Stewardship Project

A joint publication of the Land Stewardship Project and Fires of Hope

Table of Contents

Acknowledgements

For more information on ordering additional copies of this publication, please visit www.landstewardshipproject.org and www.foodroutes.org or contact: Land Stewardship Project, 2200 Fourth Street, White Bear Lake, MN 55110; phone (651) 653-0618; fax (651) 653-0589.

Special thanks to project collaborators and those who provided helpful guidance and review. Thanks to Fires of Hope, for providing the funding to conduct this literature review and to Tim Bowser for developing the idea and helping to bring it to fruition. Thank you to Kristen Corselius, who provided some of the early background research for this work. Thanks to John Ikerd and Richard Levins who provided helpful comments on an early draft. Finally, thanks to George Boody, who provided guidance and advice throughout the project.

I. Introduction

Regional economic impacts are produced by all farming systems. Understanding the difference among farming systems can help policy makers and advocates define and guide policy in response to societal goals. For example, if rural development is a goal, policies and programs can be targeted to those types of farms that provide the most benefits to the community. If diverse farming systems can be shown to provide increased local economic benefits compared to other systems, we may choose to reward that type of farming in order to promote local rural development. If certain ownership or marketing arrangements are shown to improve regional economies, local interests may choose to direct rural economic development funds towards supporting those initiatives. This paper seeks to answer the question of which, if any, farming structures outperform others in terms of local economic benefits. Improved performance could be a rationale for rural economic development programs. An economic benefit that may be desirable to communities is to keep more money in the community, which would have the effect of maintaining or strengthening local economic health and resiliency.

The National Commission on Small Farms expressed its choice for the future of American agriculture in the following paragraphs. While most of the research that is quoted in this publication is not identified specifically by USDA small farm definitions, the Commission findings provide an important overview of why this is issue is critical to society.[1]

> *"Small farms have been the foundation of our Nation, rooted in the ideals of Thomas Jefferson and recognized as such in core agricultural policies. It is with this recognition of our Nation's historical commitment to small farms that we renew our dedication to the prominence of small farms in the renewal of American communities in the 21st century. Black, Hispanic, Native American, Asian, women, and other minorities have contributed immensely to our Nation's food production and their contributions should be recognized and rewarded.*
>
> *It is our resolve that small farms will be stronger and will thrive, using farming systems that emphasize the management, skill, and ingenuity of the individual farmer. We envision a competitive advantage for small farms realized through a framework of supportive, yet responsible, government and private initiatives, the application of appropriate research and extension, and the stimulation of new marketing opportunities. As small farms and farmworkers succeed in this nurturing environment, not only will they continue their valuable contribution to the Nation's food supply, but they will also fuel local economies and energize rural communities all across America. In the process of flourishing, small farms will contribute to the strengthening of society, providing communities and the Nation with opportunities for self-employment and ownership of land, and providing a cultural and traditional way of life as well as nurturing places to raise families.*
>
> *We emphasize public policies that recognize the value of small farms and actively encourage their growth and continuation. These policies are essential to the realization of this vision; so too, are policies that recognize and reward the contributions of farmworkers and their families. Toward this end, the Commission has articulated goals and made specific recommendations to guide the*

[1] This vision is focused on those farms with less than $250,000 gross receipts annually, on which day-to-day labor and management are provided by the farmer and/or the farm family that owns the production or owns, or leases, the productive assets.

decision-making of the Secretary of Agriculture, the Executive Branch and Congress into the next century."

Nebraska's rural residents overwhelmingly support rural economic development, stressing the need for family farms, schools, stable communities and small businesses (Center for Rural Affairs, 2001). Many rural areas have seen destruction of these institutions in their communities, school closings and the loss of family farms. The increasing consolidation in agriculture, particularly in animal agriculture, exacerbates these problems (Levins 2000). Social effects have been linked to the structure of farms in research dating back to Walter Goldschmidt's study of Arvin and Dinuba in 1944 (republished in 1978). Goldschmidt compared the California farming communities of Arvin and Dinuba, considering the simple indicators including the level of retail trade, family income, and presence of schools, parks, churches and playgrounds. He found that Dinuba, surrounded by a large number of family farms, appeared to have higher quality of life across each indicator listed above, than Arvin, a town surrounded by large-scale, industrialized farms. This was true, even though the towns were about the same size and the total dollar value of farm products was similar. (Goldschmidt, 1978)

While there are intuitive links between farming structure and community vitality, the research on economic impacts to rural economies that result from different farming systems is somewhat limited in the academic literature. The research approaches the question from sociological and economic disciplines. The primary research methods used to estimate the effects of shifts in supply or demand on local economies are local area studies, input-output modeling and other econometric modeling. Local area studies tend to rely on surveys and other data to summarize farm purchases, management and sales at a detailed local level. Sociology studies usually fall into this category of analysis. Input-Output modeling is typically used at a larger county or state scale and estimates economic benefits (or losses) from discrete changes in development or business patterns. Econometric modeling is a way to estimate the direction and degree of relationship among variables. Data for econometric modeling can be collected at any scale of research, from individual to country or international.

The comparative benefits that accrue from diverse farms and larger, industrial style farms, where inputs are purchased off-farm and commodities produced are generally shipped to distant markets, are highlighted in this paper. For this paper, an economic benefit is defined as having more money circulating in the local community, from increased farm revenues or increased local spending by farmers. This increased spending has the effect of maintaining or strengthening local economic health and also can strengthen the development and maintenance of social capital. *Benefits such as increased farm profitability and value-added marketing are beyond the scope of this analysis and are not discussed in detail in this paper.* The descriptions below describe the current studies or practices that relate to agricultural issues.

Farming types vary based on size, business organization, input use, marketing methods as well as the types of products grown. Several authors have studied the differences in spending patterns among farm types. These studies have generally found that there are differences in labor, fertilizer and machinery inputs and in the dollars that are recycled

into the community under different types of farming systems. This paper attempts to summarize the literature available across these different variables by describing the studies completed to date.

A. Defining Farm Types

Farm types vary by the scale and ownership of the farming operation, the inputs purchased and the marketing methods of outputs. Different studies have approached the question of variations in community economic impacts under the different farm types. The different definitions of farm types and methodological issues are outlined below.

1. Scope and scale of farming practices

There are large differences among farms in the scale of the operation. Farms range from small, single-family supporting operations to large scale, highly specialized farms run by management companies or corporations. The USDA uses gross farm sales to classify farms by size. Three-quarters of the farms in the US have annual gross sales under $50,000 and are classified as "non-commercial" farms, meaning they do not generate enough sales to be commercially viable on their own. Half of these farmers rely on off-farm income. These farmers may be hobby farmers. Alternatively they may wish to be full-time farmers but take off-farm jobs as a necessity due to the inability to obtain an adequate return from farming. Further, farmers may take off-farm jobs to qualify for benefits such as health insurance and retirement programs. For farmers in the next highest sales class, from $50,000 gross sales to $250,000 gross sales, 86 percent of these farmers count farming as their primary occupation, but the average return on equity is negative (NCSF, 1998).

Another popular statistic used to describe the structure of agriculture is the contribution of value of production per sales class. Farms with gross sales under $250,000 make up 94 percent of all farms. However, these farms receive only 41 percent of all farm receipts. In other words, out of 2 million farms, 122,810 of the largest farms, or six percent of the total, receive the majority of farm receipts. (NCSF, 1998)

Smaller farms have different approaches to risk and tend to have different interactions with the community than larger farms. "Sustainable" agriculture, typified by smaller and diverse farms, is characterized by the minimization of environmental and economic risks by using management and labor skills to diversify production and conserve natural resources. On the other hand, industrial agriculture encourages large scale, highly specialized farms where uniformity is emphasized over quality, and where many costs are shifted from the farm operation to society. (Center for Rural Affairs, 2001b)

In 1986, the Congressional Office of Technology Assessment (OTA) predicted the demise of the moderate-sized farm due to rapid adoption of biotechnology and information technology. Citing the rapid concentration and use of new technologies (gene insertion, growth hormones, other genetic engineering techniques) in the animal sector, they predicted the same technologies (breeding for pest resistance, self-production of

fertilizers, etc.) would sweep the crop sector. The authors named organic farming as a viable alternative for small farms, stating "if farmers shifted to organic production, farms would be more diverse biologically and economically, and the small farm could remain economically competitive and ensure diverse, competitive food production systems." (OTA 1986)

Growing Concentration Changes Agricultural Sector

Management and ownership are of interest because employer-employee relationships may vary under these different types of organizations. Further, depending on the location of a cooperative or corporate "headquarters," profit (or loss) from the farm enterprise might be concentrated away from the community in which the farm products are raised. Concentration and the use of contracts have rapidly changed agricultural markets, particularly animal markets. Farm size and production have increased, concentrating production and profit in the hands of fewer farmers. The Federal Reserve Bank in Chicago says that if the growth of large hog producers continues, "some 50 producers could account for all the hogs needed in the U.S," and adding "many rural communities will be affected." (Center for Rural Affairs, 2001a)

The chicken industry entered a period of concentration before hogs. Almost all broiler production in the U.S. today is done through contracts with independent growers. One of few major companies controls contracts with farmers, placing the economic risk on the farmers shoulders while enjoying profits that may exceed 20 percent. In contrast, an average farmer with three growing houses may net $12,000 per year. (Morrison, 1998) Farmers entering contracts in the early 1980s probably signed the contract with a processor who was a neighbor. However, within the last 15 years, processing companies expanded, and local ties were lost. Guidelines on raising the chicks are stringently written and controlled by the processors. Tysons, for example, uses standardized contracts where the chicks, feed, medication and technical advice are supplied to the grower who supplies housing, poultry equipment, utilities, labor and waste disposal. The purchased inputs are likely to come from outside the community, diminishing the economic benefit that might come from having poultry growers in the community. (ibid)

Industrialization in livestock markets has been widespread across the agricultural sector. There are losses of biological diversity in animal stocks (citation?) and smaller farmers have been pushed out of business (expand using Brian's stuff?). Five corporations now control 89 percent of all beef processing. Four corporations control 58 percent of all pork processing. In the last two years, 24 percent of all pork producers went out of business. Forty producers now control one-third of all hogs raised in the country. (Center for Rural Affairs, 2001) This market domination can lead to unfair pricing practices. [2] Further, profits generated by the sale of these animals will be concentrated in the corporate

[2] The problem isn't that smaller farmers aren't economically efficient. It's that industrialization leads to closed markets where prices are fixed not by open, competitive bidding, but by negotiated contracts, and where producers who don't produce in large volumes are discriminated against in price or other terms of trade. Under these market conditions, many smaller farmers who don't participate in vertical integration are forced out of business because they have no place to sell their product in a timely manner at a fair price. (Center for Rural Affairs, 2001)

headquarters and by stockholders, rather than by the farmers who raise the animals. Small rural communities face the loss of locally owned agricultural production and thus rely on one less economic revenue source. If diversification of economic interests is of interest to a community, these statistics show the importance of measuring the scale and ownership of farming systems.

Neal Harl, an economist with Iowa State University, has expressed concern with the recent push toward contracting, stating "the greatest economic threat to farmers as independent entrepreneurs is the deadly combination of concentration and vertical integration." Concentration, via mergers and alliances, has occurred across all sectors of agriculture, including animal slaughter, grain handling and shipping, farm equipment manufacturing and food retailing. Harl asserts that, unless decisive action is taken now, farmers will be left as "powerless pawns in the production process." (Caspers-Simmet, 2001)

Powerless farmers and concentrated affiliated businesses spells trouble for smaller communities because the businesses with the power to make purchasing and other decisions may have no reason to hold operations in smaller communities. Input purchases and the processing and marketing outputs bring key dollars into communities that can be recycled through investments, jobs, and other purchases. Without those transactions or replacement economic activity, communities will suffer.

The next two sections describe the reason for including discussions of input purchases and the location and ownership of processing and marketing.

2. Inputs and Location of Purchase

The labor and materials a farmer uses to supply her farm can be purchased from local or distant suppliers and paid wages or, if the worker is a family member, may not be compensated with a paycheck. Farms can be described by the types of inputs they use, ranging from chemical supplies (fertilizers and pesticides), seed or animal stock, and "conventional" farms are used to delineate these differences.

These factors are of interest because the point of purchase generates economic activity in the community in which that purchase occurs. Regional economic models use a ratio of inputs supplied locally as a factor of analysis. The higher that ratio is, the more of each production dollar stays in the community. If a farmer buys and sells inputs with her neighbor, those dollars stay in the community and circulate, providing economic benefits. However, if farm inputs are being procured from outside the region, the resulting profits are centered in a different community. The volume of inputs purchased per farm is also of interest because it is related to the level of economic activity produced by the farm enterprise.

3. Farm Outputs and Marketing Practices

Just as the location of the inputs is of economic interest, so is the resulting output of farm products – where the goods are sold and the profits are accumulated. In farming, much of the profit is generated through processing and marketing, so the location of those enterprises is important in considering the community economic benefits of farming. Farmers' ability to retain the food dollar has slipped over the last century. The USDA reports that the share of disposable income spent on food going to farmers has dropped from 38 percent in 1953, to 27 percent in 1983 and 20 percent in 1998. Table 1A compares farm value and retail prices for several common products in 1999.

Table 1A
Farm Share of Retail Price in 1999, Selected Products

	Farm Value	Retail Price	Percent to farmer
Wheat flour (5 lbs)	$0.27	$1.45	19%
Corn flakes (box)	$0.10	$1.98	5%
Tomato (can)	$0.04	$0.56	7%
Milk (1/2 gal)	$0.67	$1.70	39%
Pork (lb)	$0.60	$2.42	25%

USDA, ERS. Food marketing and price spreads. Farm-to-retail price spreads for individual food items, Table 1.

Input suppliers, processors and marketers claim the rest. Spending on food has increased over time, but personal disposable income has grown more quickly. In the US, we spend about the same percentage (around 4 percent) on restaurant food as we did in the 1950s, but the percent spent on food to eat "at home" has fallen from 17.9 percent to 6.6 percent. (USDA ERS, 2001)

B. Measurement Tools

How are the effects of farm size, input purchase and the organization of processing and marketing measured? Several measurement tools are available to researchers wishing to study the varying economic impacts resulting from different kinds of agriculture. The three most common can be categorized as local area studies, econometric studies, and regional economic models. Each type is described in more detail below.

1. Local Area Studies

Local area studies typically involve detailed research via the use of surveys or interviews focused in a selected geographic area. In these studies, researchers may select a statistically representative sample of farmers or recruit participants to provide a general idea of the economic transactions occurring in the community. For example, John Chism, in a master's thesis at the University of Minnesota, asked farmers where they spend their money on inputs and where they sent outputs. His questions were directed to determine if different types of farmers have a greater impact on regional economies than others.

2. Econometric Modeling

Econometric modeling is a way to test relationships among variables. One factor is predicted by one or more other variables. One could use such modeling to predict individual income based on education, years of experience, gender and field of work. In such a case, researchers would hypothesize that individual income is affected by each of the other variables. For example, in "Impacts of Hog Concentration on Economic Growth in Rural Illinois: An Econometric Analysis," Gomez and Zhang argue that increasing consolidation in the hog farming industry results in detrimental effects in small towns and rural communities. The authors developed econometric models to test the hypothesis that concentrated hog production facilities benefit local communities. The results of the analysis refute the hypothesis. These large hog farms are, however, able to produce large quantities of cheap food, which benefit urban communities. The costs of this cheap food lie in environmental damages and local economic health. Different analyses could be developed using this econometric method. The results of their analysis are found below.

3. Regional Input-Output Models

Input-output models use an estimate of an expected economic "shock" (e.g., a new farm in the area) and create estimates of the total economic benefits resulting from the discrete economic event. The community benefits estimated include the jobs or money generated on the farm to the farm family and jobs created or expanded for additional labor. The second type of benefit results when those who are newly-employed (or people who have increased their income) spend more money in the community. They may spend it on increased rent or mortgage payments, increased food consumption, or purchase of more services. This increased spending, in turn, benefits businesses and their employees, who may choose to increase their spending in the community. The first economic impact is compounded, or multiplied, by the amount of money each person in the chain decides to spend in the local community.

Regional input-output analysis can trace the impacts to 528 sectors in the economy. Most regional input-output studies measure the effect of a feedlot entering a selected community. The impacts for any specific feedlot will vary with the location of the feedlot, the nature of that county's local economy, the nature of the feedlot, and the spending patterns of the producer. In addition, the net impacts will vary with the type of other development displaced, if any. This potential displacement is called an "offsetting effect."

However, given reasonable estimates of the different multipliers for different farming systems, for example, these models could also be used to assess shifts in the proportion of different types of farms. Varying the multipliers within industries is possible but the differences in the multipliers must be user-specified. For example, if one assumes that different levels of inputs are required from a hoop-house based system on a farm growing their own hog feed and an industrial model farm, one would have to change the ratio of a production dollar coming from off-farm inputs for each farm type. The different ratios would result in different levels of direct, indirect and induced local economic benefits.

Regional input-output models that can be used to estimate these effects subject to the demographic and economic characteristics of the specified area and many assumptions about human behavior.

The model sums up economic effects using three measures:

- ***Direct Effects*** - Changes in the industries to whom a final demand change was made (jobs or money generated directly from the increases in production or services).

- ***Indirect Effects*** - Changes in inter-industry purchases as they respond to the new demands of the directly affected industries (results when those with increased incomes spend money in the community, through increased rent or mortgage payments, increased demand for food and services, and so forth).

- ***Induced Effects*** - Changes in spending from households as income and/or population increases or decreases due to changes in production (from both the direct and indirect effects on production).

Results can be presented as a grand total of the above three types of impacts or separately.

Varying the multipliers within industries is possible but the differences in the multipliers must be user-specified. For example, if one assumes that different levels of inputs are required from a hoop-house based system on a farm growing their own hog feed and an industrial model farm, one would have to change the ratio of a production dollar coming from off-farm inputs for each farm type.

Typically, these models are used to estimate the value of a discrete economic "shock" or incident to a particular region, such as a state. Suppose a factory is built in Rochester Minnesota to produce a new medical product. In addition to the direct number of jobs this will create in Rochester (both for construction and operation of the factory), the people who are employed at the factory will increase their spending in the community and thus support additional services and purchase additional goods. Further, a certain proportion of the factory supplies other than labor are likely to come from local suppliers, increasing their income. Both the increased jobs and supplies will have positive economic impacts in the community. For any type of industry, there are multipliers that represent the proportion of each production dollar comes from an array of inputs. Similarly, there are multipliers for how the revenues from each industry are distributed, in wages, investments and corporate profit. From wages, a portion is saved, another is spent locally, and the rest is spent in non-local markets. All of the multipliers are flexible and can be manipulated by the user.

II. Farm Size and Organization

Uninterrupted fields of crops increasingly dominate the agricultural landscape, particularly in the Midwest. Animals have moved inside to buildings and crop rotations and diversity have diminished. Farm programs to support the production of corn, soybean and cotton crops distort behavior and have resulted in larger and larger fields planted to a few crops as farm operators take advantage of federal policies. This occurs despite evidence that diverse rotations that include oats and small grains or lower input crops outperform corn and soybean fields and that well managed pasture for animals provides benefits to soil and water quality (Boody and Krinke, 2001). However, farmers wishing to achieve good environmental outcomes on their farms face the choice of staying in the program crops, retiring their land under a conservation program, or switching their rotations at the loss of program payments.

Adoption of technologies such as precision agriculture or genetically modified plants can result in farmers managing larger and larger plots of land. For precision agriculture, this technique can be adopted by any size farm, though the trend will be to use the information as a time saving tool in the field and therefore to till more land. Olson (1998) predicts that precision agriculture will require many new jobs, as people will be needed to run the hardware and software for the information system. However, these jobs may be located away from rural areas as local presence is not necessary and the people possessing the skills to run the tools may live in urban areas. (Olson citing a NRC study, 1998)

Increasing Size of Animal Operations Changes Rural Communities

Small towns across Minnesota have experienced structural change in their economies. As changes in animal agriculture have brought decreased diversity within farming enterprises and larger and larger cash crop farms, small town shops and services have suffered. Larger regional centers have benefited from these changes, as shops and services move into the larger towns. In a study of Green Isle, Minnesota, a traditional dairy farming community southwest of the Twin Cities metropolitan area, Patricia Weir Love measured changes in farming and economic activity over the past 25 years and supplemented her work with interviews from local farmers and business people. One businessman, who closed the doors of his shop recently, summed up the troubles facing Green Isle succinctly: “When dairy gets so big, they don’t deal with you; they buy direct and bypass the local economy.”

An increasing number of animals are raised under contracting systems, where the production decisions are made by an outside entity. The poultry industry was the first to consolidate and integrate. Recently, the hog industry has followed a similar pattern. Independent farmers interviewed about the effects of concentration report feeling pressure to conform to large and mega-scale prodcution systems tied to concentrated firms through contracts. In a contract arrangement, each part of the system is controlled, from the size and type of buildings, medication and veterinary services used, and feed type and purchase. Producers are often required to set up multiple 1000-head barns to

obtain loans and get contracts with the integrator. These factors make the contracting systems less attractive from a local economic development perspective as fewer feed and input purchases are likely to be made locally when controlled by an outside entity. (Land Stewardship Project, 1999)

This report draws from a State of Minnesota sponsored a literature review on the regional economic impacts of animal agriculture. To read the review, see www.mnplan.state.mn.us and find the "Generic Environmental Impact Statement" (GEIS) on Animal Agriculture. The literature review appears in the Economics Technical Working Paper.

The GEIS study made several conclusions. First, the studies were found to be inadequate to project what might happen to the economy if changes in the animal agriculture sector were to occur. From their perspective, the studies, labeled "impact" studies, were descriptive of the economic links of the livestock sector to other parts of the economy but were not sufficient to describe what might happen to the industry if an impact (e.g., an increase in the number of farms) were to occur. The authors stipulate that to evaluate the trade-off between economic benefits and environmental or social costs of livestock production, changes have to be studied at the community or regional level. However, they also conclude that:

> *"One the regions are likely to have different economic structures. Consequently, the same type and size of livestock operation will have very different impacts in different types of local economies. Similar differences are probably true on the environmental side. The value of this generic study is in guiding future research rather than in guiding public policy."* (Morse and Guess-Murphy, 2001)

The implication of their conclusion is that local studies are necessary to understand the functioning of local economies because changes in agriculture may or may not have significant effects on rural economies that are largely dependent on other forces. However, other authors assert that some of the effects related to change in the agricultural sector are so extreme that they can be generalized to broader conclusions. These authors (Land Stewardship Project, 1999, Smith, 1992) are more conclusive about the changing shape of the agricultural sector and its importance to regional economies. There is a substantial body of literature that suggests that large-scale agricultural production does not bode well for conditions in farming communities. University of California anthropologist Dean MacCannell wrote,

> *"As farm size and absentee ownership increase, social conditions in the local community deteriorate. We have found depressed median family incomes, high levels of poverty, low education levels, social and economic inequality between ethnic groups, etc…. associated with land and capital concentration in agriculture…. Communities that are surrounded by farms that are larger than can be operated by a family unit have a bi-modal income distribution, with a few wealthy elites, a majority of poor laborers, and virtually no middle class. The absence of a middle class at the community level has a serious negative effect on*

> *both the quality and quantity of social and commercial service, public education, local governments, etc."* (NCSF, 1998)

Large Farms – Are they more efficient?

More efficient farms will generate more profit than less efficient ones, thus having the potential to have a greater local economic benefit. The assumption that large farms are more efficient because of economies of scale can be challenged using data from the Census of Agriculture. In a study to examine the efficiency of different sized farms, Peterson (1997) found that estimated economies of scale (the assumption that large farms are more efficient than small ones) disappear and that there may be diseconomies of scale as farm size increases. To get this result, the author took into account the following three factors:

- combining farm dwelling with capital inputs (smaller farms tend to include a home on site which appears as a capital cost in profitability calculations);
- correlation of management characteristics with size (large farms are often staffed by more skilled personnel than small ones); and
- the effect of off-farm employment on small farm output and production costs (management levels may be less intense on smaller farms if the principal operator has an off-farm job).

These factors tend to be more important for small farms than larger ones, making the costs of operation appear relatively higher on small farms than larger ones. This creates an unequal comparison. Accounting for these factors makes the economy of scale disappear. The author concludes that this does not mean farms will not continue to grow in size. Rather, as long as off-farm wages exceed the cost of farm machinery services (contracted to reduce their labor need on the farm), farm sizes will continue to increase.

The USDA's National Commission on Small Farms (1998) places additional caution against using gross revenues as a measure of farm performance. They summarize:

> *"While agriculture has become more segmented and specialized, most analyses of gross sales statistics have failed to distinguish between the differing, and often value-adding levels of production. Of course farms with higher levels of gross sales would appear to be more productive. Yet a closer examination shows many of those high-end operations are dependent on primary-level production constituting cow/calf, lambing, farrowing, or grain production. A simple indicator of the differences can be shown in cattle production. The average size cow/calf operation in the United States is 49 head. A medium-sized feedlot operation averages 10,000 head, yet depends upon the primary calf production as its source for feeder cattle. Without more precise indicators to measure the contribution of the primary level of production, an appreciation of the productive contributions of small farms is diminished.*

> *When a gross sales statistic is used combining all agricultural sectors, it can generate the conclusion that large and super-large farms produce most of the food and fiber in this country, when, in fact, the most critical production occurs at the primary level."*

Therefore, government policies and other forces focusing on the large and super-large farms as an inevitable result of economic progress may mislead us from the most efficient outcomes by ignoring the small farm.

Without Farm Subsidies, What Economic Benefit?

Farmers in Boone County, Iowa, put together a simple analysis that shows how diverse crop systems can support many more farming enterprises than corn and soybean, or program, crops. In absence of a farm subsidy program, to net $45,000 per farm, a corn and soybean system, returning $15.00 per acre, would need to be 3,000 acres in size. In contrast, an integrated farm system (with livestock, corn, soybeans, oats and hay in rotation), would yield $150.00 per acre, and therefore only require 300 acres to net $45,000. The differences in the net return per acre result from $75 extra per acre from the livestock, $54 in reduced input costs (fertilizer, tillage and weed control) from the oat and hay crops, and a $6 higher revenue yield from the field crops. Expanding this analysis further, the authors calculate that in Boone County, an agricultural county in Iowa of 368,640 acres, the corn and soybean systems could support 123 farm operators while the diversified system would support 1,230 operators. (Thompson and Thompson, 1994)

Raising Animals – What Scale Benefits Communities?

Agriculture has an important role to play in national, state and regional economies. Traditionally, agriculture was practiced on a smaller scale, with marketing largely occurring within the region in which the animals and crops were raised. Farms were more likely to be diverse enterprises, than the current trend toward larger and larger crop farms and to farms with contracts to raise animals that may not grow their own feed. Flora and Tweeten (2001) address the economic impact of vertical coordination (including contracting) on communities. They suggest that vertical coordination increases productivity and profits and reduces employment (due to increased productivity) and therefore reduces local income. Depending on where the issuer of the contract is located, rural communities can lose the benefit of the increased profits under this system.

In a 1994 study, DiPietre and Watson used input-output analysis to estimate the impacts of Premium Standard Farms on the state of Missouri and a five county region where the hogs and the employees are located. They estimated the impacts during the five-year construction phase as well as annually after the farm was in full operation. These *were ex ante* estimates so it is uncertain if the direct impacts were as high as estimated. The total impacts would be less than the estimates presented below if the direct impacts have been overstated.

The construction costs were industry estimates on a per sow basis, not exact figures from Premium Standard Farms. Type III multipliers, a special version of Type II which yield 15 to 20 percent lower results than the Type II, were used to estimate the total effects. The study estimated that the construction of the farm created 1,291 new jobs in Missouri in the construction period and 1,639 new jobs in Missouri during operation. These jobs are the additional jobs throughout the economy that are resulting from the employment and operation of the new Premium Standard Farm. The economic benefits assigned to this are an increase in personal income of $119 million in Missouri (87 million in the five county area) during construction and $199 million during operation ($82 million in the five county area).

However, other authors counter this evidence, saying that the addition of certain types of farms, while potentially beneficial to the state as a whole, can hurt the community in which they are located. In addition to potential external costs such as environmental planning, monitoring and clean-up, the new farms may push out existing, smaller farmers. Ikerd (1998a) reports that this same Missouri installation could displace up to three times as many independent farmers and negatively affect even more off-farm jobs. This study is discussed in more detail below.

Meatpacking plants provide benefits to local farmers but the wages paid are considerably lower than the average manufacturing wage. These wages have fallen greatly over the past decade as the meat packing plants have moved from urban unionized plants to rural non-unionized plants. (Morse and Guess-Murphy, 2001) Meatpacking and poultry processing is moving to fewer big plants in remote rural areas. This reduces the odds that communities can use this as a development strategy unless the community is remote enough and other alternative jobs are scarce. However, the move to fewer, larger plants means that more and more communities are left out.

Animal Agriculture – Hogs

The impacts of the hog industry on local economies have been more extensively studied than other agricultural sectors to date. Perhaps this is due to the rapid change that has occurred in the sector over the past 20 years without stabilizing.

In “Impacts of Hog Concentration on Economic Growth in Rural Illinois: An Econometric Analysis,” Gomez and Zhang argue that increasing consolidation in the hog farming industry results in detrimental effects in small towns and rural communities. The authors developed econometric models to test the hypothesis that concentrated hog production facilities benefit local communities. The results of the analysis refute the hypothesis. A similar analysis could be developed along other variables, for example, the presence and growth of farms using sustainable/stewardship practices. These large hog farms are, however, able to produce large quantities of cheap food, which benefit urban communities. The costs of this cheap food lie in environmental damages and local economic health.

The GEIS reviewed a study developed by Iowa State University economists that measured the effects of different sizes of pork operations. The authors used an integrated input-output/econometric model. The University work is reported in two articles (Otto and others 1998; Otto and others 1996). The two articles by Otto, et al. were based on the same research, originally reported in the "*1996 Pork Industries Economic Review*," published by the National Pork Producers Council. Starting with data from Purdue University on the costs of production and time required on farrow-to-finish operations of 150, 300, 1,200, and 3,400 sows, they used regional input-output analysis to estimate the multiplier effects of each size of operation. In the first paper (Otto and others 1996), they report the impacts under two different assumptions about corn. In the first case, they assume that the additional pork production will stimulate additional corn production, resulting in higher regional employment and incomes. In the second case, they assume that there already is a surplus of grain and that this is exported out of the region. In this case, the additional pork production would result in less exports but no increase in corn production. Consequently, the spin-off effects would be less. The data from Purdue shows a negative return to capital for the 150-sow unit with proportionally higher returns to the larger units.

The authors compared the impacts of a farm in each of the four sizes of sow units. The larger units show more positive impacts on the total number of jobs. The scenario that assumed corn production would increase as a result of the pork production yielded slightly higher total employment but lower earnings per worker. (Morse and Guess-Murphy, 2001)

The Iowa State study on the impacts of different sizes of pork operations (Otto and others 1996; Otto and others 1998) did not adjust the level of input purchases by farm size. Other authors (Chism 1993) have found that variations in spending patterns between large and small farms do occur. As outlined in the original report, the Otto, et al. papers found that larger pork operations had more positive economic impacts than smaller ones. As Thompson and Haskins (1998) point out the Otto, et al. papers should have set the total level of output equal before making a comparison but did not. When this is done, the smaller farms appear to have the advantage in terms of number of jobs but the disadvantage in terms of the quality of those jobs (i.e. income per worker).

Thompson and Haskins (1998) criticize the above research (Otto and others 1998) for failing to compare the net impacts on the community if all the production had been in the smaller farms rather than the larger ones. That is, they argue that Otto, et al. should have held the level of output constant for the four different sizes rather than comparing one very small farm with other larger farms. Using the data from Otto et al. reports, Thompson and Haskins show that twenty-three of the smallest farms would produce the same amount as the largest farm. Using Otto et al.'s data, Thompson and Haskins go on to show that if all the production was in the smallest farms they would employ considerably more persons than the one large one. The table below contains a comparison of the Otto estimates with the Thompson and Haskins estimates using the same data. Thompson and Haskins simply held the total number of

animals raised constant. Instead of comparing the employment impacts of one 150 sow farm to one 3,400 sow farm, they compared the impacts of about 23 150-sow farms to one 3,400 sow farm.

Table 2A shows that the 300-sow farms produce the highest total economic benefit resulting from employment gains. However, the jobs produced have slightly lower earnings per worker than are found on the largest farm.

Table 2A
Employment and Income Effects* of 3,400 Additional Sows Raised in Iowa**

	150 sow farms	300 sow farms	1,200 sow farms	3,400 sow farm
Primary Employment (Jobs)	32	34	28	21
Earning per worker	$28,907	$28,948	$29,469	$33,767
Secondary Employment (jobs)	30	31	25	19
Earning per worker	$16,343	$16,827	$17,492	$19,780
Total Employment	61	64	53	40
Total Employee Income	$1,415,300	$1,505,872	$1,262,433	$1,084,918

* Numbers may not sum due to rounding.
** Thompson and Haskins, 1998

Another study (Ikerd, 1998a) compared the local economic impacts among four types of hog operations in Missouri: contract farrowing, contract finishing, contract farrow-to-finish, and independent production. Using the same multiplier for economic effects per job (2.22 jobs created independent from the farm operation for each farm type), the independently operated hog farms, with higher employment, generate 28 local jobs compared to six jobs at the contract farrowing facility. Labor requirements are higher on the independent farms because feed is generally raised on site and management decisions are made on-site rather than in corporate locations for the contract farms. Table 2B presents employment estimates including local employment generated for contract and independent farrow-to-finish farms.

Table 2B
Employment Estimates per $1.3 million annual hog production

Employment Estimates per $1.3 million annual production	Contract Farrow-to-Finish	Independent
Management Jobs	0	6.17
Other Jobs	4.25	6.44
Jobs per $1.3 million sales	4.25	12.6
Local job multiplier	2.2	2.2
Local jobs produced	9.4	27.7

* Ikerd, 1998a

Ikerd goes on to discuss the displacement factor. Contract farms can raise many more hogs per worker than independent farms. Investing $5 million in a contract production facility would generate 40 to 50 new jobs but could displace up to three times as many independent producers. (Ikerd 1998a) These displaced farmers supported over 100 other local jobs (80 to 100 net jobs displaced x 2.2 = 168 to 220 jobs lost).

III. Farm Input Purchases

Studies of purchasing habits of farmers yield mixed results, largely because of different units of comparison and how "local" is measured. Does one type of farm or the other purchase more goods (spend their money) locally more than the other farm type? If there is a difference in purchasing patterns, we can encourage one type of farming over another in pursuing local economic development and we know to modify any regional input-output analyses for the "regional purchase coefficients" from the different types of farms.

Sociologist Walter Goldschmidt predicted the demise of rural communities based on the view that large farms would buy less locally (1978). Marousek (1979) surveyed 84 Idaho farmers (49 small ones and 35 large ones) and found that small farms spent a higher percentage of their production expenditures locally than large ones (59 versus 55 percent). He found that 22% of the small operators but none of the large operators expected to cease farming within five years.

Comparing Farming Systems

The following two studies compared the location of input purchases between different farming systems, defining the differences as high or low input systems or as "conventional" and "alternative" systems (the latter with a higher degrees of diversity in farming practices on the farm). The author found that the farms with lower input systems tended to by a larger proportion of their inputs locally, though the total of local purchases were not as high per acre as the "high input" farms. The more diverse, or "alternative" farms tended to outperform the "conventional" farms in the Missouri study.

Lockertz (1989) compared the economics of high input conventional cropping systems that typify farming in the Corn Belt, the eastern Great Plains and the Northwest, with lower input alternatives to assess their impacts on local communities. The low input systems all had longer rotations, used cover crops and avoided pesticide and organic fertilizer use. Using data from previously published studies comparing the economics of high input crop production and low input crop production; he assessed the production systems' contributions to the local economy. He looked at community impacts through farmers' payments of labor and indirectly through payrolls and profits of the businesses that service farmers. Lockeretz found that the lower input systems, beyond the return to the farmer, contributed less per acre to the local economy in cash flow than did the higher input systems. However, he did find that with all of the higher input systems, a greater portion of the value of production left the local economy to pay for purchased inputs.

A Missouri study used a computer based community impact assessment program to evaluate the impacts of "conventional" and "alternative" agricultural systems on the rural economy in 13 counties (Ikerd, 1998b). The researchers designed a conventional system to reflect farming methods typical of Missouri farms and current spending patterns of local farmers and county residents. An alternative farming scenario was designed to reflect more sustainable systems that utilized increased crop rotations, reduced tillage methods and more intensive input management strategies. A third scenario, the "sustainable community development scenario," was designed to reflect ecologically sustainable systems that also reflected increases in local purchases and local production of inputs and services.

The model estimated that the conventional farming scenario directly supported 400 farm households per county in 1992. As an indirect result of the farming activity, another 370 non-farm households were supported. Ikerd determined that a complete shift to the sustainable farming scenario would provide support for more than 165 additional farm households per county (565 in total). A shift to a sustainable community development scenario would have even more dramatic impacts on the local economy by supporting some 300 more non-farm households than the conventional scenario. Thus Ikerd concluded that sustainable agriculture paired with sustainable community development could add much more to rural areas than conventional farming.

Specifying the location of purchases is critical in input-output models

Input-output models that are based on generalized data (rather than on a detailed survey) must estimate the amount of inputs to a sector that are imported from outside the region being studied. The GEIS authors noted that this estimate is considered one of the weakest aspects of non-survey input-output models (Morse and Guess-Murphy, 2001). Most of the regional input-output models use an econometric estimate of the regional purchase coefficient (RPC) or estimate it via the supply-demand pool method, which relies on an assumption that all local purchases come from local supplies prior to going to imports. The supply-demand pool method arguably overstates the local economic benefits because survey data and interviews show that many farmers and managers purchase inputs from outside the region, even if they are available locally.

As summarized in the GEIS, Diego Platas' Ph.D. thesis (2000) examines the linkages between the pork industry and local economies and the linkages between the pork industry and the state's economy. This also is reported in a research report (Lazarus, Morse, Platas, and Guess-Murphy, 2000). This study provides an examination of whether large or small pork producers contribute more to local economies and the state economy. This study made several innovations over prior studies done in other states (reported next). First, this input-output study used farm level data in Minnesota to create local production functions for two different sizes and two different types (farrow-to-finish and finishing only). Second, pork producers were surveyed to learn their spending patterns for their major inputs. The producers were asked what county and state they purchased their key inputs. With this data the percentage of local demands satisfied by local production,

the regional purchase coefficient was estimated for each input. Third, estimates of the regional economic impacts were made for four different local economies and for the state for each size/type combination. Fourth, the impact scenarios assumed all production was in a given size/type so that the differences would not be due to the difference in output levels. Fifth, the consequences of considering the likely survivability of different sizes of pork operations are considered.[3]

At the state level, Platas found the overall percentage of inputs purchased within the state to range from 78 percent for large finishing operations to 89 percent for small finishing operations. Large farrow-to-finish operations purchase 85 percent of their inputs within the state compared to 88 percent for small farrow-to-finish producers. At the county level, the overall percentage of inputs purchased within the county was lower for every county and every size and type of operation. However, there was huge variation between the counties and operations. Generally, small operators purchased more locally than the large ones. At the state level this difference was very small for farrow-to-finish operators (3%) and relatively small for finishing operations (11%). In two counties, the small finishing operators purchase 25% (Blue Earth) and 27% (Pipestone) more locally than the large operators. But in Martin County the small finishing operators purchase one percent less than the large ones. For the farrow-to-finish farmers the smaller ones purchase more locally in all cases than the larger ones. However, the difference varies from only 7% (Pipestone) to 15% (Blue Earth County) to 25% (Martin County). Smaller producers purchase more locally than larger producers, for both farrow-to-finish and finishing operations. If survival rates are held constant, smaller producers will outperform larger ones in terms of positive local economic impacts. However, smaller producers have lower survival rates than larger producers. Platas used the above data and assumptions (including lower survival rates for small producers) to explore whether small pork producers contribute more to local economies than large ones. He found that the three county average value-added income of large farrow-to-finish farms was 40 percent greater than small ones, assuming both were producing $40 million in pork per county. At the state level, the difference was even greater (45 percent).

While the large producers are shown to yield more economic benefits than the small ones, this doesn't tell a policy maker that they should be preferred. These benefits have to be balanced against any environmental costs or benefits by size. Also, the lower survivability rates should be investigated to see if current policies are making it more difficult for smaller producers to thrive.

The Marousek (1979) study is one of the few input-output studies that uses survey data to develop the regional input-output model. The model is highly aggregated (19 sectors compared to recent models of 528 sectors) and has only two agricultural sectors. These are: "large farms" and "small farms." To use input-output with this type of aggregate

[3] The GEIS authors caution that the survival rates of small and large farms should be considered in the analysis. The GEIS authors go on to suggest that since large farms are less likely to fail than small ones, the positive impacts of the small farms should be reduced to account for the near certain loss of businesses each year. However, others might argue that the survivability is a function of our policies, primarily concentration and marketing arrangements. These factors can be influenced by state and federal government to better ensure the survivability of small farms.

sectors in agriculture, it is necessary to assume that the type of crops and livestock in large and small farms is identical. Assuming this, he uses the model to examine the tradeoffs between large and small farms on the rest of the community's economy. He found that: "Displacement of small farms by large farms results in greater regional income whereas increasing the number of small farms yields greater regional employment. Agricultural output is comparable for the two farm size structures" (p. 61).

Smaller farms have been found to spend a larger proportion of their income locally. In a Minnesota study of 30 crop and livestock farmers based on surveys and farm business management data, larger farms tended to buy a smaller percentage of their inputs from the local markets, particularly in the case of livestock farmers. Larger crop and livestock farmers were more likely to group together to purchase seeds and chemicals from factory or wholesale outlets thereby bypassing local sales people and receiving lower prices for their inputs. (Chism, 1993, Chism and Levins, 1994). Further, they found that farmers generally believe that large farmers are less likely to buy locally than small ones. They surveyed 30 farmers on their opinions about local vs. non-local spending. They found that these farmers felt: 1) larger farmers would benefit more from small differences in prices and would have greater incentives to purchase in non-local markets, 2) large farmers had greater capacity to shop around the region for discounts, and 3) large farms often needed specialized inputs not available locally. Not only do smaller farmers purchase a larger proportion of their inputs locally, but farmers from all sizes of operations recognize the pattern. The GEIS authors suggest that the 20-mile radius selected by Chism and Levins to represent "local" purchases should be discussed. They suggest that while 20 miles seems reasonable, it is unclear where the non-local spending goes, and if it goes to other rural areas, perhaps those economic benefits should be counted.

In a staff paper from Iowa State, Lawrence, Otto, Meyer, and Folkerts report on a 1993 survey of pork producers' spending patterns. These authors report that a larger percentage of large producers travel longer distances to purchase inputs compared to smaller producers. However, they do not report the per-acre spending which is needed to determine the local economic impact.

Otto in summarizing this work writes:

> *"Producers of all size operations appear to be willing to shop in more distant communities for their inputs and services. For producers who indicated they did not buy inputs in the nearest community, quality and service were most frequently given as reasons when professional services such as accounting, banking, and veterinary medicine were involved. Pricing became the predominant factor in producer decisions to purchase general supplies and hog equipment. Producers' concern with price and non-price attributes of inputs and services suggest that local agribusinesses in rural communities are likely to face increased competitive pressures from larger and more distant businesses. Rural agribusiness firms that are unable to provide specialized expertise may have difficulty competing in this environment*" (p. 17 and 18).

Farm Input Needs Change on Land in Retirement Programs

A related body of literature has explored the relationship between rural spending patterns and the enrollment of crop acreage in the federally funded Conservation Reserve Program (CRP). These studies reinforce the impacts of shifts in cropping systems and federal farm policy on the vitality of local communities. Generally, the studies find that idling cropland, while providing financial benefits to landowners, tends to shift spending away from local retail and crop-related spending to retail spending away from the local area. The economic benefits measured by these authors do not include any avoided costs from reduced environmental damages.

Roberts (1987) found that agriculture land use was a significant in explaining the change in the number of businesses between 1929 and 1971. Using a county level economic base model he estimated the change in the number of retail businesses in 150 counties in Kansas, Oklahoma and Texas over a forty-year period. He found that idled cropland was negatively related to the change in retail businesses. Thus he concluded that increases in CRP acreage diversions could result in a decrease in the number of retail businesses in rural areas thereby affecting rural vitality.

Martin et al (1988) used an input-output model to estimate the impact of CRP on local spending habits in three counties in Oregon. They found that local spending in rural communities actually decreased when the income with increased CRP enrollment. The CRP diversion payments caused a shift in farm expenditures from crop production-related purchases to consumer-related purchases. Because the smaller communities were unable to adequately provide the consumer oriented products that the larger surrounding communities had, they found that income generated by CRP diversion payments actually increased retail sales in larger surrounding communities.

Ikerd et al (1996) conducted another Missouri study that assessed the potential economic and ecological impact returning CRP acres into either a conventional or alternative agricultural systems. The conventional scenario reflected farming methods typical of northern Missouri farms. The alternative scenario was a more intensively managed system that utilized extended crop rotations, decreased inputs and reduced tillage practices. They found the total economic impact of crop production under the two scenarios were similar, however the distribution in the local community was different. The alternative system generated an estimated 25% more in local economic activity in addition to enhanced environmental quality. They estimated that the total economic impact from returning CRP land to production under the alternative scenario was estimated at $2.37 million in direct effects, $0.93 million indirect effects, and $4.56 million in induced effects, including direct farm income. Comparatively the conventional scenario generated $2.09 million direct effects, $0.78 million in indirect effects and $3.41 million induced effect including direct farm income.

Henderson et al (1992) assessed the impact of the CRP program on retail businesses in Oklahoma. Using tax records, they analyzed changing shopping patterns in multiple

communities. In their study of different sized communities, they found similar results as the Oregon study. Increases in government payments of crop diversion acres shifted spending patterns away from the smaller communities to neighboring metropolitan areas.

North Dakota, a heavily agricultural state with 11 percent of the cropland under a CRP contract, suffers annual losses due to the reduction in farm production and associated spending. An input-output model was used to assess the economic impact from the 3.2 million acres of cropland that was enrolled in the program in 1992. The removal of that agricultural land from production create approximately $55 million in direct losses from the state and an additional $49 million in indirect losses to bring the total revenue losses to $114 million per year. The retail sector is the hardest hit, totaling 40 percent of the $114 million loss. The businesses selling farm machinery and supplies are the hardest hit. (Leistritz, 1998) The study did not assess the avoided costs of government payments, potential water and sediment clean-up costs, or potential increase in tourism revenues that might result from the improvements in environmental outcomes with the retired land.

IV. Marketing and Market Structure

As agriculture has changed, market structure has an increasingly important impact on farm activities and profitability. Agricultural outputs and revenues, have, over the past century, shifted from farmers to input suppliers and the processing and marketing segments of the sector. Between 1910 and 1990, the farming sector has eroded from 41 to 9 percent of agricultural activity, losing to the input sector (which increased from 15 to 24 percent) and the marketing sector (which increased from 44 to 67 percent). (Smith, 1992.) As farmers began to rely more and more on inputs such as chemical fertilizers and pesticides, replacing rotations and curbing the use of on-farm livestock for fertilizer, they had grow, increasing field size to recoup the costs incurred by depending on outside suppliers. Similarly, as farmers processed and packaged fewer goods, pressure increased to recoup those costs as well. As these input suppliers, processors and marketers tend to have aggregated businesses and corporate headquarters providing centralized business services and therefore accruing revenues, the economic benefits are realized by cities or selected towns at the expense of the original farming communities. Farmers have become a less and less important part of the agricultural equation as time has passed. Most rural communities suffered with this change.

In “Finding Food in Farm Country,” Ken Meter and Jon Rosales calculated the flows of money into and out of southeastern Minnesota, a farming region composed primarily dairy and crop farms. They developed the following estimates:

- Number of farms: 8,436
- Total sales, farm products: $866 million
- Total costs, farm products: 947 million
- Amount of costs spent on inputs and credit from distant suppliers: $400 million.
- Amount that costs were in excess of sales in 1997: $80 million

- Number of residents in Southeastern Minnesota: 303,256
- Amount they spent on buying food in 1997: $506 milion

- Total amount spent raising and buying food that leaves the region: approximately $800 million. (Meter and Rosales, 2001)

Meter and Rosales show the potential for regional food systems to restore healthy economies on farms and in farm country. The processing and marketing part of the equation, highlighted by the statistics compiled by Smith (above) need to be a key part of any solution.

Dave Campbell lays out a strategy for the sustainable agriculture movement to address local economic development. He suggests that community-controlled economic development can hold power accountable, unify environmental and social agendas, and develop strong leadership. He suggests this movement is spurred by the increasing trends toward globalization and presents an alternative. Campbell suggests that networks and cooperation will be essential for farmers seeking to achieve community-controlled economic development. (Campbell, 1997) Further, many production and marketing practices associated with "sustainable" agriculture are consistent with the tenets of community-controlled economic development. (Strange, 1990) Farmers may substitute skilled labor and management for purchased inputs (such as increasing crop rotations and using Integrated Pest Management in place of chemical fertilizers and pesticides). Many farmers using low-input methods may join or start direct-marketing enterprises, as they can differentiate their products (antibiotic free, organic, etc.) from those commonly available in the marketplace. Ilbery and Kneafsey (1999), using evidence from Europe, argue that strong links between producers, consumers and institutions are critical to achieve the benefits of regional food systems and attendant local economic development.

A study conducted among New York dairy farm owners identified the various farm structures and practices in dairy farming and assessed the probability of farmers adopting Management Intensive Rotational Grazing (MIRG), a low-input, grass based system of raising dairy cows (Welsh and Lyson, 1997). The investigation included questions on farm structure such as farm size, hired labor, markets, ownership arrangement wand milk production. Analysis of these variables showed that higher sales are associated with greater use of hired labor. It was also noted that those with higher sales tend to utilize more pesticides and commercial fertilizers. The authors found that marketing practices can be used as a predictor of a farmer's inclination to adopt MIRG. Those most likely to adopt MIRG are single owners selling to differentiated markets. The authors found that market differentiation is key for small producers, as it allows flexibility and can produce higher prices and an increase in independent farm operations. Further, specialty products are not well handled by larger operations. This study was completed in 1997, before several takeovers of organic and other small premium food companies by large corporations (for example, the purchase of Small Planet Foods, producer of organics such as Muir Glen tomato products and Cascadian Farm products, by General Mills in 1999).

A study in South Dakota (Dobbs and Cole, 1992) evaluated the effects of alternative farming systems on consumer spending and marketing services in addition to business spending for production inputs. Using a whole-farm economic model they compare differences in input purchases and marketing patterns of five farms classified as "sustainable" with five "sustainable" farms. The sustainable farms were defined as "organic" in that none used inorganic fertilizer and only one farm reported appreciable use of commercial pesticides. Economic impacts on local input purchases and marketing services were negative for the organic farms. The organic farms on the other hand purchased fewer inputs and marketed fewer products per acre. They also purchased more of their inputs and marketed more of their products outside the local community because the organic "inputs" and premium prices for organic products were not available locally.

V. Conclusions

Researchers need to be clear about the assumptions used in their studies to allow accurate interpretation of results. Assumptions, such as where inputs are purchased for input-output modeling, are critical determinants of results.

Comparison across diverse types of farms is possible, though it would be helpful to keep either the output, acres, or number of animals constant to allow comparisons of similar entities. Stating that a 3,000 acre grain farm outperforms a 300 acre one in terms of job creation should come as a surprise to no one. However, given the proportion of local purchases made by the different farms and multiplying the 300 acre farm results by 10 could produce a significantly different result (See Chism and Levins, 1994, Thompson and Haskins, 1998, Thompson and Thompson, 1994.). Comparing one farm to another does not create a fair comparison. Instead, comparisons should be based on output (bushel, hog, etc.) or some other measure. The USDA, National Commission on Small Farms Report (1998) adds to the concern about simplified measurements:

> "Economic statistics speak only to the "product output" of farms by measures of crop and livestock sales and they likely underestimate the economic contributions of small farms stated earlier. These numbers do not reflect the social and environmental goods produced by a large number of small farms. Some of the public values generated by small farms include:
>
> Self-empowerment and community responsibility: Decentralized land ownership produces more equitable economic opportunity for people in rural communities, as well as greater social capital. Owner-operated farm structures offer individual self-employment and business management opportunities. . . Land owners who rely on local businesses and services for their needs are more likely to have a stake in the well-being of the community and the well-being of its citizens. . .
>
> Economic foundations: In some States and regions of the country, dispersed farm operations are key to economic vitality. Historically, decline in U.S. farm numbers were more than offset by increases in productivity and output. However,

> this does not appear to be the case in places like Wisconsin, a State whose farm economy has been characterized by a large number of moderate-sized family-operated dairy farms. Since 1988, total volume of milk produced in the State has dropped and the real value of gross sales has also decreased. The loss of dairy farms in this case has meant a loss to the State's economic output."

Thus, sensitivity to size, total output, and making comparisons as equitable as possible is needed when considering these important issues. A researcher's assumptions are particularly critical.

Thompson and Haskins (1998) state the strengths and weakness of formal mathematical models such as regional input-output models. They state:

> "*They use a mathematical model to compute the conclusions that must follow from the assumptions they make. That way, if the methods are sound and they have done the arithmetic correctly, a reader is forced either to accept their conclusions, or to argue with the assumptions. The model rules out accepting the assumption but disagreeing with the conclusions that follow. That's the benefit and the power of formal methods of mathematical modeling. But it's also their weakness.*"

Policymakers Must Set Goals, Clarify Assumptions Made By Advisors and Ask Critical Questions

- What is the area of concern?
  Consider area of concern – if thinking rural development and strengthening of small towns, diverse systems & regional marketing are good strategies.

- What is the basis for comparison?
  Are comparisons being made between farms or are standardized outputs or other metrics used? How are survival rates handled in the models? Are jobs tallied or measured by changes in per capita income?

- Is the distribution of money in society important?
  How are profits divided? How is income measured? Are profits accruing to a few controlling interests or more evenly among many? Are markets open and flexible?

Economic Outcomes Shaped by Factors Out of Farmer's Control

- Farm policy distorts incentives and influences farmer and landowner behavior. Subsidies of commodity crops have put us on a road of ever increasing farm size, management and profit going to non-local entites.

- Increasing use of technology (including, but not limited to fertilizers, pesticides, growth hormones) shifts the value added from the farmer's management skill to the developer of the technology. Accordingly, the revenues for such innovation

are concentrated with the developers, located away from the farm. As a result, farmers increase field size and strive for higher yields and increasing farm size to cover their increased costs.

- Market concentration at all levels of the agricultural sector shapes economic results Concentration impedes market entry & exit and therefore violates a free market economics assumption for the most efficient outcomes.

Connecting Farm Policy and Rural Development

- Subsidies to individuals do not equate with rural development funding. I didn't get too far into this, but few farms receive the majority of farm payments.

- Farm policy that leads to more diversified and smaller scale farming is necessary if agriculture is to more effectively contribute to long-term rural community development and vitality.

References

Boody, George and Mara Krinke. 2001. "The Multiple Benefits of Agriculture: An Economic, Environmental and Social Analysis." White Bear Lake, MN: Land Stewardship Project. November 2001.

Campbell, Dave. 1997. "Community-controlled economic development as a strategic vision for the sustainable agriculture movement." American Journal of Alternative Agriculture, 12(1): 37-44.

Caspers-Simmet, Jean. 2001. "Harl doesn't like trends in agriculture," Agri News. December 24, 2001.

Center for Rural Affairs, 2001a, cfra.org/resources/market_competition.htm

Center for Rural Affairs. 2001b. http://www.cfra.org/issues/entrepreneurship.htm.

Chism, John W. 1993. Local spending patterns of farm businesses in southwest Minnesota. Unpublished Masters Thesis, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul.

Chism, John W. and Richard A. Levins. 1994. "Farm Spending and Local Selling: How Do They Match Up?" Minnesota Agricultural Economist. Number 686 (Spring).

DiPietre, D. and C. Watson. 1994. "The economic effect of premium standard farms in Missouri." Columbia, MO: University Extension, Commercial Agriculture Program, CA 144, University of Missouri.

Dobbs, T.L. and J.D. Cole, 1992. Potential effects on rural economies of conversion to sustainable farming systems. American Journal of Alternative Agriculture. 7: 70 – 80.

Goldschmidt, Walter. 1978. As you sow: three studies in the social consequences of agribusiness. Montclair, NJ: Allanheld, Osmun and Co. Publishers, Inc.

Gomez, Miguel I. and Liying Zhang. 2000. "Impacts of Hog Concentration on Economic Growth in Rural Illinois: An Econometric Analysis." Presented at the American Agricultural Economics Association meeting, July 31 – August 2, 2000: Tampa, Florida. http://agecon.lib.umn.edu/aaea00/sp00go03.pdf

Guess-Murphy, Steffanie.2000. "Economic Impacts of the Minnesota Dairy Industry." Prepared for the Center for Rural Design, University of Minnesota, Department of Applied Economics, June.

Henderson, D. L.Tweeten, and M. Woods. 1992. "A multicommunity approach to community impacts: The case of the Conservation Reserve Program." Journal of the Community Development Society. 23(1): 88 – 102

Ilbery, B. and M. Kneafsey. 1999. "Niche Markets and regional food specialty products in Europe: Towards a research agenda." Environment and Planning A, 31: 2207-2222.

Ikerd, John E. 1998a. "Sustainable Agriculture, Rural Economic Development, and Large-Scale Swine Production." In K. Thu and E. Durrenberger, Pigs, profits and rural communities. Albany, NY: State University of New York Press, pp. 157-169.

Ikerd, John E. 1998b. "Sustainable Agriculture as a Rural Economic Development Strategy," report of joint research project with University of Missouri and Tennessee State University cooperating, University of Missouri, Columbia, MO.

Ikerd, J. G. Devino, S. Traiyongwanich. 1996. Evaluating the sustainability of alternative farming systems: A case study. *American Journal of Alternative Agriculture* 1(1) 1996.

Land Stewardship Project. 1999. "Killing Competition with Captive Supplies." White Bear Lake, MN: April 1999.

Lazarus, W., Morse, G., Platas, D., and Guess-Murphy, S. 2000. "Economic and government impacts of the Minnesota swine industry." University of Minnesota, Department of Applied Economics. Final Research Report prepared for the Minnesota Pork Producers Association (April).

Leistritz, F.1993. "Economic impact of expanded dairying in North Dakota." Fargo, ND: North Dakota State University, Department of Applied Economics. AE 93010.

Leistritz, F. Larry. 1998. "Using Input-Output Analysis in Evaluating Conservation Programs and Projects: Lessons Learned from Evaluation of the Conservation Reserve Program (CRP)." Organized Symposium Paper, American Agricultural Economics Association 1998 Annual Meeting, August 2-5, 1998. Salt Lake City, Utah.

Levins, Richard A. 2000. Willard Cochrane and the American Family Farm. University of Nebraska Press. Lincoln, Nebraska.

Lockeretz, W. 1989. Comparative local economic benefits of conventional and alternative cropping systems. American Journal of Alternative Agriculture: 4: 75-83.

Love, Patricia Weir. 1995."The Impact of Changes in Dairy Farming on a Local Economy: A Case Study." A Plan B Paper Submitted to the Faculty of the Graduate School of the University of Minnesota. May 1995.

Marousek, G. 1979. "Farm size and rural communities: some economic relationships." Southern Journal of Agricultural Economics. December 1979.

Martin, M., H. Radtke, B. Eleveld, S. Nofziger. 1988. "The Impacts of the Conservation Reserve Program on Rural Communities." Western Journal of Agricultural Economics. 13(2): 225-232.

Meter, Ken and Jon Rosales. 2001. Finding Food in Farm Country: The economics of food and farming in Southeast Minnesota. Community Design Center, St. Paul, Minnesota. March 2001.

Morrison, John M. 1998. "The Poultry Industry: A View of the Swine Industry's Future?" In K. Thu and E. Durrenberger, Pigs, profits and rural communities. Albany, NY: State University of New York Press, pp. 145-154.

Morse, George W. and Steffanie Guess-Murphy. 2001. "Literature Review Update: Regional Economic Impacts of Animal Agriculture." In Generic Environmental Impact Statement on Animal Agriculture in Minnesota Final Technical Working Paper on Topics D, E & F: Economic Structures, Profitability & External Costs. Submitted to the Minnesota Environmental Quality Board, June 29, 2001. Project Leader: William F. Lazarus, Department of Applied Economics, University of Minnesota.

National Commission on Small Farms (NCSF). 1998. A Time to Choose: A Report of the National Commission on Small Farms. Miscellaneous Publication 1545. USDA, Washington, D.C.

Olson, Kent.1998. "Precision Agriculture: Current Economic and Environmental Issues." Paper presented at the Sixth Joint Conference on Food, Agriculture and the Environment. Minneapolis, MN, August 31-September 2, 1998.

Office of Technology Assessment. 1986. Report on the Impact of Emerging Technologies on Agriculture (March).

Otto, D., J. Lawrence and D. Swenson. 1996. "Local economic impacts of hog production." Pork Industries Economic Review: pp. 27-38.

Otto, D., P. Orazem, and W. Huffman. 1998. "Community and economic impacts of the dairy industry in Idaho's economy." Moscow, ID: University of Idaho, College of Agriculture, Department of Agricultural and Applied Economics. Staff Paper P92-18.

Peterson, Willis L. 1997 "Are Large Farms More Efficient?" Staff Paper Series, Department of Applied Economics, College of Agricultural, Food and Environmental Sciences, University of Minnesota. January 1997.

Platas, D. 2000."Economic and fiscal impacts of different sizes of swine operations on Minnesota counties." University of Minnesota, Department of Applied Economics, Ph.D. thesis.

Robison, M., J. Foltz, N. Meyer, S. Wolf, and R. Smathers.1993. "The role of the dairy industry in Idaho's economy." Moscow, ID: University of Idaho, College of Agriculture, Agricultural Experiment Station.

Roberts, R.S. 1987. "Rural Population Loss and Cropland Change in the Southern High Plains: Implications for Cropland Retirement Policy." Professional Geographer. 39(3): 275-287.

Smith, Stewart.1992. "Farming Activities and Family Farms: Getting the Concepts Right." Presentation at the Joint Economic Committee Symposium "Agricultural Industrialization and Family Farms: The Role of Federal Policy." Washington, DC: October 21, 1992.

Strange, Marty. 1990. Rural Economic Development and Sustainable Agriculture. Center for Rural Affairs, Walthill, Nebraska.

Thompson, Dick and Sharon. 1994. "Farming Systems and the Viability of Rural Communities." Thompson On-Farm Research with Wallace Institute. Published for On-Farm Research Field Day.

Thompson, Nancy L. and Loren Haskins. 1998. "Searching For 'Sound Science': A Critique Of Three University Studies On The Economic Impacts Of Large-Scale Hog Operations." Walthill: NE: Center for Rural Affairs.

Tweeten, L.G., Flora, C.B. 2001. "Vertical Coordination of Agriculture in Farming-Dependent Areas. Task Force Report, No. 13, Council for Agricultural Science and Technology (March).

United States Department of Agriculture, Economic Research Service. 2001. Data on www.fl-ag.com/agfacts/foodexps.htm.

United States Department of Agriculture, Economic Research Service. 2001."Food Marketing and Price Spreads. Farm-to-retail price spreads for individual food items.' www.ers.usda.gov/briefing/foodpricespreads/spreads/table1.html.

Welsh, Rick and Thomas A. Lyson. 1997. "Farm structure, market structure and agricultural sustainability goals: the case of New York State dairying." American Journal of Alternative Agriculture. Vol.12, No.1 p.14(5).