A Life Cycle Approach to Sustainable Agriculture Indicators

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University of Michigan - Ann Arbor, MI

PROCEEDINGS

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The cover photo is the courtesy of the Community Farm of Ann Arbor.

This event is affiliated with the National Town Meeting for a Sustainable America being held in Detroit, Michigan from May 2nd through the 5th, 1999. The National Town Meeting, together with its Affiliated Events, including a series of Journey to Detroit events that have been held over the last year, is drawing together thousands of people from across the country to recognize and focus attention on a national movement towards a Sustainable America, focusing on sustainable solutions that are available today and ways to take advantage of them. The National Town Meeting will mainstream sustainability and communicate a message that we can meet our environmental and social goals while achieving economic vitality. Hosted by City of Detroit, the National Town Meeting is being co-sponsored by the President's Council on Sustainable Development and the Global Environment & Technology Foundation.

Sustainable America

A National Town Meeting
Detroit, Michigan and Points Across America
The National Pollution Prevention Center for Higher Education, A Proud NTM Partner

1. INTRODUCTION

Background

The National Pollution Prevention enter for Higher Education (NPPC) was established by the US EPA in 1991 with a mission to educate students, faculty, and professionals about pollution prevention and to integrate the ideas of sustainable development into all branches of higher education. One of NPPC's main activities was the development of pollution prevention educational resource materials in a variety of disciplines. Between 1994-1998, the NPPC published 14 Pollution Prevention Educational Resource Compendia in diverse fields. The compendium on Sustainable Agriculture, developed under the leadership of Dr. David Pimentel at Cornell University, was published in December 1997.

“A Life Cycle Approach to Sustainable Agriculture Indicators,” held on February 26-27, 1999, was the first in a series of professional workshops based on the compendia. The NPPC/CSS workshops aim to bring together key stakeholders to discuss the critical issues facing pollution prevention in each field. Each workshop is a forum to begin developing life cycle indicators to measure progress towards sustainability in that field.

In 1999, the NPPC is evolving into *The Center for Sustainable Systems(CSS).* The CSS will continue to convene similar workshops based on the compendia. The next in the series is the “National Sustainable Buildings Workshop” to be held at the University of Michigan on October 8-9, 1999.

Objectives

The objectives of the workshop “A Life Cycle Approach to Sustainable Agriculture Indicators” were:

1. To introduce the concept of life cycle assessment as it applies to agriculture and to enhance the use of NPPC's "Pollution Prevention Educational Resource Compendium: Sustainable Agriculture" as a tool for incorporating the principles of sustainable development into US agricultural programs;

2. To initiate a dialog among resource professionals, active farmers, government agencies and faculty members in the Great Lakes/ North Central Region to begin to form a comprehensive, interdisciplinary understanding of sustainable agriculture;

3. To develop an initial set of performance indicators to gauge the environmental, economic, and social impacts of all stages of the agricultural life cycle.

The workshop was attended by sixty participants from Michigan and other Midwestern states, representing:

- sustainable agriculture and agroecology programs at colleges and universities
- family farms (organic and conventional)
- agri-business
- state and national level governmental agencies involved in agricultural policy-making
- non-governmental organizations and independent research organizations

The participants were organized into four working groups (dairy, fruit, grain, and pork). These proceedings include manuscripts and/or slides from the speakers, summaries of the case study presentations and the panel discussion, and descriptions of the final indicators developed by the working groups. These indicators are only an initial set of indicators that should be applied in the field and reviewed and changed as necessary. The dialogue out of which they were formed should be continued among the participants of the workshop and expanded to include input from other interested parties. It is the hope of the organizers that each participant will share the indicators with his/her colleagues and local community members in order to expand their application.

The completed indicator list, included in these proceedings, will serve as an initial standard against which farms and agricultural institutions throughout the country can begin to evaluate their overall progress towards sustainability. In addition, the indicators will help faculty members and academics develop educational programs that will promote sustainability in agriculture.

Definition of Terms

Sustainable Agriculture

> "The real problem of food production occurs within a complex, mutually influential relationship of soil, plants, animals, and people. A real solution to that problem will therefore be ecologically, agriculturally, and culturally healthful. ...A good solution improves the balances, symmetries, or harmonies within a pattern - it is a qualitative solution - rather than enlarging or complicating some part of a pattern at the expense or in neglect of the rest." - Wendell Berry, *Solving for Pattern (1980)*

Unfortunately, "sustainable agriculture" has become a contentious issue in some circles, as it is sometimes distorted to represent a dichotomy between conventional and organic farming. This was not our intention at this workshop. We did not wish to discern between sustainable and non-sustainable methods, but rather take a systems approach to consider the agricultural growing and food production cycle along with the ecosystems and communities which surround that system. We considered the economic, social, and environmental aspects of agriculture as parts of an integrated whole, in order to design changes in the system to improve the whole, as well as each component.

Life Cycle Approach

Life Cycle Assessment (LCA) is a quantitative method used to measure the energy and material flows associated with all stages of a product from cradle to grave. The application of LCA to agricultural and food production processes is beginning to increase. Our goal in applying this model, however, was *not* to perform a quantitative LCA of the case studies examined, but rather to encourage "life cycle thinking," i.e. to keep the entirety of the system in mind when considering the sustainability of certain components. This involves considering all of the processes associated with the production of the food we eat. By invoking life cycle thinking, we hoped to provide an objective framework within which to discuss the trade-offs that sometimes occur when trying to improve the sustainability of various parts of the system. Life cycle thinking simply adds another dimension to our view of the agricultural system as a whole.

Framework for Indicator Development

The framework below represents our view of the agricultural system: a combination of the life cycle approach and the economic, social, and environmental aspects of sustainability. Horizontally, we see the temporal span of all stages of agricultural production, from the seed production or breeding processes through to the disposal of waste from the final product by the consumer. Vertically, it is the integration of economic processes, the social fabric of the community, and the environmental quality of the ecosystem.

Agricultural Life Cycle Indicator Matrix

Life Cycle Stages ____________ **Impact Categories**	*Resource Origin* (type of breeding/ genetic engineering of seeds and livestock) + Transportation	***Agricultural Production and Growing*** **(nutrient and chemical inputs, animal feed; tilling, harvesting) + Transportation**	*Agricultural Processing:* (food and product processing, packaging) + Transportation	*Use of Agricultural Product* + Transportation	*End of Life:* (waste production, utilization) + Transportation
Economic: Productivity, Externalities, Profitability					
Social: Employment and Quality of Life of Primary Stakeholders, Laborers					
Social: Employment and Quality of Life of Broader Community					
Environmental Impacts and Burdens (water, air, biota, soil contamination)					
Environmental: Resource Use and Quality (energy, land, water, biota, minerals)					

For the purposes of the workshop, participants focused on the second column of this matrix, that represents the agricultural growing stage, while still keeping in mind its connection to the other stages in the system. The workshop also focused primarily on food, as opposed to other agricultural products. It is crucial that this process be continued by developing indicators for the other stages as well.

2. PLENARY PRESENTATIONS

WELCOME AND INTRODUCTION TO THE NPPC/CSS
Dr. Jonathan Bulkley

Dr. Jonathan Bulkley, Director of the Center for Sustainable Systems (formerly the National Pollution Prevention Center or NPPC), opened the workshop *A Life Cycle Approach to Sustainable Indicators* on Friday morning, 26 February 1999. Dr. Bulkley acknowledged Workshop Coordinator, Guntra Aistars, and thanked USEPA Region V, the SARE North Central Region, and the Kellogg Biological Station for co-funding the workshop. He also recognized the contributions of workshop speakers and the Steering Committee.

Dr. Bulkley briefly summarized the history of the National Pollution Prevention Center (NPPC), which was established when the University of Michigan successfully responded to an USEPA Request for Proposal in October 1991. The NPPC mission since then has been to develop educational materials in a wide range of disciplines to encourage pollution prevention concepts in the area of higher education. Since its inception in 1991, the NPPC has organized numerous workshops and assembled over 14 compendia that have been made widely available on the Internet and in hard copy, including the Sustainable Agriculture Compendium produced in collaboration with David Pimentel. As of early January 1999, a new Center for Sustainable Systems was created to replace but build on the foundations of the NPPC.

Dr. Bulkley introduced the three workshop objectives:

- To enhance the use of the Sustainable Agriculture Pollution Prevention Educational Resource Compendium and to introduce the concept of life-cycle assessment as it applies to agricultural issues;
- To initiate a dialogue among active farmers, resource professionals and faculty members on sustainable agriculture; and
- To develop an initial set of indicators to gauge the environmental, economic and social impacts of all stages of the agricultural life cycle.

OVERVIEW OF LCA AND ITS APPLICATION TO SUSTAINABLE AGRICULTURE
Dr. Greg Keoleian

Dr. Keoleian defined the desired products of the workshop to be indicators of sustainability in draft form, which would be sent around the group for refinement and finally made available on a website. Also it was suggested that a publication may be developed out of the workshop.

Life Cycle Assessment (LCA) is a scientific method used to evaluate the energy and material flows associated with production processes. The results of an LCA can be used, for example, to define which products are environmentally preferable. LCA is an accounting tool used to measure inputs and outputs at all stages of the life cycle: acquisition of raw materials, production, processing, packaging, use and retirement. It provides an environmental profile of the product system to comprehensively account for materials, energy, waste and co-products. Dr. Keoleian illustrated this methodology using milk production as an example.

In comparing conventionally produced to organically produced milk, the organic milk is more energy efficient (conventional consumes 10770 MJ per 100 gal. and organic consumes 9108 MJ). These data were reported by Cederberg, 1998. Single use glass and HDPE packages consumed about 7000 MJ/100 gal., whereas refillable containers used for 20 trips consumed about 1000MJ/100 gal. Waste generation of refillables versus single-use containers was also evaluated, and refillable containers generally produced less life cycle solid waste. This example emphasized that Life Cycle Assessment takes the whole system into account. Packaging LCA data were based on Keoleain and Spitzely, 1999.

In another example, the energy impacts of pork and lamb production were compared. Dr. Keoleian presented results from an LCA study by Moller et al, 1996. The comparison included feed production, transport, slaughter, packaging and consumption. Lamb production gives the additional products of wool and skin. After examining energy across the life cycle, the big difference was in the greater environmental burdens related to lamb feed. Carbon dioxide and methane of these systems were also compared. Lamb was slightly higher in carbon dioxide production and greatly higher in methane production, a more potent greenhouse gas.

QUESTION AND ANSWER SESSION

Q: Please describe the production systems for pork and lamb. These results seem counterintuitive.
A: This is just an example, but the figures were representative for 100 kg of meat including bone. Energy input figures are for fossil fuels, not including photosynthetic energy inputs.

Q: I have a question regarding the carbon dioxide released- did the study include foraging
A: The pork system studied was grain feed and the lamb system investigated used fodder and grazing. Carbon dioxide emissions were higher for the lamb system, due mainly to feed production. The emissions are associated with the diesel combustion in feed harvesting and processing. Methane emissions are also significantly higher for lamb due to their ruminant function. The global warming potential of methane is 21 times that of carbon dioxide. The system evaluated was a pesticide inclusive system, as pesticides were used on the feed. Once again, the total system was emphasized; other issues were also evaluated, such as eutrophication.

In order to successfully derive indicators for sustainability, it is necessary to look across the whole life cycle of the product. Social indicators may address issues such as how well nutrient and caloric needs of a community are being met, as well as consumer satisfaction. Economic and environmental indicators should similarly address both production and consumption. Dr. Keoleian referred to the framework provided to participants in the registration packets (see pg. 5).

In the examples given, the cost of nutrient and resource depletion was not addressed, but the geographical scale should enter in. The workshop's resultant indicators should include land use and quality, transportation and emissions at all levels.

ECOLOGICAL RESOURCES AND AGRICULTURAL SUSTAINABILITY
Dr. David Pimentel

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Agricultural shortages exist because the human population is increasing faster than the food production capability of the agricultural system. Uneven distribution of food, inability to afford food, and political unrest also threaten world food security for human society.

Currently, more than 3 billion humans worldwide are malnourished; this is the largest number and proportion of hungry people ever recorded in history (WHO, 1996)! Based on current rates of increase, the world population is projected to double to more than 12 billion in less than 50 years (PRB, 1997). As the world population continues to expand at a rate of 1.5%/year -- adding more than a quarter million people daily -- the task of providing adequate food becomes an increasingly difficult problem. The number of malnourished people could conceivably reach 4 to 5 billion in future decades.

Reports from the FAO of the United Nations and the U.S. Department of Agriculture, as well as numerous other international organizations, further confirm the serious nature of the global food supply problem (NAS, 1994). For example, the per capita availability of world cereal grains, which make up 80% of the world's food supply, has been declining since 1983 (Figure 1) (Kendall and Pimentel, 1994). These shortages have economic consequences as well, as is reflected in recent major increases in the price of cereal grains (USDA, 1996).

Because the world population continues to expand, more pressure than ever before is being placed on the basic resources that are essential for food production. Unfortunately, the human population is growing exponentially, while food production can only increase linearly. Furthermore, degradation of land, water, energy, and biological resources that are vital to a sustainable agriculture continues unabated (Pimentel et al., 1998a).

Agricultural Resources

More than 99% of the world's food supply comes from the land; less than 1% is obtained from oceans and other aquatic habitats (FAO, 1991; Pimentel et al., 1998a). As mentioned previously, the continued production of an adequate food supply is directly dependent on the availability of ample quantities of fertile land, fresh water, energy, and natural biodiversity. And obviously, as the human population grows, the requirements for all these resources escalates. Even if these resources are never completely depleted, their supply, on a per capita basis, will decline significantly because they must be divided among more and more people.

Land

Throughout the world, fertile cropland is being lost from production at an alarming rate. This is clearly illustrated by the diminishing amount of land now devoted to cereal grains (Figure 2). Soil erosion by wind and water, in addition to general overuse of the land, are responsible for the loss of about 30% of the world's cropland during the past 40 years (WRI, 1994; Pimentel et al., 1995). The natural reformation of a mere 25 mm (1 inch) of fertile soil takes 500 years; to sustain adequate crop production, a soil depth of 150 mm is needed.

Most eroded and unproductive agricultural land is now being replaced with cleared forest land and/or marginal land. Indeed, the urgent need for more cropland accounts for more than 60% of the world's deforestation (Myers, 1994). Despite such land replacement strategies, per capita world cropland is declining, currently standing at only 0.27 ha per capita. This is only about 50% of the 0.5 ha per capita that is considered the minimum land area needed for the production of a diverse diet similar to that of the United States and Europe (Lal and Stewart, 1990; Pimentel et al., 1998a). Other countries have even less land; for example, China now has only 0.08 ha available per capita, about 15% of the accepted minimum (Pimentel et al., 1998a).

Water

Rainfall, and its collection in rivers, lakes, and vast underground aquifers, provides the water needed by humans for their personal survival and diverse activities.

Fresh water is critical for all vegetation, especially crops. All plants transpire massive amounts of water during the growing season. For example, a hectare of corn, producing about 8,000 kg, transpires more than 5 million liters of water during just one growing season (Pimentel et al., 1997a). This means that more than 8 million liters of water must reach each hectare during the growing season both as rainfall and irrigation, to provide the adequate water supply for crop production. In total, agricultural production consumes more fresh water than any other human activity. About 70% of the world's fresh water supply is consumed, or used up by agriculture, making it unavailable for other uses (Postel, 1996).

Water resources are continually stressed as populous cities, states, and countries increase their withdrawal of water from rivers, lakes, and aquifers every year. For example, by the time the Colorado River reaches Mexico it has dwindled down to a trickle (Sheridan, 1983; Postel, 1996). Also, the great Ogalla aquifer in the central U.S. is suffering an overdraft rate that is about 140% above its natural recharge rate (Gleick, 1993). Water shortages in the U.S. and elsewhere in the world are already reflected in the per capita decline in crop irrigation that has occurred during the past twenty years (Postel, 1996).

To compound the water problem, about 40% of the world population lives in regions that directly compete for shared water resources (Gleick, 1993). In China, for example, more than 300 cities already are short of water, and these shortages are intensifying as Chinese urban areas and industries expand (WRI, 1994). Serious competition for water resources among individuals, industries, and regions both within and between countries is growing throughout the world community (Gleick, 1993).

In addition to the quantity of water available, water purity also is vitally important. Diseases associated with impure and unsanitary water systems rob people of their health, nutrients, and livelihood. These problems are most serious in developing countries, where about 90 percent of common diseases can be traced to a lack of pure water (WHO, 1992; Pimentel et al., 1998b). Worldwide, about 4 billion cases of disease and approximately 6 million deaths are caused by impure water or are water-borne each year (Pimentel et al., 1998b). Furthermore, when a person is stricken with diarrhea, malaria, or other serious disease, from 5 to 20 percent of an individual's food intake is used by the body to offset the stress of the disease, further diminishing the benefits of his/her food intake (Pimentel et al., 1998b). Disease and malnutrition problems appear to be particularly serious in the third world where poverty and poor sanitation is endemic (Shetty and Shetty, 1993).

Poverty, disease, and malnutrition are especially serious in cities, particularly third-world cities. The number of people living in urban areas currently doubles every 10 to 20 years, creating environmental problems that include a lack of water and sanitation, increased air pollution and significant food shortages. For these reasons, the potential for the spread and increase of disease is especially great in urban areas (Science, 1995).

Energy

Energy from many sources, most importantly fossil energy sources, is a prime resource used in food production. About 75% of the fossil energy used each year throughout the world is consumed by populations living in developed countries. Of this energy, about 17% is expended in the production, processing, and packaging of food products (Pimentel and Pimentel, 1996). In particular, the intensive farming technologies characteristic of developed countries rely on massive amounts of fossil energy for fertilizers, pesticides, irrigation, and machines that substitute for human labor. In contrast, developing countries use fossil energy primarily for fertilizers and irrigation to help maintain yields, rather than to reduce human labor inputs (Giampietro and Pimentel, 1993).

The present world supply of oil is projected to last approximately 50 years at current production rates (Campbell, 1997; Duncan, 1997; Youngquist, 1997; Duncan and Youngquist, 1998; Kerr, 1998). The world's natural gas supply is considered adequate for about 50 years, and the coal supply for about 100 years (Youngquist, 1997). These projections, however, are based on current consumption rates and current population numbers; if population and consumption levels continues to increase, these fossil energy stores could be depleted even faster.

Youngquist (1997) reports that current oil and gas exploration drilling data has not borne out some of the earlier optimistic estimates of the amount of these resources projected to be in the United States. Both the production rate and proven reserves have continued to decline. Reliable analyses suggest that by now (1998) the United States has consumed about three-quarters of the recoverable oil that was ever in the ground, and that we are currently consuming the last 25% of U.S. oil resources (Bartlett, 1998). Projections suggest that U.S. domestic oil and natural gas production will be substantially less in 20 years than it is today. Even now U.S. oil supplies are not sufficient to meet domestic needs, and oil is imported in increasing yearly amounts (Youngquist, 1997). Importing 60% of its oil puts the United States economy at risk, due to fluctuating oil prices and difficult political situations, such as occurred during the 1973 oil crisis and the 1991 Gulf War (U.S. Congressional Record, 1997).

Biodiversity

A productive and sustainable agricultural system, as well as the quality of human life, also depends on maintaining the integrity of the natural biodiversity that exists on earth. Diverse species, though most are small in size, serve as natural enemies to control pests, help degrade wastes, improve soil quality, fix nitrogen for plants, pollinate crops and other vegetation, and provide numerous other vital services for humans and their environment (Pimentel et al., 1997b). Consider that one-third of all crops worldwide require insect pollination. Humans have no technology to substitute for this vital pollination task, or for many of the other contributions provided by the estimated 10 million species that inhabit the earth (Pimentel et al., 1997b).

Biodiversity has an economic value for the world as well. For instance, it is estimated that the benefits of natural species to the U.S. economy is more than $300 billion/year, and approximately $3 trillion/year for the world (Pimentel et al., 1997b).

Food Distribution

Many assumptions have been made as to how market mechanisms and international trade will function to effectively ensure against future food shortages. Unfortunately, the biological and physical limits of resources are typically overlooked in this equation. When these limits of resources are reached, food exports and imports will no longer be a viable options for countries. At that point, food importation for rich countries will only be sustained by starvation of the poor. In the final analysis, the existing biological and physical resource constraints regulate and limit all food production systems.

These concerns about sustainable food sources for the future are supported by two observations. First, most of the 183 nations of the world now are dependent on food imports. Most of these imports are cereal grain <u>surpluses</u> produced only in those countries that now have relatively low population densities, where intensive agriculture is practiced and where surpluses are common. For instance, the United States, Canada, Australia, France, and Argentina provide about 80% of the cereal exports on the world market (WRI, 1992). This situation is expected to change, if, the U.S. population doubles in the next 70 years as projected by the current population growth rate (USBC, 1996). Then, instead of exporting cereals and other food resources, these foods will have to be retained domestically to feed 540 million hungry Americans. The United States will no longer be able to serve as a primary food exporter.

In the future, when the four major food exporting countries retain surpluses for home use, Egypt, Jordan, and countless other countries in Africa and Asia will be without the food imports that are essential to their survival. China, which now imports many tons of food, illustrates the severity of this problem. If, as Brown (1995) predicts, China's population increases by 500 million beyond their present 1.2 billion and their soil erosion continues unabated, it will need to import 200-400 million tons of food grains each year starting in 2050. This minimal quantity is equal to more than the current grain exports of <u>all</u> the current exporting nations mentioned earlier (USBC, 1996). Based on realistic trends, by 2050, sufficient food supplies probably will not be available for import by China or any other nation on the international market (Brown, 1995).

Technology

Over time, technology has been instrumental in increasing industrial and agricultural production, improving transportation and communications, advancing human health care, and generally improving many aspects of human life. However, much of technology's success is based on the availability of the natural resources of the earth.

In no area is this more evident than in agricultural production. No current or conceivable future technology will be able to double the world's arable land. Granted, technologically produced fertilizers are effective in enhancing the fertility of eroded croplands, but their production relies on the diminishing supply of fossil fuels. In fact, fertilizer use per capita during the past decade has decreased 23% and continues to decline, probably due to increasing economic costs (IFDC, 1998).

The increase in the size and speed of fishing vessels has not resulted in increases in per capita fish catch (Pimentel and Pimentel, 1996). To the contrary, in regions like eastern Canada, over-fishing has become so severe that about 80,000 fisherman have no fish to catch, and the entire industry has been lost (W. Rees, University of British Columbia, personal communication, 1996).

Consider also that the available supplies of fresh water must be shared by more individuals, for the expanding agriculture and industry required to support an increasing population. No currently available technology can double the flow of the Colorado River; the shrinking ground water resources in vast aquifers cannot be refilled by human technology. Rainfall is the only legitimate *supplier* of water.

Certainly improved technology can continue to help increase food production. Technology can result in more effective management and conservation of resources, but technology cannot produce an unlimited flow of those vital natural resources that are the raw material for sustained agricultural production. What technology can be used to stop the decline in per capita cereal grain production, that has been diminishing since 1983 and continues to decline (Figure 1)?

Biotechnology has the potential for some advances in agriculture, provided genetic modifications are cautiously and wisely used. However, the biotechnology developments from more than 20 years ago have not been able to stem the decline in per capita food production during the past 15 years. Currently, about 40% of the research effort in biotechnology is devoted to the development of herbicide resistance in crops (Paoletti and Pimentel, 1996). This technology will not achieve its promise to increase crop yields, but it will increase the use of chemical herbicides and the pollution of the environment.

What of the Future and Ecological Resources?

We can no longer afford to ignore the fact that per capita food production has been declining for more than a decade, that now more than 3 billion people are malnourished (WHO, 1996). Related to this decline has been a per capita decrease in availability of the following resources: Fertilizers, 23%; cropland, 20%; irrigation, 12%; forest products and fish, 10%.

Strategies for global food security must be based first and foremost on the conservation and ecological management of the land, water, energy, and all biological resources that are essential for a sustainable agricultural system. Our stewardship of world resources must change. The basic needs of all people must be brought into balance with the life sustaining natural resources. The conservation of these resources will require the coordinated efforts of all individuals and all countries. Once these finite resources are exhausted they cannot be replaced by human technology. More efficient and environmentally sound agricultural technologies must be developed and put into practice to support the sustainability of agriculture and life on earth (Pimentel and Pimentel, 1996).

Unfortunately, none of these ecologically sound conservation measures will be sufficient to ensure adequate food supplies for future generations unless the growth in the human population is simultaneously curtailed. Several studies have confirmed that to in order to enjoy a relatively high standard of living, the optimum human population should be less than 200 million for the United States and less than 2 billion for the world (Pimentel et al., 1998a). This seemingly harsh projection assumes, that from now until such an optimum population is achieved, all strategies for the conservation of soil, water, energy, and biological resources will be successfully implemented and an ecologically sound, productive environment will be maintained. The lives and livelihood of future generations depend on what the present generation is willing to do now to make agriculture sustainable and conserve the world's ecological resources.

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THE SOCIAL DIMENSIONS OF A SUSTAINABLE AGRI/CULTURE – Dr. Gerry Campbell

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Note: The citations and text below are taken from Dr. Campbell's slides, accompanied by notes on his presentation.

Dr. Campbell began by introducing himself as an "economist in recovery." Throughout his 25 years as an administrator and professor, he has continued to return to his intellectual roots at Michigan State University where he was a doctoral student in economics and exposed to big picture thinkers such as Jim Schaefer and Al Schmidt. Being an "economist in recovery" has come from a sharp awareness of the ways economics has become less interested in studying human beings and the big picture, tending instead towards a highly quantified, theoretical world distanced from social life. Even contemporary interests in socio-economics are in sociology rather than economics departments. Moreover, disciplinary separations continue unabated, such that training in agriculture and economics in the American academy is usually disassociated from the humanities, and vice versa.

What is Sustainable Agriculture?: Diverse Perspectives

Dr. Campbell highlighted how discussions of indicators, in contexts such as this workshop, depend on the kind of perspective though which sustainable agriculture is seen and imagined. According to Kathleen Wilson and George Morren, at least four different perspectives can be distinguished:

- The first perspective equates sustainability with the ability of agriculture to continue to supply enough food to go around.

- A second group rejects this view as irresponsible in the face of the many detrimental effects of unsound farming practices that have already been observed. Instead, they advocate a more ecologically balanced agriculture with a focus on both permanence and productivity.

- Yet a third group rejects both the emphasis on the biophysical aspects of agricultural ecosystems and the economic bias. The real issue for them is the viability and security of the rural way of life and the mores and morality of the agrarian ethic.

- According to a fourth perspective, the problems of contemporary agriculture transcend issues of technology, economics, ecological integrity, and even the survival of rural communities. For them, the real issue is the way humanity lives, what foods are eaten, what natural resources are used, and the ethic underlying of all of this.

  From: Wilson, Kathleen & George E.B. Morren, Jr., "Systems Approaches for Improvement in Agriculture and Resource Management" .

Many variants of these and other views are part of the sustainable agricultural movements in the world. Situating orientations and recognizing differences are essential to understanding what kinds of indicators of sustainable agriculture can be conceived.

Sustainable Agri/Culture and Nature

Although considered too "impractical" by economists, Dr. Campbell called for making Wendell Berry's books required reading for economics and agriculture students. Berry perceptively pushes us to ask ourselves about what cultural dimensions make us what we are and what sustainable agri/culture is about. Berry states:

"A culture is not a collection of relics or ornaments, but a practical necessity, and its corruption invokes calamity. A healthy culture is a communal order of memory, insight, value, work, conviviality, reverence, aspiration. It reveals the human necessities and the human limits. It clarifies our inescapable bonds to the earth and to each other. It assures that the necessary restraints are observed, that the necessary work is done, and that it is done well. A healthy *farm* culture can be used only upon familiarity and can grow only among a people soundly established upon the land; it nourishes and safeguards a human intelligence of the earth that no amount of technology can satisfactorily replace."

From: The Unsettling of America: Culture and Agriculture, Chapter 4, "The Agricultural Crisis as a Crisis of Culture" by Wendell Berry.

Despite the disappearance of frontiers, and given US debates about "boomers and stickers", Dr. Campbell emphasized that the quintessential "American way and psyche" wants to leave when the first sign of difficulties become apparent. Why? In order to go some place else, rather than stick with ties to where they are. Berry comments:

"Thus it is possible--and probably necessary--to think of Wallace Stenger's work as taking form within the tensions between these historical opposites: boomer and sticker, exploitation and settlement, caring and not caring, life adapted to available technology and personal desire and life adapted to a known place."

"If enough of us were to choose caring over not caring, staying over going, then the culture would change, exploitation would become subordinate to settlement, and then the choice to be a sticker would become easier. The necessary examples would be more numerous and more available. The way would be clearer."

From: "The Obligation of Care" by Wendell Berry *in the September/October 1995 issue of* Sierra.

Citing the controversial position of William Cronon, Fred Jackson Professor of History at the University of Wisconsin, Dr. Campbell invited participants to reflect on the paradoxes we tend to set up when we think of nature and wilderness. In *A Nature's Metropolis*, Cronon shows how the city of Chicago is not the opposite of nature, but intimately linked and connected to the woods and nature of Wisconsin and Michigan. Cronon further concludes:

"This, then, is the central paradox: wilderness embodies a dualistic vision in which the human is entirely outside the natural. If we allow ourselves to believe that nature, to be true, must also be wild, then our very presence in nature represents its fall. The place where we are is the place where nature is not. If this is so -- if by definition wilderness leaves no place for human beings, save perhaps as contemplative sojourners enjoying their leisurely reverie in God's natural cathedral--then also by definition it can offer no solution to the environmental and other problems that confront us. To the extent that we celebrate wilderness as the measure with which we judge civilization, we reproduce the dualism that sets humanity and nature at opposite poles. We thereby leave ourselves little hope of discovering what an ethical, sustainable, *honorable* human place in nature might actually look like."

"Calling a place home inevitably means that we will *use* the nature we find in it, for there can be no escape from manipulating and working and even killing some parts of nature to make our home. But if we acknowledge the autonomy and otherness of the things and creatures around us--an autonomy our culture has taught us to label with the word "wild"--then we will at least think carefully about the uses to which we put them, and even ask if we should use them at all."

"If wildness can stop being (just) out there and start being (also) in here, if it can start being as humane as it is natural, then perhaps we can get on with the unending task of struggling to live rightly in the world -- not just in the garden, not just in the wilderness, but in the home that encompasses them both".

From: . "The Trouble with Wilderness; or, Getting Back to the Wrong Nature" by William Cronon. *Uncommon Ground: Toward Reinventing Nature, William Cronon, editor. 1995*

Berry and Cronon both call upon us to get out of the trap of aggrandizing someplace “wild” and assuring that Yellowstone remains pristine while neglecting to think about the trees growing alongside our buildings, in our farms and countryside, and the environment around us. A cultural sense for the places that we live in is essential. As Berry points out*:*

> "Our presence in this varied and fertile world is our perpetual crisis. It forces upon us constantly a virtual curriculum of urgent questions:
>
> - Can we adapt our work and our pleasure to our places so as to live in them without destroying them? That is, can we make adequately practical and pleasing local cultures?
> - Are we Americans capable of an authentic (which is to say a land-based) multiculturalism? Can we limit our work and economies to a scale appropriate to our places, to our place in the order of things, and to our intelligence?
> - Can we understand ourselves as creatures of limited and modest intelligence?
> - Can we control ourselves?
> - Can we get beyond the assumption that it is possible to live inhumanely and yet "save the planet" by a series of last-minute preservations of things perceived to be endangered and, only because endangered, precious?
>
> *From: "The Obligation of Care" by* Wendell Berry *in the September/October 1995 issue of* *Sierra.*

Trends and Contests over US Agriculture, Sustainable Food Systems and Information
Kindly (Re)Connections to Our Food Cultures, Farms and Homes
Dr. Campbell then moved to a discussion of the last 40 years in US agriculture and the kinds of debates about its restructuring, specialized production, and alternative food systems. He points out that *for most of us food remains a connection to the land....but it has become an abstract connection.*

In working group discussions in Seattle, Chicago and Baltimore about how “middle Americans” think about agriculture, a common refrain was an extraordinary concern but respect for the hard work, low returns and riskiness of farming, yet the absence of concrete connections between most people and actual farms. Two indicators for sustainable agriculture could thus be:
1) a gardening sympathy indicator of the number of gardens there are in any community;
2) a local food culture indicator indicating the extent to which people cook their own food and know where it comes from.

Just think of how wonderful and pleasing it is to hear the manager of Ann Arbor’s famous deli, Zingerman's, on Wisconsin public radio interview discuss the olive oil being sold in terms of the places it came from in Italy, the kinds of olives, the oil’s aroma and its taste.

Wendell Berry reminds us that, in the past,

- . . . the idea of a farm included that idea of a household: an integral and major part of a farm’s economy was the economy of its own household
- **Households … dependence (on the farms) … was limited in two ways**
  - the town or city household was itself often a producer of food
  - the urban household carefully selected and prepared the food that it bought.

But over time, these latter two situations became less and less true. Berry goes on to discuss the relation of household and farm to standards of health of people and the land:

♦ **The collaborators purified their roles--**the household became simply a house or residence, purely consumptive in its function; the farm ceased to be a place to live and a way of life and became a unit of production**--**and their once collaborative relationship became competitive.

♦ . . . **the merchant,** who had been only a supplier of raw materials, began to usurp the previous functions of both household and farm, **becoming increasingly both a processor and producer.**

♦ To treat every field, or every part of every field, with the same consideration is not farming but industry. **Kindly use depends upon intimate knowledge,** the most sensitive responsiveness and responsibility.

♦ The understanding of **kindly use** in agriculture **must encompass both farm and household**, for the mutuality of influence between them is profound. . .

- Wendell Berry

"But kindly use is a concept that of necessity broadens, becoming more complex and diverse, as it approaches action. The land is too various in its kinds, climates, conditions, declivities, aspects and histories to conform to any generalized understanding or to prosper under generalized treatment. The use of land cannot be both general and kindly – just as the forms of good manners generally applied (without consideration of differences), are experienced as indifference, bad manners. To treat every field, or every part of every field, with the same consideration is not farming but industry. Kindly use depends upon intimate knowledge, the most sensitive responsiveness and responsibility As knowledge (hence, use) is generalized, essential values are destroyed. As the householder evolves into a consumer, the farm evolves into a factory **--** with results that are potentially calamitous for both.

"The understanding of kindly use in agriculture must encompass both farm and household, for the mutuality of influence between them is profound. Once, of course, the idea of a farm included that idea of a household: an integral and major part of a farm's economy was the economy of its own household; the family that owned and worked the farm lived from it. But the farm also helped feed other households in towns and cities. These households were dependent on the farms, but not passively so, for their dependence was limited in two ways. For one thing, the town or city household was itself often a producer of food: at one time town and city lots routinely included garden space and often included pens and buildings to accommodate milk cows, fattening hods and flocks of poultry. For another thing, the urban household carefully selected and prepared the food that it bought; the neighborhood shops were suppliers of kitchen raw materials to local households, of whose needs and tastes the shopkeepers had personal knowledge. The shopkeepers were under the direct influence and discipline of their customers' wants, which they had to supply honestly if they hoped to prosper. The household was therefore not merely a unit in the economy of food production; its members practiced essential productive skills. The consumers of food were also producers or processors, or both."

"The collaboration of household and farm was never, in America, sufficiently thrifty or sufficiently careful of soil fertility. It is tempting to suppose that, given certain critical historical and cultural differences, they might have developed sufficient thrift and care. As it happened, however, the development went in the opposite direction. *The collaborators purified their roles* – the households became simply a house or residence, purely consumptive in its function; the farm ceased to be a place to live and a way of life and became a unit of production – and their once collaborative relationship became competitive. Between them the *merchant*, who had been only a supplier of raw materials, began to usurp the previous functions of both household and farm, *becoming increasingly both a processor and producer.* And so an enterprise that once had some susceptibility to qualitative standards – standards of personal taste and preference at one end and of good husbandry at the other – has come more and more under the influence of standards that are merely economic or quantitative. The consumer wants food to be as cheap as possible. The producer wants it to be as expensive as possible. Both want it to involve as little labor as possible. And so the standards of cheapness and convenience, which are irresistibly simplifying and therefore inevitably exploitative, have been substituted for the standard of health (of both people and land), which would enforce consideration of essential complexities."

From: The Unsettling of America: Culture &Agriculture. By Wendell Berry;Published by Sierra Books, 3rd Edition, 1996,pp 31-2.

Ikerd on Sustainable Agriculture
Dr. Campbell invoked Ikerd's definition of sustainable agriculture:

Ikerd sees sustainable farming systems as

those in which farmers become **effective generators and managers of the knowledge** it will take to conserve resources, produce efficiently, compete commercially, and enhance quality of life for farmers and society overall.

Ikerd, John E., "The Need for a Systems Approach to Sustainable Agriculture," Agriculture, Ecosystems and Environment, 46 (1993) 147-160,Elsevier Science Publishers B.v., Amsterdam.

As Ikerd notes:

The application of technology to food systems has

- greatly increased the complexity at all levels
- encouraged a high degree of specialization
- increased the interdependence among levels in the food system

Our U.S. food system has been highly successful in:
producing an abundance of food with fewer and fewer human resources.

The public is increasingly interested in a food system which continues to be :
- efficient in resource use

and also
- "ecologically sound, economically viable and socially acceptable."

Ikerd, John E., "The Need for a Systems Approach to Sustainable Agriculture," Agriculture, Ecosystems and Environment, 46 (1993) 147-160,Elsevier Science Publishers B.v., Amsterdam.

Ikerd argues that:

Agriculture creates human systems to manage these organisms to satisfy human wants

Our management of Food Systems creates new ways of organizing these complex organisms and their interaction with the environments in which we produce, transport, process, distribute and consume food for our purposes.

Our management of these systems has often ignored the complex interactions between the systems we created and the broader environments in which our farms, processing plants, transportation corridors, restaurants, supermarkets and homes exist.

Ikerd, John E., "The Need for a Systems Approach to Sustainable Agriculture," Agriculture, Ecosystems and Environment, 46 (1993) 147-160,Elsevier Science Publishers B.v., Amsterdam.

Sustainable Agriculture, Food Systems and Information

> "Value created on farms in the future may result much more from the application of knowledge than from the possession of other resources, capital or production technology.....Knowledge is embodied in the arrangements which are characteristics of wholes."
>
> > *Ikerd, John E., "The Need for a Systems Approach to Sustainable Agriculture,"* *Agriculture, Ecosystems and Environment**, 46 (1993) 147-160,Elsevier Science Publishers B.v., Amsterdam.*

According to Harold Breimyer:

> **"I view the restructuring now underway as essentially the drawing of agriculture into a product differentiation contest among ever fewer giant corporations, many of them conglomerates. It's a power struggle that is reshaping the food economy on the one hand, and rural society on the other. To view it in any lesser terms would be a mistake."**
>
> > *From: "Understanding The Changing Structure of American Agriculture by Harold F. Breimyer, University of Missouri-Columbia. Increasing Understanding of Public Problems and Policies--1995. Steve A. Halbrook and Carroll E. Merry, editors.*

Michael Porter has also pointed to the idea of a value chain that disaggregates firms and links the farm to the processor, wholesaler, retailer and consumer.

In *Competitive Advantage: Creating and Sustaining Superior Performance*, Porter says: "The value chain disaggregates a firm into its *strategically relevant activities* in order to understand the behavior of costs and the existing and potential sources of differentiation. A firm gains strategic advantage by performing these strategically important activities more *cheaply or better than its competition*."

Shifting the Focus of Strategy From Head-to-Head Competition to Creating New Market Space		
The Conventional Boundaries of Competition	**HEAD-TO-HEAD COMPETITION**	**CREATING NEW MARKET SPACE**
Industry	Focuses on rivals within its industry →	**Looks across substitute Industries**
Strategic group	Focuses on competitive position within strategic group →	**Looks across strategic groups within Its industry**
Buyer group	Focuses on better serving the buyer group →	**Redefines the buyer group of the Industry**
Scope of product And service Offerings	Focuses on maximizing the value of product and service offerings within the bounds of its industry →	**Looks across to complementary Product and service offerings that Go beyond the bounds of its industry**
Functional-Emotional Orientation of An industry	Focuses on improving price-performance in line with the functional-emotional orientation of its industry →	**Rethinks the functional-emotional Orientation of its industry**
Time	Focuses on adapting to external trends as they occur →	**Participates in shaping external trends over time**

Source: "Creating New Market Space", Harvard Business Review, January-February 1999.

A News Story about Sustainable Agri/Culture

To conclude, Dr. Campbell emphasized that one of the worst cultural perspectives rampant in the U.S. is that of assuming there is always only one answer to any problem. Peter Senge in his book *The Fifth Discipline* has said that the worst thing that we do in schools and some universities is to convince students that there is one best answer, often something that can be clearly rationalized and quantified. And yet, we know that "life is not one best answer". We are all complicated people, as is our society a complicated place. Dr. Campbell challenged working group facilitators and participants to keep this in mind and resist coming up with one answer, so as to explore the many ways and cultural dimensions of a number of perspectives on sustainable agriculture indicators.

Dr. Campbell finished his presentation with a February 25th letter in the New York Times editorial section that "tongue and cheek" suggests what the US might be like if sustainable agriculture becomes more prevalent. Written by David Ivins, the letter focuses on "Rampaging Rustics" and how "rural sprawl is threatening our way of life," perhaps an indication of how the movement towards sustainability is making progress, gaining credibility and being listened to by the wider public.

> Rampaging Rustics!
>
> In case you city dwellers and suburbanites haven't noticed, be warned: the countryside is slowly creeping up on you. Like a rapidly growing week that smothers everything in its path, rural areas are encroaching on our cities and suburbs, and no one -- not our elected officials, public interest groups or citizens -- is doing anything to stop this rural sprawl.
>
> In countless confrontations, rural extremists are preventing businesses from building industrial parks, shopping malls, condominiums, single-family homes, theme homes, theme parks, airports and sports arenas. They are even fighting the construction of new highways! What would the country be without the network of freeways and parkways linking our cities, suburbs, shopping malls, theme parks and sports arenas?
>
> Rural sprawl began quietly with the infiltration, in ever-increasing numbers, of wildlife -- squirrels, rabbits, songbirds and other small, cuddly, apparently innocuous creatures -- into our suburbs and the fringes of our major cities. Now it seems that these small animals were only the advance guard of a cunningly planned invasion that also includes deer, coyotes, beavers, mountain lions, bears and other despoilers of our cherished suburban and urban habitats.
>
> Areas that otherwise would be given over to job creation and highly profitable logging, strip mining and oil drilling are being expropriated by wild animals, which are inherently valueless since they contribute nothing to our economy. Once these beasts establish themselves, shielded by hell-bent wildlife-protection groups and misguided politicians from Al Gore to Christie Todd Whitman, they can never be dislodged.
>
> But these animals are only the unwitting servants of the quaint seeming "country folk" whose diabolical plan is to eradicate or make unlivable our suburbs and cities by covering our streets, sidewalks and highways with grass, shrubbery and trees. They want to inundate shopping malls and sports arenas with lakes, ponds an streams; replace our condo developments with "picturesque" villages and hamlets and our suburban tract homes with drafty, old-fashioned farmhouses.
>
> The ultimate goal of these fanatical rustics is to return all of us to lives of unsophisticated rural primitivism. Is this the kind of life we want to lead? Fight rural sprawl now, before it's too late!
>
> *By David Ivins, a freelance writer. Thursday, February 25, 1999, New York Times.*

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NOTE: Bold citations are the overheads used for "The Social Dimensions of A Sustainable Agri/Culture" by Gerry Campbell, February 26-27, 1999.

LINKING SOIL QUALITY, WATER QUALITY, AND AGROECOSYSTEM HEALTH
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Abstract

A healthy agroecosystem is essential for a sustainable agriculture. Yet as population pressures and living standards increase, especially in densely populated countries, stresses on ecosystems also increase. A healthy agroecosystem is one that maintains biodiversity, protects natural resources, including water, air and soil, and is productive of food and fiber while providing a quality standard of living for its people. Current trends in agriculture support increasing productivity at the expense of agroecosystem health. This is done through intensive food and grain production, relying on use of tillage and chemicals without considering the effects of these treatments on the biota, soil and water resources. Meat and milk production also are moving to more intensive approaches, with the use of large-scale animal production systems that generate concentrated wastes and odors. Often small farmers lack sufficient capital and management skills to compete with intensive crop and agriculture operations. Instead, integrated global conglomerates become owners and managers of agricultural production systems. Farmers are then employed as workers and agricultural production profits leave the community.

This review has evaluated the many functions and services of a healthy agroecosystem that we must consider when future technologies and policies are designed. It is apparent that soil quality is one of the central issues. While production of agricultural goods can be maintained over the short term by unhealthy agroecosystems, this is not a sustainable approach. The systems designed must maintain a healthy soil. Without this, all other functions of a healthy ecosystem will be difficult to obtain and likely will not be sustainable.
Maintaining healthy agroecosystems despite the pressures to increase production and profits is difficult. A new degree of ecosystem level planning is required. The planning should regard air, soil, and water as core resources that must be preserved. Improving the living standards of local communities and maintenance of family farms must be the goals of the planning. Also needed are indicators of healthy agroecosystems, and policies that permit their establishment and maintenance.

First presented at the International Conference on Soil Quality Management and Agroecosystem Health for East and Southeast Asia. Korean Society of Soil Science and Fertilizer. Cheju Island, Korea. November 11-14, 1997. Also presented at the Asia-Pacific High-Level Conference on Sustainable Agriculture. Beijing, China. October 4-8, 1998

Introduction
It is now clear that human intervention has markedly altered many of the world,s ecosystems (Vitousek et al., 1997a, b). Maintaining the key functions of ecosystems will require expert management at varying levels. Examples of collapsing ecosystem abound. Included is the marked decline in yield of ocean fish, eutrophication of fresh waters and estuaries, widespread groundwater pollution, shifts in forestation patterns and die off of forests, and decreased ecosystem biodiversity. The causes of ecosystem modifications are complex and often interrelated. They include alteration of the land surface by agriculture, urban, and industrial development; increases in fixed nitrogen; modification of rivers and lakes; appropriation of much of the worlds available fresh water; destruction of wildlife habitats; and increased release of greenhouse gases. The rapid increase of carbon dioxide in the atmosphere, coupled with human additions of other greenhouse gases has altered the carbon and nitrogen cycles in a manner unparalleled in human history (Keeney, 1997a, Asner et al., 1997, Vitousek et al., 1997b).

The consequences of ecosystem alteration worldwide vary from subtle effects such as climate change that may take generations to observe, to rapid crashes in ecosystems such as ocean fisheries. Ecosystem alteration affects us in many ways; some direct, some indirect, and some in unknown lost opportunities. Clearly one of the major effects is on the sustainable supplies of food, potable water, and clean air. Advances in science and technology have helped mask many of the problems that ecosystem deterioration has created. Improvements in agricultural technologies have helped increase the food supply even as soils are eroded and natural resources are damaged. Advances in health care and medicines have kept diseases at bay. But our understanding of the effects of ecosystem disruptions on ecosystem functions are rudimentary at best, and it is likely that many effects will be observed long before they are understood. As Vitousek et al (1997a) state „We are changing the world more rapidly than we are understanding it. ‰

Many ecosystems can be restored, at least in part, to their original functions, and badly damaged or destroyed ecosystems can in time regenerate without human intervention. Preventative measures are even more important. In many cases, recognition of problems near their onset can lead to less intensive uses and spur changes in management to achieve sustainability. Unfortunately, in most situations we lack the knowledge base, creativity, and political will to carry out changes that will arrest or reverse ecosystem decline. .

The organizers of this conference look at agroecosystems in terms of their health, more specifically in reference to soil quality and to quality of agricultural resources, particularly production of food and fiber. I submit that this is not sufficiently broad. As the world‚s ecosystems become less functional, it is critical to examine what our agroecosystems can do beyond production of crops. We have to look to how we manage land, and to the functions of soil quality, and how the quality/health of soils and other natural resources relates to the other major functions of agricultural ecosystems. In this discussion, I will relate the issue of sustainable food and fiber production to the other critical functions of agroecosystems. I will leave the debate on „who will feed who to another time. It seems to me that without the goal of sustainability of our food production systems, this debate is moot. Intensive production to meet pressures of world trade without paying attention to sustainability, global production and distribution of food (food as a basic human right), equity of income, and research in developing countries to increase the production of food and improve quality of life in such resource-poor nations is foolhardy. Our future societies may well be forced to deal with these problems as full-blown crises. Surely we owe it to them to be more cognizant of our ecosystems now and to protect what we have from further degradation.

Development Of Food And Fiber Production Systems

Agricultural ecosystems will increasingly be called on to deliver food and fiber for a demanding and expanding global population. Until recently, increased production relied on expansion of the amount of land under cultivation and irrigation. Since WWII, production advances have relied on genetics, advances in fertilizer and pesticide use, and improved cultural management (Matson et al., 1997). Since 1950, agriculture worldwide has expanded cereal production by an average of 2% per annum while population has increased only 1.9% per year (Borlaug and Dowswell, 1994).

Modern science-based agriculture had its beginnings in the late 19th century with improved traction and tillage equipment. However, it was not until after WWII that the research findings that led to the modern-day productive systems in the United States and later in European and other developed countries. The expansion was directly related to the great demand for food to support the Allied war effort. Knowledge bases developed in plant genetics, physiology, and pathology, along with a ten-fold increase in fertilizer use, advances in seed technology, weed control, irrigation, and cultural methods allowed the development of the systems that dominate agriculture in many of the countries today. Corn, or maize, responded dramatically to the advances in production technology. U. S. maize yield in the U. S. has increased more than 300% over the past 50 years and continues to rise. Maize production technology has been delivered worldwide (Borlaug and Dowswell, 1994).

The Green Revolution

The „Green Revolution" has resulted in marked production increases of wheat and rice in many developing countries. It started in Mexico with the development of improved packages of technology, genetics, and infrastructure and expanded to Asia in the 1960s and 1970s. China‚s current yields of cereal crops approach those of the U. S. Borlaug and Dowswell (1994) point out that the Green Revolution does not transfer readily to all countries. Yields in countries with poor infrastructures such as lack of roads, rural credit, and education; as well unsuitable soils and poor weather; have had limited growth using the 1960s Green Revolution model. This is not necessarily a failure of the model, but an indication that alternate models are needed (Eswaran et al., 1997). Support for efforts to expand crop production in needy regions, especially sub-Sahara Africa and other areas with subsistence agriculture, has diminished, and criticism of the Green Revolution approach as „non-sustainable" has increased, particularly from the international environmental community. This has led to recriminations by supporters of research for improved crop production, and the stalemate appears to have lessened opportunities for research in areas of the world where local food production systems are in jeopardy.

Functions And Services Of Agroecosystems

Quality Water

A primary function of ecosystems is the cleansing of water. Most of the world,s fresh water falls as precipitation on lands managed for agriculture. Marked changes in landscapes to increase crop production have drastically altered the hydrology and soil quality of these ecosystems. The resulting soil erosion and deterioration in surface and groundwater quality have created problems worldwide. Increasing reliance on agricultural chemicals and irrigation and intensification of animal production has created further problems. Agricultural ecosystems can be managed to protect water supplies if we understand and incorporate principles of hydrology; stress the maintenance of quality soil; manage crop nutrients, pesticides, animal, and other residues wisely; and maintain plant cover on the soil during periods of intense rainfall.

Quality Soil

Perhaps the most important long-term issue in sustainable agriculture is the quality and conservation of soil (Keeney and Cruse, 1997). The Soil Science Society of America (1995) defines soil quality as „the capacity of a specific kind of soil to function, within the natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation." Similarly, the Natural Resources Conservation Service (1995) defines soil quality as "the capacity of a soil to function for specific land uses or within ecosystem boundaries. This capacity is an inherent characteristic of a soil and varies from soil to soil. Such indicators as organic matter content, salinity, tilth, compaction, available nutrients, and rooting depth help measure the health or condition of the soil--its quality--in any given place." Significantly the NRCS definition also recognizes the concept of soil health/soil condition as a part of soil quality. Closely related are the factors such as soil structure, soil erosion index, and water infiltration as they affect the efficiency of crop production practices.

Soil quality is closely linked to issues of soil conservation and sustainable agriculture (Karlen et al., 1990; NRC, 1993, Larson and Pierce, 1994; Keeney and Cruse, 1997). The 1993 National Research Council report by the Board on Agriculture Committee on Long-Range Soil and Water Conservation (NRC, 1993) has lent new awareness to this concept and to the relationship of the soil to the environment and to the long-term sustainability of soil resources. Soil quality concepts cover issues central to environmental soil science including soil compaction, soil salinization, and soil organic matter, as well as soil erosion. The concept of designing agricultural practices to improve soil quality is not particularly new. The failure of in-field approaches to solve environmental problems (for example, conservation tillage) has opened awareness for a strong interface between sustainable agriculture and soil quality in association with agroecosystem changes (Keeney and Cruse, 1997).

The NRC (1993) report states that soil quality should be used to guide the recommendations for conservation practices and for targeting of federal programs in resource conservation. It also emphasizes the importance of a holistic approach to policy recommendations. The development of policies and technologies that expand production of row crops such as corn on highly erodible lands is a good example of an economic system that rewards operators for using unsustainable farming systems. Current policies that may decrease soil quality include the strong emphasis on exports (moving erodible land into production, and use of unsustainable practices to maximize yield), emphasis on research and technology to increase grain production rather than on alternate crops and profitable crop rotations, and emphasis on chemical rather than management alternatives for pest control.

Carbon and Nitrogen Sequestration

Soil organic matter is the critical component in the functioning of terrestrial ecosystems, providing substrate for biotic reactions, nutrients for biological activity, maintenance of soil structure and soil permeability and resistance to wind and water erosion. Soil organic matter is critical to soil quality, carbon and nitrogen turnover and nutrient retention. Intensive cultivation of agricultural crops has caused a major loss in soil organic matter relative to natural ecosystems (Matson et al., 1997) and likely is a major factor in global carbon and nitrogen balances (Vitousek et al,. 1997a; Asner et al., 1997). In natural ecosystems, nitrogen usually acts to limit the amount of carbon sequestered. Therefore, as soils are disturbed by cultivation, organic matter is decomposed and available nitrogen is released. The increased plant growth would seem to increase plant sequestering of carbon, but there is evidence that this feedback cycle is being defeated by excess levels of anthropogenic nitrogen (Asner et al., 1997). Recent calculations by Vitousek et al. (1997b) indicate that the amount of nitrogen fixed by human activity has doubled since the advent of modern civilization and is projected to double again in the next 25 years (Asner et al., 1997). Further, many temperate and tropical forests and wetlands have been converted to agriculture and biomass burning has increased, resulting in major releases of carbon dioxide to the atmosphere. This trend has accelerated recently. Can agroecosystems be modified to sequester rather than release carbon and nitrogen? Could society begin rewarding farmers for planting trees and implementing other organic matter building practices that would counteract the amount of carbon dioxide being released through burning of fossil fuels?

Biodiversity

Modification of land surfaces by human activity, particularly by intensive agriculture, has resulted in major losses of genetic variability and species (Vitousek et al, 1997a). Species simplification has been important to agriculture for control of pests and development of high-yielding monocultures. Agricultural activities have destroyed habitat, leading to large losses in the number of species of birds, fish, and animals. Further, there is evidence that many ecosystem processes and functions are not carried out if biotic diversity is not maintained (Chapin et al., 1997). These include resistance to adverse effects of environmental change, management of pests and diseases, turnover of carbon and nitrogen, and likely many other activities not yet identified (Burton et al., 1992; Chapin et al., 1997). It has been shown that the soil biological community in agricultural systems is markedly different in composition and activity compared to natural systems (Matson et al., 1997), but the significance of these differences is not well understood. Modern agriculture, with its reliance on fertilizers and pesticides, as well as tillage, has managed to overcome many of the ecological effects of lowered biodiversity. Ecosystems can be managed to increase soil biotic diversity by increasing organic matter recycling through crop residue retention, reducing tillage, and likely increasing crop diversity.

Beauty

No discussion of the benefits delivered by healthy agroecosystems would be complete without including esthetics. Even though landscape beauty is difficult if not impossible to quantify, it exists. As art merges more with science, the benefits of a scenic landscape to human welfare are even more obvious. Ecotourism is one economic recognition of a beautiful landscape and other intangible benefits are obvious in the rich poetry and paintings and photography of renowned artists. Modifications of landscapes to provide beauty likely go hand in hand with modifications to provide other benefits.

Achieving Healthy Agroecosystems

Landscape Modification

Landscapes can be modified and/or restored to improve ecosystem health and provide the benefits and services discussed previously (Meals, 1996, Keeney, 1997b). For example, wetlands, which remove or attenuate pollutants and sediments are a primary cleansing mechanism in natural systems, They have been reestablished in many U. S landscapes, but unfortunately the policy approaches taken to wetland protection have slowed this effort greatly. Also, there is little information available to help landowners create functional wetlands at reasonable cost. The change in attitude of state and federal officials and a gradual realization of the importance of wetlands offers new hope that these systems can be reestablished. As private landowners gain experience with reestablishment of wetlands, they marvel that t he added benefits of wildlife and beauty gained by these and other landscape modifications easily make up for the small, sometimes insignificant, loss in production.

Stream banks are a significant source of eroded soil, and when runoff enters the stream directly, there is little opportunity for retention or removal of nutrients, pathogens, and pesticides. Just as with wetlands, there is considerable recognition of the importance of stream bank protection, but little action. Part of the reason for the lack of attention to such a simple approach has been that research and demonstration programs have not been stressed. Another difficulty has been the perception that removing land contiguous to stream banks from production is a cost to the landowner in lost productivity. Recent research and demonstration programs in several states in the U. S. have shown how easily stream bank protection can be done. There are added benefits as well, including bringing wildlife, biodiversity, and beauty to the landscape.

There are other aspects of the landscape that can readily be altered to protect water quality and enhance soil quality. Permanent vegetation can be incorporated where soil erosion is a continuing problem. For example, fast growing trees can provide a source of income, soil erosion control, beauty, and wildlife habitat. Crop rotations, crop residue management, and reduced tillage will add organic matter and improve soil quality (Keeney and Cruse, 1997).

Economics

The way economic returns from agriculture are calculated does not take into account the long-term effects of agriculture on agroecosystems, the external environment, or people. Thus, many of the landscape modifications that could be done to provide more healthy agroecosystems will not return a profit. Usually they cost the landowner and incentives must be provided to encourage adoption of resource-protecting agroecosystem options. However, there are promising signs of a change in ways of calculating benefits to the environment. Some watersheds are now being organized so that the municipality receiving the water or other benefits will pay for watershed management to achieve the desired services or benefits. Such is the case in New York State where New York City is working with the watershed that provides its water. (Coombe, 1995). Other opportunities will be created if state and federal policies on land controls are altered. An example in the U. S. is the Conservation Reserve Program (CRP) where highly erodible erosive lands were placed under voluntary-long term lease, and only perennials, primarily grasses, could be planted. This protected soils from extensive wind and water erosion, and resulted in soil quality improvements, lowering of soil erosion rates, and improvement of surface water quality in many watersheds. Wildlife benefited greatly, and scenic vistas were created. But this approach had several drawbacks. Environmental benefits were not as great as they could have been because funds often were not directed to the areas most in need of protection. Further, loss of income to local communities occurred to the extent that some areas lost population, and finally, CRP was expensive to the taxpayer. The approach now is to target the CRP funds to areas where water quality and other environmental benefits will be greatest. The result will be one of the first programs to reward farmers for setting aside lands for buffer strips, wetlands, etc. As this program gains momentum, we could see a change in attitude of policy makers and of the general public toward paying private landowners for environmental benefits not tied to production.

Changes in agricultural practices

Many agroecosystems are under intensive management. The corn-soybean system in the highly productive U.S. Corn Belt, and continuous corn, wheat, cotton, grass, or rice elsewhere are examples of simple agroecosystems with little resilience. They commonly exhibit loss of soil organic matter, high rates of soil erosion, reduced biodiversity and off-site water and air pollution relative to their less intensively managed counterparts (Matson et al., 1997). Under the current economic system, they tend to be highly profitable. They have evolved to require little human labor, and rely on outside inputs for control of pests and maintenance of fertility. The negative ecological consequences of a monoculture approach to food production are well known, yet productivity and acceptance of these systems has been greatly aided by public and private research. Conversely, very little research has gone into alternate cropping systems that would offer more stability to the landscape and are less vulnerable to the whims of pests and markets. Several sustainable agriculture research programs are in place to correct the deficiency in alternate crop research, but funding is small relative to that allotted for major crops. Similar problems exist for subsistence agricultural ecosystems, where lack of funding has prevented development of adapted varieties, improved cultural practices, and alternate crops. Animal agriculture, particularly intensive confinement, has increased greatly in some countries. The consumption of meat, milk and eggs is also increasing worldwide. The result has been less reliance on grains and legumes as food, and more reliance on these crops as feed. Often, animal manure causes environmental problems. Concentrated animal production also creates social problems and frequently a less attractive (and more odorous) rural landscape results. Nutrients and pathogens from animal manure that has been improperly stored or applied to the soil have long been recognized as a source of water pollution. Animals allowed to roam freely with access to streams and ponds also pollute these bodies of water. Outbreaks of human disease from water-borne pathogens traced to animal manure are being reported with increasing frequency.

Quantification Of Healthy Agroecosystems

Is it possible to quantify a healthy agroecosystem? This question is worthy of examination, even though as in many of life,s worthier pursuits, quantification is a difficult, if not impossible, activity. Even the subjects of sustainability defy precise definition (Keeney, 1997b). Soil quality, a more objective term, has also been difficult to discuss in quantitative terms (Doran et al., 1997), but descriptive soil health terms are more easily obtained from farmers (Harris and Bezdicek, 1994). Because soil quality is central to healthy agroecosystems, it could well prove difficult to obtain even semi-quantitative evaluations of ecosystem health that could be understandable to scientists, policy makers, and the public, though the farmer may know rather precisely, in subjective terms that an agroecosystem system is healthy.

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THE ECONOMICS OF SUSTAINABLE AGRICULTURE: IT'S MORE THAN JUST MONEY

Dr. Michael Duffy

Note: Michael Duffy was unable to attend the workshop due to illness. His paper was presented by Dennis Keeney.

I. Introduction

Good morning! I appreciate the opportunity to be here today and to be a part of this conference. I hope it will be productive and I am looking forward to learning more about the life cycle approach.

The purpose of my talk is to discuss the economics of sustainable agriculture. There are many different approaches and economic issues surrounding sustainable agriculture. In the short time that I have with you I would like to touch on just of few of what I consider to be the more salient issues and perspectives. I won't have time to go into depth but hopefully it will broaden your appreciation for the issues.

Economics is the study of the allocation of scarce resources. Those resources are land, labor, capital, or management. Economics provides a framework for how people choose to allocate resources among the competing choices. If there were no scarcity and you could do everything you wanted then there would be no need for economics.

Money is a very convenient means of quantifying the options and allowing for rational choice among the alternatives. However, some goods and services are very difficult, if not impossible, to quantify and this is where problems can arise. This is a subject to which we will return shortly.

The economic system we have relies on the market to establish the prices for goods and services. We operate under the auspices of a free market. The general belief is that an efficient allocation of resources will be achieved with everyone acting in their own self-interest and guided by the market as if by what Adam Smith called an invisible hand.

Over the years we have modified this approach in response to recognized problems. Our concept of a 'free' market and individual rights are constantly evolving.

We need money in a market economy to help us judge efficient allocation of resources. Money, however, is not the be all, end all, in the economics of sustainable agriculture. There is more to it than that.

The study of economics is broadly divided into two segments: micro and macro. Micro economics is the study of the firm or households. Macro economics, in general, is the study of the workings of the economy as a whole.

This paper will follow those two broad divisions. First I would like to discuss profitability and some of the issues and concerns for any discussion or calculation of profits. The next section will cover some of the major economic issues in sustainability.

Profit

Profitability is included in almost every definition of sustainable agriculture. To be sustainable, agriculture has to be profitable. The individual farmer has to make money to provide for his/her other needs.

An examination of the profitability of agriculture can occur at the enterprise level or at the whole farm level. Partial budgeting is the usual tool used for comparing enterprises. This is the type of analysis most often used in sustainable agriculture studies. The sustainable way is usually compared to the 'conventional' way.

A whole farm approach looks at all of the resources on the farm and how they are allocated. For most sustainable agriculture projects a whole farm approach should be used. Unfortunately, many studies that claim to be a whole farm approach are simply the addition of two or more enterprises. They are simply multiple enterprise analysis rather than a whole farm analysis.

Profits are revenues minus costs. At the enterprise level revenues are simply the quantity produced times the price per unit of production. Costs are more problematic and will vary depending upon the study and particular purpose.

Costs can be divided and sub-divided in many different ways depending on the level of analysis. Costs can be fixed or variable. They can be cash or non-cash. They can be direct or indirect.

One of the most useful concepts is that of an opportunity cost. An opportunity cost is simply the cost of using the resource in its next highest and best use, or the cost of what is given up. For example, if you spend an hour doing one thing then you can't spend that hour doing something else. The value of the labor in the next highest and best use is the opportunity cost. In some cases this may be other jobs but in some cases it may be an hour of leisure or family time.

These divisions of costs are necessary depending on the type and level of analysis that is being conducted. It is not simply a matter of what you paid for something.

The costs directly associated with production are the easiest to understand and quantify. Seed, chemicals, fertilizers, and so forth are all relatively straightforward. So too is the fuel used for the machinery operations. But what about the other costs associated with running the farm business that are not so easy to divide? How do you value the farmer's labor, the labor of the family members? How do you value the land?

The point is that simply adding up the revenue and subtracting the costs is not an economic analysis. In addition, that type of an approach can also give misleading results. There are many examples of situations where given two alternatives a farmer would make more income by choosing the alternative that had the lower return per unit. This result is possible because of the resource constraints. For example, assume strategy A has a profit of $5 and strategy B has a profit of $3. But, A requires six hours of labor while B only requires two. For the same amount of labor, say, 6 hours, the farmer would earn $9 versus the $5 with B instead of A.

This illustrate just one of the many other considerations besides the profit per unit. Labor is one of the key resources that have to be evaluated. It is not only the quantity of labor but also the quality of labor that is important. Manure management is a prime example of the impact of the quality of labor. Handling manure is not a pleasant task. Study after study shows that proper manure management can save money but study after study also show that many farmers do not follow what would be considered proper manure management. One of the big reasons for this is the desire to get done with the task as quickly as possible. There are many other examples of decisions that appear irrational from a revenue/cost analysis that are perfectly rational from the individual farmer's perspective.

Capital and land are other resources where the constraint may make one alternative infeasible at the level necessary for an adequate income. One system may appear the best but resource constraints can prevent income at the desired level.

The final resource category, management, is also one where the constraints can be observed. Management is hard to define but in general it can be thought of as the ability to combine the other resources, land, labor, and capital. Different systems will require different types and levels of management that may not be available to the individual farmer. Some systems are just too complex for the individual to comprehend.

There are other factors besides the simple cost/revenue calculation that also influence the desirability or acceptability of a different method or system. Risk is one of these factors. System A may have a higher expected value than System B but the farmer could still choose B if the negative outcome in A was greater than the farmer was willing to accept.

Profit and profitability are complex topics. It is not as easy as just adding and subtracting if you really want to account for the actions of individuals. Farmers have to make money but an assumption of profit maximization is most often used may not be a valid one. There are many other factors that come into play. We have seen that resource constraints can influence what is the most profitable alternative. The goals of the farmer will also influence which of the alternatives they find acceptable. The quality of the labor, the amount of family time, the perception of the neighbors and so forth are all concerns that exert an influence to a greater or lessor extent in the farmer's decision.

Other issues

There are problems with calculating profits and then using profits to predict what farmers will do. Beyond those problems are also some serious issues that should be addressed in any complete discussion of the economics of sustainable agriculture.

The first of these issues is what are called externalities. An externality is simply a cost or a benefit that is not accounted for in the market price. Soil erosion, odor, and so forth are examples of negative externalities. There are also positive externalities like the creation of scenery or other positive amenities that could be associated with the type of farming practices chosen. In general, the term externalities is used in connection with negative production aspects.

There are two major problems with externalities; how to value them and the best way to get the decision makers to incorporate them into their decisions. There are numerous studies and work under way trying to better understand and evaluate externalities. The externalities represent one of the major market failures that has an impact on the economics of sustainability.

Another economic issue for sustainable agriculture are what are known as public goods. Public goods are not provided by the public but are goods available to everyone. In general terms a public good is characterized by non-excludability, everyone can enjoy it, and by non-rivalry, one persons enjoyment does not detract from another's enjoyment. Clean air would be an example of a public good.

It is difficult with public goods to assign costs and benefits. An individual farmers use of a particular pesticide may not cause resistance but each use contributes to resistant. A large scale pest management strategy suffers from the public good aspect. Why should I pay when I will receive the benefits anyway?

Externalities and public goods illustrate the important role played by property rights. Who has the right to do what to whom? The courts are continually deciding and redefining the property rights issues especially as they relate to sustainable agriculture.

A final important feature to the economics of sustainable agriculture is the question of time and generations. How do we value the costs and benefits to those not born? The typical way to value costs and benefits that will occur in the future is to discount them to the present. This approach places all the value on the present generation. Many of the arguments surrounding discounting focus on the appropriate discount rate to use. However, when evaluating out many years the choice of the discount rate becomes irrelevant because the value of any cost or benefit approach zero.

This is an especially problematic issue for the evaluation of sustainable agriculture. Society or the individual has to be able to evaluate decisions today that will have implications in the future. There really is no clear cut method available to do this.

Conclusion

The economics of sustainable agriculture is more than just money. There are several important economic issues that have to be considered as we think about sustainability.

What do we mean by profits and how are they being measured? How do profits fit into the farmer's decision-making, in other words what level of profits is the farmer seeking? What are the impacts of the resource constraints?

How are we handling or dealing with the known areas of market failures related to sustainability? There are many costs and benefits that do not enter into the farmers' decision-making. Should we try and measure these as precise as possible or just admit that there is no way to know there exact worth and estimate them? What are the odds that we will over or under-estimate and what are the consequences if we do?

There are many economic issues when evaluating sustainable agriculture. We must not get lulled into the false sense of security that it is simply adding and subtracting. Economics is not the study of money but rather it is the study of how the individual or society allocates its resources.

3. PANEL DISCUSSION: MULTIPLE PERSPECTIVES ON ENVIRONMENTAL SUSTAINABILITY

Moderator: Guntra Aistars

Panelists: Wayne Craig (dairy farmer), Mitchell Lynd (apple grower), Dean McIlvaine (grain farmer), Mike Natvig (hog farmer), Ron Meekhof (USDA), Kurt Thelen (MI Dept. of Ag.), Paul Dietmann (University of Wisconsin – Extension)

Panelists began with brief statements on the main environmental challenges they face in their work and commented on their understanding of environmental sustainability. The floor was then opened for discussion.

Wayne Craig, Dairy Farmer

Wayne Craig, a rotational and seasonal dairy farmer from Wisconsin, noted that most environmental costs are long- term and not directly attributable to the production of agricultural products. The responsibility for long-term environmental sustainability may seem to fall on government, since the market deals with the short term. Yet maybe the government is not where we should focus. The government is made up of us; and consumers will have to move ahead and deal with these costs. Soil erosion is a major issue for his 200 acre farm and he addresses it with rotational grazing and grass covers. He commented that natural systems work well and need to be incorporated into production. For example, grazing along intermittent streams has been made illegal in Wisconsin, yet if done on a rotational basis, manure run off into streams is not a problem, because soils can retain manure within 12 hours after a rain. Rather than thinking about eliminating erosion, it is preferable to work with natural systems and think about “growing soil.”

Paul Dietmann, A University Extension Agent

Paul Dietmann, extension agent in Wisconsin, challenged participants to consider how to take ideas generated by the workshop beyond the academic and policy realm to farmers. Changing the mindset of “real, conventional farmers” is a huge task. Making a shift to rotational grazing and seasonal dairy farming as Wayne Craig has done is difficult for farmers to make since changing to alternative systems is risky. In his county in Wisconsin there has been a 5% increase in small farms under 179 acres, often as a result of people having had other careers in the corporate world and now wanting to farm. Some may think of these small farmers as not serious as “fringy, back-to-the-landers.” But these small farmers bring a fresh perspective to agriculture, in part because they do not have 5 generations of conventional mindset to overcome and are willing to take risks that conventional farmers are unwilling to make. But they can also work out the bugs of these alternative systems so that other farmers feel less of a risk in adopting more sustainable practices.

Ron Meekhof, USDA

Ron Meekhof noted the increasing consciousness about sustainable development and its importance at the USDA. Adele Backiel is currently leading a serious USDA-led working group on sustainable development that is bringing together people from different government agencies to formulate positions and coordinate activities. There has been active involvement of the USDA and other agencies in the President’s Council on Sustainable Development to better define broader policy roles for sustainable development. Activities at a macro policy level are important, Mr. Meekhof said, but he noted that he learned more at this workshop on sustainable agriculture than he has in any sustainable development discussions in Washington DC. In a sense, the perspective in Washington is that sustainable development has to be community-driven and locally meaningful with on-farm levels being the most crucial. The USDA has been working on identifying what environmental benefits and criteria are associated with sustainable agriculture and natural resource conservation at landscape and watershed levels as well. They are trying to quantify and understand what practices bring benefits with respect to landscape aesthetics, clean air and water, biohydrophysiological dimensions, bird hunting and biodiversity. Such indicators are relevant to sustainable agriculture. However, sustainable development indicators on environmental services and functions have to be matched with sustainable development indicators that reflect improvements in socioeconomic variables. They have to be changes that can be detected and understood by any farmer and practitioner, thus measurable in terms that are important to participants. Educational programs directed to individual farmers would probably have the most immediate and real effects for long term sustainable agriculture.

Mitchell Lynd, Apple Farmer

As a 6th generation apple grower from Ohio, Mitchell Lynd began by discussing how even those farmers that may not have called themselves environmentalists or communitarians are concerned about contributing to their community in a positive way. They are concerned about having good air quality, judicious and reduced use of pesticides, and good water quality. Fruit people are more or less tree fruit people. As a result, they did not think as much about soil erosion as a dairy or grain farmer might. They also do not think too much about air quality; they do not have a case of bad air. Most Midwest apple and fruit farming is not irrigated, but rain-dependent, and so water use is restricted to harvest cleaning and the packing line. This is very different from West coast farmers that use water irrigating their apples.

For sustainability, what apple farmers are most concerned about is the protection of apples from diseases and insects. This poses an immense problem since apples and fruits are subject to attack from various fungal and bacterial diseases and insects. Each visits orchards at different times and so growers are constantly spraying pesticides for something. As a result, the pesticide use rate is high in the tree fruit sector. The only hope for sustainability lies in breeding programs that build in natural resistance to our apple and fruit cultivars. Before, fruit growers were sold almost any product by the chemical industry. But the organisms and pests out-maneuver any product. Resistance to pesticides happened quickly and nothing has ever gone extinct from our use of pesticides. As a result the best indicator of sustainability for our sector is not only a reduced use and eventual elimination of pesticides, but also pest-resistant fruit trees. Like medicine or aspirin, pesticides are to be used with care and dosage is everything: 2 aspirin relieve headaches but a whole bottle can kill you. There is a legitimate fear about pesticide residue effects on living things, just as overuse and misuse, but it is not clear how to evaluate such risks. What is clear is that in the long—term, spending so much on pesticides is not affordable. Disease and pest resistant apples would be financially and environmentally advantageous. Also, the more we get away from the Red Delicious variety the better off we will be by diversifying our apple groves.

Kurt Thelen, Michigan Department of Agriculture

Mr. Thelen spoke about environmental challenges facing farmers and how his agency offers assistance. He had a cash crop and dairy farm in Clinton Township, which he has handed over to his brother. He still has beef cattle.

The short-term challenges are to address the problems which farmers face now. There are two MDA programs to prevent pesticide pollution. These are the Clean Sweep Program that collects unused pesticides from producers (being held up as a national model) and the Spill Response program that offers a 1-800 number for producers to call if they have a pesticide spill. The MDA will come out and help the producer clean the spill.

To address the long-term challenges, a grower stewardship program has been established. Farmers fund this program when they buy fertilizers and crop protection products. Money is directed back to farms to reduce risk to ground water. Cost-share is available; funds go to the most critical problems. Interestingly, of all the money coming into fund, 40% is from homeowner bought products. Other programs include: closing abandoned wells, integrated pest management, nitrate testing for corn growers, and water testing.

Under the right-to-farm law, the Department of Agriculture has defined generally acceptable environmental practices. A task force defines these practices. The criteria are scientifically based. They want to avoid putting producers at economic disadvantage relative to other states, but must also protect the environment. They work with the producer and also bring in local soil conservation officers and others to fix environmental problems.

Non-farm challenges include the need to separate social from scientific issues. It is important to know what is based on science and what is based on social pressure when considering changes. Some 80% of all meat is processed by 4 major companies. They like to work mainly with big producers. It should be a level playing field for everyone, big farms and small farms. Market forces play a big part in driving these changes. International marketing challenges involve differences in packaging laws. The European Union has labeling laws that require identification of BT corn. Currently, the US can't separate BT corn from non-BT corn so the EU won't accept any of it. Market forces are driving biotechnology, but science needs to be applied to evaluate it.

Dean McIlvaine, Grain farmer.
Farming practices have changed since Mr. McIlvaine began farming. There is growing concern about water pollution, land erosion, nitrogen and phosphorous runoff. He has addressed these concerns by changing his farming practices such as eliminating chemicals and incorporating crop residue to build organic matter. This holds nitrogen and phosphorous on the land because the increased water-holding capacity results in less runoff. Cover crops are also important in reducing runoff. Microbial activation is useful to keep the soil porous. Fossil fuel inputs on the farm have decreased.

Most recently the final problem is excessive government intervention in a successful system. If politics get too thick it may change or destroy a system that works on a farm. To quote Bill McDonough "Regulation is a sign of design flaw". A well-designed system is self-regulating. The market consumer has a voice that can direct industry.

Mike Natvig, Hog farmer
Mike Natvig raises organic grains, organic hogs, and some hazelnuts. It is a struggle to manage each and think of it in a holistic manner. As an outcome of this symposium he would like to see a way to bring the information to farms so land managers can monitor what they are doing. He wants to know for sure that his practices will be good for the land in 7 generations. Mr. Natvig left further comment to the question and answer session.

QUESTION AND ANSWER SESSION

Q: Michelle Miller: Do any of you use holistic management practices?
A: Mike Natvig: Yes. We are trying to incorporate some holistic management. We belong to a group of surrounding farms that meet once a month to figure out solutions to various farmers concerns. We go out together and do some monitoring like soil checks, riparian and biodiversity monitoring. Doing this type of activity together is a really positive experience.

Q: How did you start this group?
A: Mike Natvig: There were two of us who had the idea originally and we started talking to other farmers that were also interested. I feel that it is one of the most positive experiences of my farming life.

A: Paul Dietmann: Maybe its a good idea to explain a little bit what holistic farming is. Essentially it is a farming system that puts quality of life of the farmer first. I did some work at the Center for Holistic Research in Albuquerque, New Mexico and taught five sessions of holistic farming to a group of conventional farmers. I'm interested in taking the concept of holistic management and applying it at the watershed level. So we gathered up a group of people in Albuquerque that we knew had a receptive mindset to this type of a concept and who all knew each other. They were very enthusiastic about the idea and so we then brought this idea to a group of conventional farmers. They too had a very positive response, and we ended up leading 5 workshops around the county.

Q: Do tree fruit producers monitor beneficial insect populations?
A: Mitchell Lynd: Yes, we sure do. You can't be competitive if you don't. We monitor predators of the European red mite. In high school I remember the introduction of organophosphates and they were the greatest thing ever. They killed everything. Dad would go out and scorch the earth every day. The insecticide killed the European red mite for 24months. The European red mite is the worst pest for fruit tree crops. After 24months the mite was back in full force. We have now settled on one organophosphate called Emmedin, which is safe for humans. This pesticide is the only thing left that controls plum curculio, which is a larva that tunnels through the fruit. Emmedin lets the populations of green lacewings and phalaceous amboselis, organisms that prey on the red mite, survive. In the 1950s the pesticide companies would send us miticide after miticide, and each of them would only last for a couple months. Emmedin is the only one that allows the natural predators to persist. I once monitored the drift of Emmedin at the request of my neighbor, and I told him that even if I drove by and aimed the spray of it directly at

his house he would only receive LD50 of the chemical, which is equivalent to approximately 7 aspirin. So this product is relatively safe for us. We have yet to find a natural system that controls the red mite. There have been entomologists that have gone to Kazakhstan where the apples that I have come from to study the natural predators of the mite. If we can understand the system better there will be hope of finding a natural way to control the pest.

Q: (Devdatt Kurdikar): What is the role of industry in facilitating the development of disease resistant apples?
A: Ron Meekhof: Probably the role of industry will shift from the pesticide industry to the banking and insurance industries. It’s not just the chemical industry that prevents the widespread adoption of sustainable practices of agriculture production, but financial institutions as well. Financial institutions have to submit to a great deal of risk to endorse and fund these non-conventional practices. A possible policy solution would be to implement an insurance program that protects producers from incurring a loss from reduced yield if they decide to switch to a more sustainable management system.

C: Paul Dietmann: I'll turn the question back to you, What do you think industry's role is in developing resistant strains of crops? How does the industry capture value from sustainable development? This is not something industry would do simply because it's good for everybody in the farming industry. It must also be good for the company's investment.

C: Charles Cubbage, Advisory for Responsible Chemical Usage: The industry is selling products that are currently meeting a need **-** is there another way that we can meet farmer's needs without the industry's inputs?

A: Mitchell Lynd: Here's what Mr. Monsanto can do. Monsanto obviously has accountants that figure out that 95% of the benefits of the products go to their company and make sure that we only get 5% of the benefits. And we're supposed to be thrilled with that 5%. Let me tell you something **-** we're NOT!
The labels on the chemical containers advise 6 lbs. per acre and we figured that we could get the same effect using half the suggested dosage. Pretty soon the chemical industry figured out what we were doing and now chemical corporations have put a lower suggested dosage. Now when a new product comes out on the market we are ho-hum about it, because the cost/ benefit ratio is not that great because of the high level of resistance.

C: Kurt Thelen: The jury is still out on biotechnology, but glycophosphate has been shown to be benign in that it doesn't move in the soil and there is absolutely no risk to groundwater from it. The bottom line in terms of Round-Up is that it makes good economic sense.

C: Paul Dietmann: Economically you are better off with the conventional system.

C: Wayne Craig: The market is driven by Monsanto.

C: Gerry Campbell: Farmer-to-farmer connections are the most important asset for sustainable farming to work and they must be encouraged.

C: Paul Bantle: Going back to the industry question, systemically, the currency we are talking about is soil, water, air, and sun. Industry has not grasped that. They think only in dollars and cents. There must be a dialogue about soil fertility and the extremely long time it takes to generate soil. It is this type of currency that must be generated and saved, not dollars and cents.

C: Wayne Craig: That's true, because ultimately it is in industry's best interest to preserve the soil.

C: Paul Bantle: Yes, because once they've exhausted the productivity of the soil, they won't have anything to apply their chemicals to. What we need to do is take the information that we are learning here about sustainable agriculture and take it out to the field. So how do we do that? How do we package up this information and deliver it?

C: Wayne Craig: Farmer networks, extension agencies, industry, if they had some sort of incentive to do it. We must make it a dollars and cents issue in order to generate the interest of industry because unless we can do that they will never consider sustainable agriculture a priority. If we can get industry involved there will be infinitely more funds available since they have such a huge resource base.

C: Mitchell Lynd: Extension people would be a good outlet since they are well respected and believed back at home.

C: Wayne Craig: Lots of people at home and in the ag. extension service are against sustainable management systems.

C: Dean McIlvaine: What we need is a type of reeducation. You need to continually look at alternative systems, to document and publicize them in order to educate illiterate people in the agrarian community.

C: You've pointed out the complexities of the issue. How are we going to sustain these farmers if we don't sustain other aspects of the agricultural community. How do we have sustainable agriculture if we don't have sustainable comminutes? It comes down to education: we need to have a semester on agriculture and on biotech as compulsory education in the schools.

C: Mitchell Lynd: Seems like when I think about questions of biodiversity and the sustainability of food, what will be the thorn in our side always comes back down to the fact that there are simply too many people in the world.

Q: Jonathan Bulkley: What led you to make the change to organic agriculture?
A: Dean McIlvaine: I was fresh from college and I had the idea on my head that you are what you eat. I didn't have any earth-shattering experience like some who go through some horrible toxic exposure ordeal. I simply studied it. I figured health comes from the soil and I wanted to promote that and I wanted to make that change. The ultimate issue was economics. Yeah it's better to eat wholesome foods, but can we make it pay. When we found out that we definitely couldn't make it pay using conventional farming because of the input costs we decided to try organic. We figured if we can't control the market at least we can control our inputs.

C: Back to the holistic management for a second. In holistic management you must set objectives. You must set quality of life objectives. How has holistic management affected quality of life issues for farmers?

A: Wayne Craig: If all farmers sat down and put quality of life as their first priority there would be a shift in farming management. When we had a conventional farm we had no quality of life, so to speak. After we went to rotational grazing there was much less stress and less debt. Quality of life is where all farmers should start, however not enough people address this aspect of their life.

A: Mike Natvig: What you do on your land affects your quality of life. My quality of life is different from my dad's and maybe my dad liked to do things the way he did them.

C: We need to discuss the root cause of our current lack of systems thinking which is our worldview that embraces mechanistic, rather than holistic perspectives.

4. WORKING GROUP REPORTS

TASKS AND METHODOLOGY

Participants worked in four parallel working groups on Friday afternoon and Saturday morning: dairy, fruit, grain and pork. Each group worked with the following tasks:

Timeline

Participants listed events since 1945 that affected their sector. The purpose of this exercise was for the group to begin identifying key issues in the sector that need to be addressed by the indicators.

Current Trends

Participants in each group created a "mind map" of current trends affecting their agricultural subsector. The trends were written up on a flip chart to show how they are inter-related. Each participant then voted to show which of these trends he/she finds most important.

Case Study Farm Presentation

One farmer was selected for each group to be a case study farmer, who presented information on his farm, management practices, understanding of sustainability, and challenges to sustainability.

Overview of Sector and Comparative Case Studies

Other farmers and industry representatives presented the conditions on their farms/ and/or statistics on the sector in order to supplement the case study data.

Indicator Sessions

Each indicator working session (economic, social, environmental) was divided into an initial brainstorming session and a revision session. The results of both are recorded in the group reports.

The order of the tasks and the specific methods used varied slightly among groups and are described in each individual group report.

4.1 DAIRY WORKING GROUP

Facilitators: Gerry Campbell and Ron Meekhof
Case Study Farmer: Wayne Craig
Participants: Paul Bantle, Amara Brook, Eldon Christophel, Thomas Guthrie, Greg Keoleian, Tom Kriegl
Rapporteur: Darci Andresen

TIMELINE

The dairy group formed two parallel timelines: one of world events, and one of events in the dairy industry since 1945.

Year	World Events	Dairy Events
1945	WWII ends, DDT, Begin shift to petrochemicals	Pasteurization required, Cooperative marketing system established, Increase in capital intensity
1948		Hay roller
1950		:Field hopper, Machine milking, Elsie the cow, Bulk milk handling Inspection regime for bacterial count , Refrigerated transport
1955	GATT Castro/Cuba	End of door-delivered milk Move from grazing to cutting silage Switch to bulk milk production
1960		Herd size increases to over 100 Move towards specialization
1960s		Move to drylot feeding
1962	Rachel Carsen's *Silent Spring* Kennedy shot	
1965	Vietnam War	
1968		Pure Food and Drug Act – FDA Zero tolerance of residues Colored Oleo margarine
1969	First man on the moon	
1970	Earth Day	
1970s		Rise of milk production in other states
1972-73	Oil Crisis	PBB scandal in Michigan
1975		Manure storage requirements 'Real Dairy' seal on products, Growth in cheese consumption –fast food, pizza
1979		Shift in dairy policy, Milk pricing system
1985	Farm Crisis Dairy buyout	Component pricing 'Got Milk' advertisements
1990s		Average age of farmers increases, decrease in family farms Fencing technology facilitates Management Intensive Rotational Grazing (MIRG) and other mgmt strategies
1995	rBGH approved OJ trial	rBGH BST, Land encroachment/conversion, Artificial insemination, genetic manipulation
1998	Impeachment	

CURRENT TRENDS

Key Issues

Each member of the working group assigned priority to three issues in the dairy timeline which he/she felt to be the most important in structuring the current dairy industry:

1. Decline in new farmer entry to dairy industry, decline in family farms (8 votes)
2. Shift to petrochemicals (6 votes)
3. Artificialism: rBGH, genetic improvement (6 votes)
4. Milk pricing system and price supports (6 votes)
5. Capital intensity (4 votes)
6. Fencing technology (3 votes)
7. Land conversion (sprawl) (3 votes)
8. Specialization in dairy production and marketing (co-ops) (2 votes)

DAIRY CASE STUDY: WAYNE CRAIG, THE GRASSAWAY FARM

FARM PROFILE

General
Our farm consists of 247 acres, 220 of which are considered tillable. Approximately 200 acres are in sod, with the remaining 20 crop acres to be seeded down this spring. The farm is located between Lake Winnebago and Lake Michigan in east central Wisconsin.

We are located 2.5 miles south of New Holstein (3,000 people) and 3 miles west of Kiel (3,000 people). We are close to several larger cities:
20miles **-** Fond du Lac: 36,000
20 miles – Sheboygan: 50,000
35 miles – Appleton and Fox Cities: 100,000
60 miles – Milwaukee: 2,000,000

Land use in the area is primarily agriculture, with dairy and cash grain farming the most common. Due to the number of towns and cities near us, significant residential housing has been going up in the rural area. This is having an impact on land values that border our farm.

We have a seasonal dairy herd of 120 cows that freshen from March 30th through the end of May. The cows are Holstein, Jersey, and Holstein.Jersey cross. The herd average is 15,400 pounds. All breeding youngstock are fed and raised on the farm. They number about 80 head.

Secondary enterprises on the farm include a laying hen flock and direct marketing of pork and beef. The laying hens are housed in an "eggmobile" which is moved through the grazing paddocks approximately two days behind the cows. The hens provide parasite control for the dairy cattle by eating fly larvae in manure pats. About 70% of their feed consumption come from the manure pats, grass and bugs during the grazing season. Eggs are sold locally directly to consumers and through a food coop.

The pork enterprise consists of approximately 12 pigs per year, which we purchase as feeder pigs. When they reach 80 to 100 pounds, we move them to the bedded manure pack built up over the winter by the dairy herd. The pig' root through the pack looking for corn which is seeded in the bedded pack. This process helps to compost the bedded pack material, which is spread on the grass paddocks in late summer. The pigs also receive any waste milk and garden waste. The pigs are butchered in the fall and sold directly to the consumer.

The beef enterprise consists of approximately 5 dairy steers per year. They are grazed with the heifer group and butchered in the fall. The beef is then sold directly to local consumers.

Kay and I both grew up on small dairy farms in Wisconsin. We both have BS Dairy Science degrees from UW-Madison. We worked in agriculture related industry from college graduation until we purchased our farm in 1993. I worked for the Farm Credit System for 11 years as a loan officer, branch manager, assistant vice president and credit analyst. Kay worked for the Farm Credit System, ASCS, and a small feed mill. Later, Kay went back to school for a Master's degree in Food Science and worked five years for Marigold Foods, a dairy processor, as an operations manager.

Social
We employ only a small amount of part time labor through the year. The additional labor is needed during the spring calving season and to assist with milking cows several times per week. Total hired labor is less than one half of a full time equivalent. Wages range from $7 to $10/hour, depending on experience and the jobs performed.

The local economy is very strong and labor markets are tight. The local communities have a strong base of manufacturing, including Tecumseh Engines (the largest employer in the area), and several specialty metal fabricators.

We rely on the local communities for hardware needs, purchased feed, machinery repair, and animal health care needs. Due to the strong economy and manufacturing base, these communities are growing and provide any service we might need.

Economic

The dairy enterprise is by far the major profit center on the farm. The herd production average is 15,400 pounds milk per cow, which totals 1,700,000 pounds over the year. Cost of production for 1998 was $10.03/cwt if only direct costs are considered. Average price per hundred weight received in 1998 was $15.80/cwt. All milk is marketed through to Dairy Cooperative, which makes cheese in two locations. Milk prices received in 1998 were record highs. The milk price trend for 1999 is down significantly to more historical levels of $12 to $14/cwt.

Environmental

The dairy herd ration relies heavily on grass harvested by the animal. Approximately 12 to 14 pounds of grain are fed per day, which is 25% of the cow's total feed intake. For 199 all grain and corn silage will be purchased from a neighboring farm. Our farm will be entirely in grass.

Milking is done in a 15 swing parlor, which allows us to milk 120 cows in 90 minutes or less. This parlor was built in 1996 and is very simple. Total cost was $75,000, which is $2,580/ stall. Conventional parlors being built in our area today are costing $10,000 to $15,000/ stall.

The dairy cattle are rotationally grazed. Seasonal calving allows us to synchronize the cows' nutritional needs with spring grass growth. Cows are moved to a new paddock after every milking. Paddock subdivisions are made using portable poly-wire and step-in posts.

During the grazing season, manure is spread in the paddocks by the cows. The manure breaks down quickly in the heat and moisture of summer and is nearby broken down by the next rotation. Milking parlor wastes are pumped to a settling pit and the fluid is pumped onto a filter strip once per week. Solids are cleaned out of the pit once per year and spread on paddocks. During winter, cows are housed in two loafing sheds with a bedded pack. The bedded packing made up of corn stalks, sawdust, and old hay. In the spring when cows go on grass, we bring in 100# pigs. The pigs aerate and compost the pack while they search for corn that we have seeded in the pack. In late summer we clean out the pack and spread it thinly on the grass paddocks.

Water is provided in all paddocks through 1" black poly-pipe. Water tanks are moved with the cows and youngstock from paddock to paddock. In the milking parlor, water used for wash-down is first used to pre-cool milk through a tube cooler during milking.

Energy use on the farm is reduced with grazing. The cows are harvesting over 75% of their dry matter needs during the grazing season. In addition, they are spreading their own manure. Our cows are n grass at least 21 hours a day, so savings in energy consumption are significant.

The grazing system has a significant impact on the ability of the soil to retain moisture as well as reduce soil erosion. We have increased soil organic matter levels on the farm by seeding down more acres and because of the effects of pulsed grazing. The grassland have the ability to capture and sore more total moisture than cropland. Due to reduced erosion with the grasslands on our farm, erosion has virtually been eliminated. The reduced erosion combined with MIG, in which pulsed grazing builds organic matter, creates a situation where we are actually creating soil faster than it is depleted. We are very excited about the power and the potential of this process.

Sustainable Practices
Management intensive grazing (MIG) is the key sustainable practice used on our farm. MIG is a system of low cost production that relies on natural systems and cycles. Cows and youngstock harvest their own forage system of low-cost production that relies on natural systems and cycles. Cows and youngstock harvest their own forage needs and spread manure at the same time. Virtually no outside energy sources or other inputs are required to make the system work. MIG allows us to move the cattle to forage at the optimum time and gives us complete control. We further enhance the natural system by managing the cows and the grass to maximize profits. First of all, we synchronize breeding so that all cows freshen in the spring. Their maximum nutritional needs are then in synch with maximum forage growth. Secondly, we manage forage growth by creating a stair step effect in the paddocks. The stair step approach ensures that not all forage matures at the same time. By grazing individual paddocks differently in the fall and spring, we stager forage growth and maturity to allow cows to always by grazing forage at its highest quality.

A laying hen enterprise added in 1998 utilizes sustainable practices. A portable hen house (eggmobile) is moved through the grass paddocks approximately 2 days behind the cows. The 100 chickens free range and seek out lye and worm larvae in the manure pats and also eat grass and bugs. We are relying on the natural instincts of the chickens to reduce fly and parasite loads in the cattle. The eggs from the hens are sold at premium because they are free range and are of excellent quality. The egg proceeds are used to purchase feed and cover other costs of the enterprise. Next winter we plan to build a small greenhouse where the chickens will over-winter. We will use a bedded pack system that we plan to leave in place and use as a growth medium for early vegetables.

We direct market meat from the pig enterprise and dairy beef enterprise to consumers. These meat and egg products are actually a side benefit to the activities these animals are doing for us on the farm, aerating bedding, spreading manure pats and grazing. By direct-marketing these products, we provide quality health food to local consumers. Direct marketing from farm to consumer promotes good relations and helps consumers to better understand where their food comes from.

Another sustainable practice used on the farm is the raising of dairy youngstock to become herd replacements. These replacements are bred to calve in the spring with the rest of the herd. Our goal is to maintain or increase total dairy cow numbers over time, without bringing in cattle from outside sources. These replacements are grazed on a separate rotation from the cows and receive little or no supplemental feed during the grazing season.

Our bedded pack system used for winter housing also has some sustainable features. We do bring in carbon sources, e.g. corn stalks, sawdust, straw, poor hay from outside sources. These are spread in the loose housing sheds over the winter period, up to five months, while the cattle are off pasture. The high carbon bedding ties up nutrients in the manure. We then use pigs to aerate (piggerators) the bedding, using their natural instinct to root and dig. We seed the pack with shell corn, top to bottom to provide an incentive. This aeration action helps to compost the bedded pack, which is already heating naturally. In late summer we then remove the pigs and spread the partially composted material on the grass paddocks. This is an excellent source of nutrients and organic matter. We see a significant growth response in the paddocks from the application over subsequent years. The farm has been sustainable from an economic perspective since we have implemented our MIG system. In 1998 direct costs per cwt. of milk was $10.03, while price paid per cwt. was $15.80. Return on assets for 1997 was 8.77% and 11.18% for 1998. Return on equity for 1997 was 16.155 and 20.54%for 1998.

This sustainable farm system is actually a series of smaller individual sustainable systems, that when combined, enhance and create an integrated larger whole.

Greatest Challenges
The seasonal dairy herd is both our most challenging management practice and also significantly simplifies the day to day management. Getting all cows bread within a 10-week window requires intensive management and the willingness to cull cows that do not fit the system. Calving in 120 cows in 10 weeks also creates challenges. During the period we average 2 calves a day, although in reality some days 5 to 6 calves are born. We have designed a management system to deal with these numbers and hire additional help during this time.

Even with the challenges of seasonal calving, the rewards to simplify daily management are considerable. With seasonal calving all cows are in the same stage of lactation. This means that feeding, breeding, and milking are designed for only one group instead of several. Management time can be focused on one thing at a time instead of trying to juggle multiple roles on a daily basis. We get the maximum benefit out of the spring flush of forage growth because cows are at the peak production at the same time. We are able to use less hired labor because workloads are clustered around certain times of the year: April and May are our calving months, June and July we are breeding and harvesting excess forage, August through January are generally low-stress months because there are no baby calves to feed, breeding is completed and mechanical forage harvesting is completed, and February and March are the dry months, and time for us to attend conferences, catch up on reading, and visit friends.

Our management challenges are similar to other grazing operations, especially those that are seasonal. Most non-seasonal grazers practice a modified seasonal approach to get maximum benefit of the spring growth flush. A modified seasonal producer clusters calving into spring and fall with no winter calving. However, our daily challenges are very different from the conventional dairies in our area. Their daily routines are much the same throughout the year, as they relate to the dairy cattle wit year-round freshening. Their need to harvest and store all feed for the dairy herd requires additional labor and capital costs to complete the tasks in a timely manner.

The most noticeable change over the past five years is the volatility of the milk prices. Less government control has meant price fluctuations caused by supply and demand and other factors. We have also noticed a significant increase in the pace of mergers and acquisitions in the agricultural sector. In most cases, this has decreased competition for farm products at the farm gate.

The next significant change we anticipate in the near future is increased regulation in the

PRESENTATION AND DISCUSSION

Wayne Craig:
Our farm is a seasonal grass-based grazing dairy operation. This is not the traditional type of dairy farming in Wisconsin and only 1 –2 % of the dairy farms in Wisconsin are non-traditional farms. We have 120 cows that are moved twice a day to fresher pastures, which is why it is called rotational grazing. In the early 1960s we couldn't control the duration and the area where the cows were grazing, but now thanks to electric prodding and new fencing technology we can control the cows quite easily with minimal labor input. This means that the cows rely heavily on the grass for food and the 12 to 14 lbs. of grain that we supply them with per day amounts to approximately 25% of the cow's total feed intake.

We've been on the farm for 5 years (since 1993). We went to rotational grazing in 1994 and put in the fencing and the water throughout 1993 and 1994. This year we enjoyed record high milk prices, something that probably won't happen again any time soon. In the winter of 1994 to 1995, we had winter dairy cattle. In order to do this, we used a windbreak that provided 80% wind blockage, which was enough to keep the animals warm and healthy and productive. We never had any problems with pneumonia because the windbreak provided so much protection. The challenge that we face is spring mud. It's very difficult to calve in the mud. We would like to build a higher quality compost for their paddock but we can't due to the moisture.

We put in a swing parlor in 1996 that can accommodate 30 cows. We don't use any automation to monitor milk production or detect for mastitis infection. A system like that is very expensive and we are not looking to achieve maximum output, but rather to have a low level of input, especially in terms of labor. Whatever we can get out of that we are happy with. Our idea is to let the cows do the majority of the work. We approach dairy farming at a systems level – the more you can incorporate the natural functioning of the system, the less work we have to do and the healthier the system in general. Some of the ways that we try to do that is to use a bedded pack system using corn stalks, sawdust, straw and poor hay. We spread this pack down in the housing sheds over the winter period while the cattle are off pasture. This material then begins to compost and we then seed the bedding with corn and let the pigs come in there and fulfill their natural instinct to root around. This action helps to aerate the composting material which helps to heat it up. So we not only have a source of nutrients for our pigs, but the cows suffer much less incidence of frozen teats, etc and they have a soft place to sleep.

Another aspect of using the natural systems approach is what we call our eggmobile. It's a portable hen-house that follows the cows through the grass paddocks about 2 days behind. This is to control for fly and worm larvae in the manure, and also to control for insects and parasites. From this side enterprise we get eggs, premium free-range chickens, and an effective means of biological control.

Thus we believe that while management intensive grazing is exactly what its name implies, it actually simplifies our day-to-day management and results in a more sustainable farm system.

QUESTION AND ANSWER SESSION

1. Are there any other farmers in the area that are using this same management practice?
   Four out of six hundred other farmers are grazing their animals, but they are not seasonal. The challenge with seasonal production is the calving.

2. Why aren't others using this management strategy?
   This strategy is very different from the traditional management practice and most people are very unwilling to try out a new management strategy. In this type of management you lose a degree of control over your animals because when you wake up they aren't there where you left them, because they are out grazing. For a lot of people this is disconcerting; people want to know where their cows are. It actually takes less physical labor to use management intensive grazing, but you do at times make mistakes and some people literally cannot afford to make mistakes. People are accustomed to sticking with what is tried and true, and bank loan requirements do not encourage them to change. A switch to this type of management system requires a mental shift; you must give up control.

3. Where can you get information on seasonal farming?
   There is a grazing conference every year in Wisconsin, the Stockwing Grass Conference, and we are part of a local grazing group.

DAIRY: SECTOR OVERVIEW AND COMPARATIVE CASE STUDIES

Eldon Christophel, Dairy Farmer
Our farm is more traditional, in that it is an old family farm run by my two brothers and I who inherited it from my father. We have 100 cows and 650 acres of grain crop. We market 250 acres of cash grain and harvest the rest for the dairy herd. Our milking parlor dates back to the 1970s, and most of our equipment is very old. Our strategy is to have everything last just about as long as we do, since my brothers and I are all in our late 60s.

The farm is located about 30 miles outside of Battle Creek near the Detroit/Chicago corridor and we realize what the future of this farm may look like given this location. Our real concern is how to manage our farm with that prospect (urban encroachment via roads and infrastructure) in mind.

Our strategy is to have the highest production level as possible while remaining as low tech as possible. We milk the cows two times a day and we produce approximately 23,000 gal. We use drylot feeding with some pasture and replacement efforts. We are able to make a fairly decent living for the three entire families that rely on the business, however that means no weekends and no vacations.

Q: How have the internal working relations been with the family?
A: The three families have gotten along fairly well over the years with a lot of determination and patience; it’s worked well. There were of course some hard times and it took us about 25 years to figure out who did what best and who should manage what aspect of the farm so that it would run smoothly. I think the level of tolerance is higher for siblings than it is for more distant family members like cousins. None of the offspring have decided to take over the farm and I think that may stem from the fact that they’ve seen through the years the struggles we’ve gone through in dealing with the family. I wanted my son to have the option of taking over the farm, but I in no way expected him to. I wanted it to be very clear to him that he could do whatever he wanted with this life and that he wasn’t tied to dairy herding if he didn’t want to. I think he thought for awhile he would do it, but he’s gone along and done other things. I was glad that he could make that decision for himself.

Paul Bantle, Community Farm of Ann Arbor
Our farm is a Community Supported Agriculture farm and so we don’t have a huge production output. We have 4 cows and two old barns that were built by German immigrants. We hand-milk our cows and the milk is given to the various members of the community. We make our own farmer cheese and yogurt, which also goes to the members. We have 5 acres in vegetables and 20 acres of hayfield. The hayfield will be rotated with some fruit trees and vegetable crops. Our on-farm strategy is to use a lot of practices that are throwbacks to the past, but also we are looking to incorporate new practices as much as possible.

Because we are a member-oriented farm with 180 families relying on the farm for vegetables, we are close to the people in the area and they bring their kids out to the farm. The kids just adore all the farm animals. One thing that I find really uplifting is that when the kids are absorbed with the animals it attracts the attention of the parents and other adults. The kids are able to remind them about what is important in life and they go away with a more tangible sense of where their food is coming from. So we feel we are getting support not only for our food products , but also for the various other aspects that accompany farming.

Tom Kriegl, Center for Dairy Profitability
In order to get rotational grazing to work effectively you must have a high level of management. So because of this people ask me all the time, which is more profitable, grazing or conventional dairying? In my opinion, there will never be a definitive answer to this question. I think the better questions are:

1. Is grazing economically viable?
2. Is grazing sustainable?
3. Where does each system work better?
4. What practices make each system more viable?

5. How can each system be managed for the benefit of the families operating them – economically and non-economically?

As an economist, my central question is: how can we maximize output with the least input or, conversely, with how little input how can we maximize output? Although a lot of people criticize any attempt to measure inputs and outputs on a farm, I think it makes sense to measure those things that we can, because they do exist and with the many aspects that are truly not measurable, it's better to have some data than none. The most important and most difficult factor to measure is management. All successful managers do three things:

- ♦ control costs,
- ♦ control investment, and
- ♦ generate income.

A great manager needs to optimize all three of these factors. So returning to the questions we have:

1. Is grazing economically viable?
   Yes, but it's not automatic. Management Intensive Rotational Grazing (MIRG) requires less investment and less debt per cow. It also reduces the operating expenditures per cow. However, studies show that MIRG generates less income per cow, but at the same time, many studies also show that grazing is profitable.
2. Is grazing sustainable?
   It can be. Comparing state-of-the-art MIRG with confinement management, most agree that:
   _ MIRG may reduce soil erosion on grazing farms
   _ MIRG requires less investment and debt per cow
   _ MIRG can reduce fossil fuel use per cow
   _ MIRG may make marginal land (hilly slopes) that is normally unsuitable for agriculture more valuable because of its ability to be grazed.

In order to determine the cost/benefit trade-offs involved in the various types of dairy farm management, the University of Wisconsin Center for Dairy Profitability conducted a study of 120 farms comparing selected MIRG to conventional dairy management practices. Four categories of management were compared: a full-time MIRG farm, a low capital grazing operation, a transitional, high capital grazing operation, and lastly a conventional dairy farm . To compare the financial performance of these farms of different sizes, net farm income from operations per cow (NFIFO/cow) was used.

It was found that in general, grazers are controlling costs and controlling investment a bit better than conventional farmers. However, conventional farmers tend to be better at generating income. The farmers that enjoy the best financial performance focus on optimizing the relationship between income generation and the control of cost and investment.

Q: Would grazing become more viable if environmental externalities were included in the price of milk?
A: Yes, the Dairy Forest Research Center has had positive responses to sustainably produced dairy products.

DAIRY WORKING GROUP: ECONOMIC INDICATORS

BRAINSTORMING SESSION

- **Rate of return on investment**
- **Government pricing relative to cost: Economic equity among industries**

If the dairy industry is not treated fairly in government pricing regulations, then industry is not sustainable.

- **Community vitality**

If the local economy is doing well, this implies that the farming community is also experiencing the benefits of a thriving economy. This may not, however, always be the case, since in some situations, the economy of the community may be thriving while the dairy industry is experiencing a slump.

- **Entry/ exit rate of farmers entering and leaving the industry.**

This indicator may also relate to the rate of land conversion; if neighboring farms have succumbed to pressure to sell their land to land developers, then the rate of exit may be much higher.

- **Land cost**
- **Risk aversion / Market stability** = price stability plus input costs

May be a difficult indicator to assess because it could be that the more sustainable farmer would be less risk averse, in that he/she would be able to take risks should difficult situations such as a market crash happen. However, the opposite could also be true, in that more risk averse farmers have established a stable system that prevents disturbances in the market from wreaking havoc on their farm. This indicator is also related to the degree that each farmer possesses an "entrepreneurial spirit." Meaning that a less risk averse farmer may be one that is more inclined to be innovative in his/her approach to income generation. Farmers with such characteristics may be more sustainable because will be less likely to anchor themselves in one single management system or product. Their willingness to take risks may make them less susceptible to devastating crises in their single mode of operation. This characteristic may also work against them if their innovative approaches fail.

- **Farmer's share of consumer dollars spent on dairy products**

If consumers spend $3.00 on a gallon of milk and the farmer receives $.01 of that expenditure, the sustainability of that farmer is in jeopardy.

- **Share of total consumer income spent on food.**

This indicator attempts to capture the relative value that consumers place on food as compared to other goods such as material goods (clothes, electronic items, appliances, etc), travel, education, etc. A high percentage allocated to food would reflect a more sustainable agricultural sector.

- **Internalization of external costs of environmental regulation.**

If the true costs of dairy production, such as the costs associated with erosion, ground water depletion, water contamination and nitrogen accumulation were included in the cost of milk, farms that use sustainable practices would be at a much greater advantage than they are currently.

- **Health costs to dairy farm families.**

Farmers may have high health bills, which would decrease the sustainability of their industry. Stress and the rigors of physical labor, however, are often not reflected in doctor’s bills because they are not short-term treatable manifestations of a sickness. For this reason, this indicator was tabled until the next discussion regarding social indicators.

- **Veterinary costs**

If a farmer’s vet bills are high, it may be an indication that the management strategy he/she is employing is not very sustainable.

- **Speed of technological adoption.**

If technology is adopted quickly, it may mean that a farmer is innovative and willing to diversify (such as the adoption of MIRG management), thus more sustainable. But a high rate of technological adoption may also be a sign of the desire for a technological fix such as BGH. Such decisions are often economically sustainable at the outset by increasing milk yields, but unsustainable in the long term because it leads to high veterinary bills due to increased mastitis and premature death.

- **Byproduct utilization / disposal costs**

Recently the cost of disposal of waste materials, such as manure, used bedding material, and crop residues, has increased dramatically and will continue to do so as the number of waste disposal sites diminishes and the tolerance of effluent falls. If farmers can transform these costs into income by feeding pigs with used bedding, growing vegetables from manure, feeding chickens with discarded crop residues, etc., then the economic sustainability of their farm is not only stabilized, but increased.

- **Percent of farm inputs that come from outside the community**

The greater the amount of inputs (pesticides, fertilizers, feed, etc) that come from outside the community, the less sustainable the farm will be, not only due to the direct cost of the input, but also due to the dependence it engenders on external fluctuating market prices.

- **Livelihood lists**

The lower the number of listed occupational farmers there are, the less sustainable the industry.

- **Dependence on government subsidies**

Subsidies could be the in the form of soil conservation payments, welfare checks, research grants, price supports, etc. In general, the larger the portion of the farmer's income that is in the form of government subsidies, the less sustainable the farm.

- **Capital cost of entry into farming**

It is difficult to determine whether a high or low cost of entry is more sustainable. If the cost of entry is high, it may mean that the land is amenable to farming and will provide a good return on the investment. It may also mean, however, that the land is in prime development territory and is actually not at all suitable for farming. For this reason, the group assumed that the intent of this indicator was included in the indicator "Return on investment."

- **Sound management**

Although extremely vague and unquantifiable, this indicator was proposed simply to remind us that there is no better indicator of economic sustainability than insightful management. A manager that can foresee that milk consumption is declining and can respond to that observation by shifting his farm to the production of cheese or chicken will be much more economically sustainable than the farmer who concentrates only on achieving specified milk production levels.

- **Diversity of structure and scale of farms on a macro scale.**

Dairy farming will be a more sustainable industry for the individual farmer if large producers exist alongside small producers. Parallel to this coexistence of large and small-scale producers, milk products should be marketed equitably so producers, regardless of their size, have access to all consumers.

PROPOSED ECONOMIC INDICATORS

1. Rate of return on investment
2. Output price relative to cost
3. Dollar turnover in community
4. Entry / exit ratio of individuals into the farming profession
5. Internal cost of environmental regulation
6. Diversity of structure and scale of industry
7. Health costs to farm family
8. Veterinary costs
9. Flexibility of the production system
10. Byproduct use on farm
11. Share of inputs purchased from outside the community
12. Percent of farm income derived from government subsidies

DAIRY WORKING GROUP: SOCIAL INDICATORS

BRAINSTORMING SESSION AND PROPOSED INDICATORS

Note: All of these issues were considered to be relevant, and all were proposed as indicators.

- **Consumer willingness to pay for sustainable food**

This was regarded as an indicator of utmost importance since ultimately, if consumers find no value in sustainably produced food, the industry cannot survive and all other indicators will be rendered useless.

- **Health cost / value of dairy product consumption**
- **Animal welfare**

More than simply the veterinary costs associated with animal management on the farm, this indicator should reflect some sense of the well-being of the resident livestock. This may include pasture acreage, level of exposure to extreme weather conditions, amount of bedding used, or access to adequate and nutritious feed. The assumption is that well-kept animals reflect a higher level of sustainability for society as a whole.

- **Quality of life for the farmer family (leisure time, lack of stress, suicide rate)**

Farming families are often living on the edge of subsistence depending on the fluctuations of the market and of the weather. The unpredictability of both of these factors has increased of late and makes farming an undesirable profession. In order to preserve the great farming culture upon which our nation was founded, it is necessary that farmers have a high quality of life. As an indicator, if the number of hours spent with ones family or in other leisure activities is severely small in comparison to the amount of time spent in matters of the farm, the social sustainability of farming is in jeopardy. Quality of life can also be measured in terms of the incidence of stress-related conditions in the farming community. Other ways to measure quality of life include suicide rates of farmers as well as the percentage of chronic physical problems related to hard manual labor.

- **Community health**

Social sustainability is reflected in a unified and cohesive community in which the connection to agriculture and to the land itself has not been lost. A manifestation of this type of interdependence of farm and community may be reflected in the presence of farmers markets or direct sales of local produce to community members.

- **Presence of farm organizations and civic organizations dedicated to farming and other activities.**

In many communities there are farm organizations and there are separate civic organizations. A more sustainable community may be created if there was an overlap in activities of these types of organizations so that the community would be more socially integrated.

- **Cultural expression of farm life**

This indicator can be measured by the number of harvest festivals, county fairs, or other such agriculturally related celebrations held in the community. The more a community recognizes and incorporates farming into local life and activity, the more cognizant and appreciative the community will be of the origins of their food. This connection may also spark greater interest in the profession of farming in local youth.

- **Presence of infrastructure relating to farming**

This indicator looks at the number of equipment retailers, seed merchandisers, and other agriculturally related stores to assess the ability to acquire the necessities for agriculture.

- **Ratio of locally owned businesses to externally owned business**

As chain corporations move in, communities lose their unique sense of place, and pride in local ownership is replaced by minimum wage service jobs. This intervention of outside ownership not only alienates the interior community from itself, but also loses fundamental connections with the outlying agricultural community.

- **Conversion rate of agricultural land to urban use.**

As the population continues to grow, agricultural land is under increased pressure from developers who want to transform the land into new urban housing complexes. Farmers, who are often struggling financially, are tempted by the prices offered by developers.

- **Number of educational programs that incorporate the local and agricultural community.**

As farms become rare sites in our daily lives, children have lost a fundamental sense of their attachment to the land through the food they eat. Field trips to local farms or agriculturally related curriculum would remind children of this connection even in absence of its daily physical presence. The use of agriculture in education may encourage more children to think of farming as a profession.

- **Landscape aesthetics**

Open space is a desirable attribute of many communities and the concept is often equated with the presence of farmland. As communities demand more open space, farming will be a more desirable profession to cultivate in the area and the industry will be more socially sustainable.

- **Community perception of farming**

Related to the indicator above, communities may perceive the presence of farming as a cultural asset to their community. However, they also may consider the smells, dust, and animals to be a nuisance to the urban population and may pressure for re-zoning of agricultural lands. It is important that the community be supportive of agriculture in order for it to be sustainable. Which perspective a community takes of the agricultural profession may relate to the degree to the exposure of children to agriculture in education - the less individuals are exposed to farming the less accepting they may be of its presence.

- **Population persistence**

This indicator attempts to measure the stability of farming communities. Migration to urban or suburban centers is a trend that is generally more common than migration from the urban areas to farming communities. Looking at the percent of the population that has been there longer than ten years may be a way to gauge the sustainability of a farming community.

- **Social equity.**

Level of social equity may be measured by the percent of racially, ethnically, or gender oriented crimes in the area. Another measure may be the number of social justice related organizations in the community. Level of social equity will also be reflected in the condition of labor housing. A more socially equitable society will be more sustainable.

- **Ratio of owner -operated farms compared to tenant agriculture.**

Owner operated farms are more likely to have strong ties to the community because they will depend on individuals of the community for their income. Although both tenant farmers and owner-operated farmers will interact with the community for their business and educational needs, tenant farmer relationships with the local population will be more ephemeral. Tenant farmers will not necessarily be concerned with whether or not the local community buys their product because they are employed by someone outside of the area.

- **Rate of return of local children**

This indicator is related to the population persistence of the community. If children who go away to college return to the community to live, the social persistence of the town will be more sustainable.

- **Entrepreneurial spirit of community.**

This indicator may be measured in the number of bank loans granted to non-conventional farmers or small entrepreneurial business interests. It is presumed that the willingness of local institutions to support progressive and non-conventional methods of income generation will be more sustainable in the long term.

- **Average age of farmers**

Average age of farmers across the board has increased. The only way for the industry to be sustainable is to lower the average age of farmers.

DAIRY WORKING GROUP: ENVIRONMENTAL INDICATORS

BRAINSTORMING SESSION

The group focused on six main aspects of environmental quality: 1) soil quality, 2) air quality, 3) water quality, 4) pollutants, 5) energy use, and 6) biodiversity / wildlife

♦ **Tons of finished compost per acre farmed**

Addresses both soil and water quality.

♦ **Number of acres of cover crop per unit of production**

Cover crops prevent soil erosion, build organic matter, and may reduce water use. It also helps with nutrient retention and reduces run-off, thereby improving water quality.

♦ **Tons of soil erosion per unit of production**

♦ **Balance between number of animals on the land and the ability of the land to use nutrients**

♦ **Amount of inputs used**

This is a resource and energy-use problem, since resources from other areas are being depleted and being added to farm. On a typical dairy farm, a lot of feed is grown on-farm, but there are still outside products that are introduced to the farm. One way to look at the indicator is an analysis of nutrient build-up or depletion so that if you have a high level of chemical inputs relative to milk or meat output, the farm is probably not sustainable.

♦ **Percent of agricultural land in perennial ecosystem state**

Originally this indicator read: 'Reforestation per acre of farmland' and was changed after the following discussion: The reason why we are losing soil at such a rapid rate is because larger and larger acreage are being put into production without windbreaks or hedgerows or other such soil retention management strategies. This not only affects soil persistence, but also water quality, air quality and rainfall patterns. In Wisconsin, however, forest is not the native vegetation, rather it is prairie so a better indicator would be the amount of acreage that was converted back to native or perennial ecosystems. Also, for areas where woods are the native vegetation, a replanting of woodlots also serves to shade cows in the summer. What we are really interested in preserving is ecosystem health, which essentially means preserving the natural functions of ecosystems, i.e., preserving the ecosystem services that they provide. Therefore, perhaps a better description of the indicator is the percent of land in perennials.

♦ **Fraction of renewable energy use to total energy use**

♦ **Change in abundance and diversity in wildlife species: threatened / endangered / rare vs. invasive / non natives**

Originally this indicator read: Number of species in the county that are present on the farm

This wording was criticized for its lack of specificity and for its potential unfair treatment of geographically separate farms. Farms in certain locations are simply more diverse than are others due to their geographical location. Another problem with this indicator is that it may reflect a large number of exotic or invasive species, which would be a non-sustainable system. Farmers should encourage the presence of rare, endangered or threatened species and discourage non-native species.

♦ **Number of open-pollinating plants in relation to the number of hybrid or bioengineered varieties**

Bees are crucial for their pollination services and their populations are being severely reduced due to chemical use and mite infestations. Bee diversity should thus be encouraged by planting plants that are attractive to them. Also, hybrid and bioengineered varieties have very limited genetic diversity, and as more fields are planted solely with these varieties the genetic basis of our seeds is reduced and entire commodities become susceptible to diseases to which they have no resistance.

♦ **Animal well-being: life expectancy and incidence of mastitis in dairy herd**

The health of the livestock must be taken into account as its own indicator of sustainability, because as in the case of rBGH and PBB it may indicate an environmental problem.

♦ **Earthworms per acre**

This indicator was widely accepted with no discussion.

♦ **Livestock / crop production diversity**

There are multiple levels of system interaction and multiple levels in the food chain, which contribute to environmental sustainability of a farm. We captured this concept as an economic indicator, as the degree of innovation that the farmer applies on his/her farm. For instance, there are Wisconsin farmers who argue that the integration of dairy farming and crop production is better than the more conventional drylot farming. The more natural systems levels you can incorporate in a cohesive way on the farm, the more sustainable it will be.

♦ **Adaptive monitoring in management**

The worst part of conventional farming is its cookbook prescription. Conventional farming is not good at evaluating the practice in which it is engaged. The problem is that the mindset of conventional farming is focused exclusively on generating profit. By consistently monitoring and making conscious decisions about the management of a farm, unsustainable practices will automatically be abandoned.

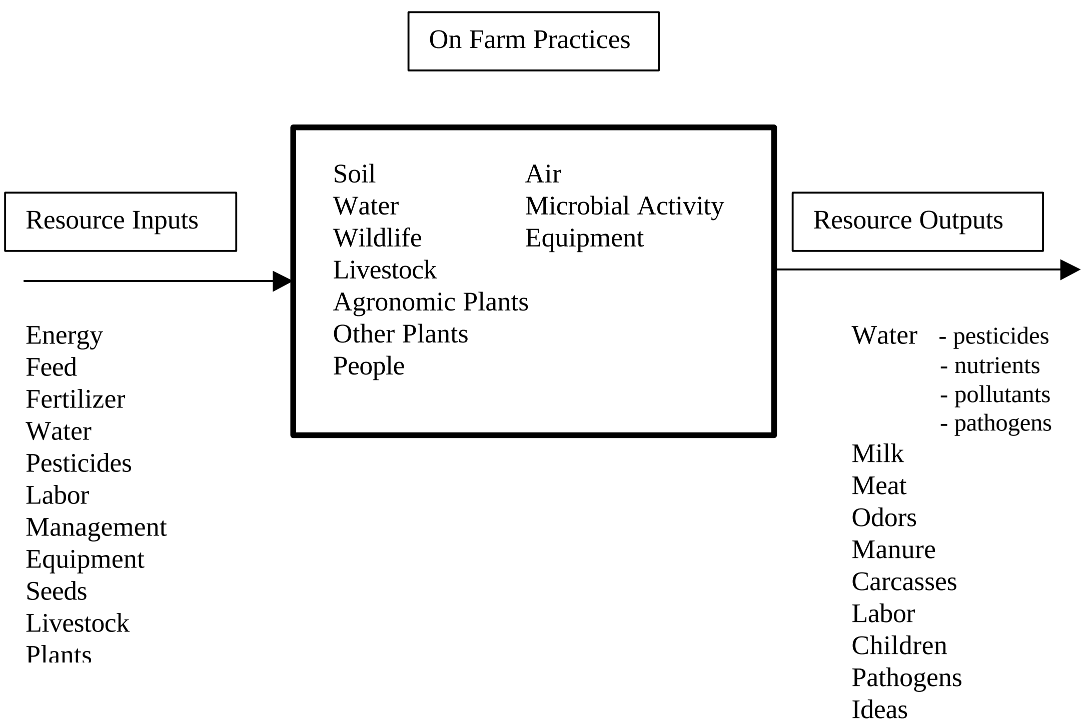
♦ **Percentage of farmers who are involved in environmental partnerships with wildlife organizations**

This indicator originally read: “Percent of farmers that belong to environmental organizations.” Concern was voiced about equating membership to an environmental organization with environmentally-friendly management practices. While anyone can belong to the Sierra Club, this does not necessarily imply that he/she will manage lands in a sustainable manner. Active involvement in partnerships with groups concerned with wildlife protection, however, translates to positive relationships with the wildlife present on the land.

♦ **Chemical and particulate accumulation in groundwater.**

In terms of water quality, there has to be a monitoring of both on-farm practices and their outcome. Some suggestions for specific measurement were: nitrate measures, atrazine parts per million, and other contaminants in parts per unit, as appropriate.

PROPOSED ENVIRONMENTAL INDICATORS



DAIRY: REVISED INDICATORS

Each person in the group choose 3 indicators that he/she felt are the most important from any of the three sections:

Economic Indicators of Sustainability

- Return on investment
- Exit / entry ratio
- Flexibility of the production system
- By-product utilization

Social Indicators of Sustainability

- Consumer's willingness to pay for sustainable products
- Social equity / community inclusion of agriculture
- Quality of life for farming families
- Share of disposable income of consumers spent on food

Environmental Indicators of Sustainability

- Use of renewable resources relative to total resource use
- Tons of soil erosion per unit of production
- Earthworm and microbial activity per acre
- Share of open-pollinated plants relative to hybrid and genetically modified varieties
- Balance between number of animals on the land and ability of land to use nutrients

4.2 FRUIT WORKING GROUP

Facilitator: Dennis Keeney
Case Study Farmer: Mitchell Lynd
Participants: George Bird, John Fisk, Craig Harris, Michelle Miller, Nancy Osborn, Gita Passelt, Murari Suvedi, Thomas Wilson
Rapporteur: Nabiha Megateli

TIMELINE AND CURRENT TRENDS

Note: The fruit group combined the discussion of historical events and current trends. Group discussion centered on the Midwest and apples, but also included other fruit trees and strawberries. Both international and regional perspectives were considered. Each member voted on the 5 most significant trends that he/she considered important for the fruit sector. A similar approach was taken with indicators.

Less Farmers, Lower Prices
There was a tremendous decrease in farmers in the United States after WWI and WWII. From 5.7 million farmers in 1954, the US is now down to 1.9 million farmers and 60% of them are part time. 300,000 farmers produce 85% of the produce eaten in this country. In real terms, food prices have also declined.

Family, Farms and Labor
The family farm has lost ground in the past 50 years. This is partially the result of the pull of cities and the economic crises that have hit small and medium farmers. This has caused significant labor changes. Since the 1890s, during harvest time, a huge number of people have been hired to work from the local area. Unions were stronger then and unemployment was not so high. Getting labor from family members and the local area has become increasingly difficult. Fruit farmers now are mostly dependent on migrant labor. This migrant fruit sector labor in the mid-west is mostly of Hispanic immigrants, or short-term laborers from Mexico and Central America. Most apple growers now have migrant housing to accommodate this new labor regime.

Shift to Chemical Pesticide Dependency
There was an expansion in the use of organic synthetic pesticides and synthetics right after WWII as a result of army chemicals and warfare technology intruding into civil, post-war industrial and agricultural life. The group noted that before 1945, most people used arsenic, lead, sulfur, copper and mercury. Then there were fears of all of these chemicals being poisonous and the post-WWII shift to organic pesticides took over, even of DDT (once used by the army for lice control). Several group members felt that the chemical industry was a driving agent for this shift.

After WWII, the chemical industry promoted “better living through chemistry.” In 1945, there was a move from sulfur to DDT and Caplan. After the war the ammonia industry had a huge role to play and also exploded on to the scene with fertilizers. The use of DDT also eliminated of the natural predators of pests like mites -–thereby leading to a cycle of increased pesticide use, loss of good predators, and the ironic increase in pests. In the 1930s it became recognized that pesticide resistance would be an issue.

Today, pesticide use is the key social and environmental issue in apple and fruit growing.
The effects of many pesticides are sometimes unclear and unknown. There has been increased federal and state regulation or pesticide use. There is still a great distance between sustainable and organic agriculture. For many, being totally organic is not practical or feasible for the fruit sector as a whole. Others disagree, stating that the industrial model of food production is unsustainable and killing life. A total rehaul of fruit growing would be necessary to diversify and introduce organic production systems.

Sub-urbanization, Deer and Food Safety Issues
The rise of suburbs and urban flight has impacted the fruit sector by taking up good farmland. People came back from fighting in WWII and could not find housing. After World War II there was a great belief in the modernizing forces of urbanization, sub-urbanization and pesticide use.

Today, deer have become an emerging problem for apple growers as they refurbish their groves with new seedlings. There is a threat of E. Coli bacteria in apple cider. Small growers that can not afford pasteurization to remove E. Coli from apple cider have been pushed out of the apple cider market by big industry. Both the increase in deer and increase in incidences of E. Coli bacteria are connected with sub-urbanization, reconfiguration of the countryside.

Central Markets to Super Markets
With the advent of the supermarket (replacing central markets), there has been a tremendous shift in the way produce gets sold. Independent entry points into large central markets are less common and easy to negotiate. The wholesale market has changed and direct and terminal marketing has diminished tremendously. Access to processing of fruits by farmers has also decreased, as wholesalers and intermediary processors have taken over the market.

Transportation
There has been an increased use of refrigeration and long-distance selling with more elaborate transportation infrastructure. In recent years, there has been a distinct shift towards more frozen fruit slices and an explosion of consumer-ready fruit products.

International Markets
An important export market has increased along with an import market for apples from places like South Africa and Argentina. The dependence on exporting to the Far East has particularly affected apple growers. The recent Asian financial crisis has meant that West coast red delicious growers have lost a huge international market, and thus had to flood the US market – lowering prices and creating further financial hardship for all apple growers in the US.

Rise in Fruit Monoculture
The majority of apples on the market today are Red Delicious from Washington and Oregon. There are hardly any heirloom, dwarfed and small apple varieties any more. There is a dominance of only 5 varieties. Despite the decrease in tree fruit acreage, there has been a rise in production, but with less variation. Hence in a state like Michigan, there has been a 90% decrease in farmers. Regarding other tree fruit, pears and apricots are hardly grown and peaches dominate the acreage.

Agricultural Intensification: From Seedling Rootstocks to Dwarf Trees
There has been a big shift from seedling root-stock of apples at 27 trees per acre to dwarfing fruit trees at 600 trees per acre. Dwarf trees make harvesting easier without 20 foot ladders and hence lower the cost of harvesting and technology needed. However, this move towards intensification likely decreased the varieties of apples grown in the US.

Change in Soil Nutrient Management
There has been a huge change in the nutrient management of fruit farms, with the loss of organic manure sources due to dairy farms going out of business. This has caused increased use of fertilizers and tractors for soil preparation. As apple diversity has declined, so has soil biodiversity due to the use of pesticides and herbicides. The move towards ground cover and no tillage is less difficult for fruit sector farmers who do not till their land and contribute less to soil erosion. Fruit farmer now tend to weed not by sickles but by herbicides, such as Round Up.

Farm Economic Transformations
One of the greatest challenges to the fruit sector, particularly apple growers, in the 1990s is the replacement of local banks by bank conglomerates. Given a loan from a large bank with high interest, when a farmer loses a yearly crop, one may go bankrupt or not recover for 6-8 years. Insurance to protect farmers from this is necessary but only adds costs and downward pressure on possible profit margins. Now, most fruit farmers might spend half of their potential profit on insurance to prevent losing one year’s crop and having to pay debtors.

Part-Time and Hobby Farmers

In Ohio, the number of full-time apple growers has decreased tremendously in the past 5-6 years, leading to a situation where many farmers supplement their income by doing part-time work in town even if they'd prefer to be full time farmers. There has also been an increase of city-folk coming into the countryside to start a new life or to supplement their income and lifestyle by fruit growing.

FRUIT CASE STUDY: MITCHELL LYND, PATASKALA, OHIO

FARM PROFILE

General

Size:

total acres owned ------------ 640	apples----------------------300
crop acres---------------------- 410	other tree fruit--------------20
non crop land-------------------230	pumpkins, gourds, corn-90

Address: 9090 Morse Rd., Pataskala, Ohio

Description of surrounding area: 12 miles to the west is I -270, the interstate highway that encircles Columbus, Ohio. About 1,000,000 people live inside the circle. Twelve miles to our east is Newark, our county seat, with about 60,000 people. Water and sewer lines have recently been installed along many of the rural roads in our adjoining townships. The population of Pataskala, our nearest village is changing rapidly:

1970 ---------1831
1980---------2958
1990---------3365
2000 -------14000 est.
2010 -------25000 est.

Social

Employment on our farm: (Year ending Feb. 98)

6 owner-managers ---$195,000
87 hourly seasonal workers (8.00/hr av.) -------------------242,744
26 piece rate apple pickers (9.00/hr av.+ housing)---------69,447
total wages and salaries---507,191
Payroll taxes--- 79,524
Health insurance--- 29,963
Workers compensation--------------------------------------- 7,388
Disability insurance--- 3,955
total labor related expense-------------------------------------- 120,830

Employment in the community:

Unemployment is under 3% for both Columbus and Newark. Columbus is headquarters for many insurance companies and banks. Government and education (5 universities) are large employers. Many companies have distribution centers in Columbus and Newark. Almost nobody makes anything, everyone shuffles paper and products. Every fast food place has a sign in the window: $8.50/hr. to start + ins.+ 401k + hiring bonus if you stay 12 weeks.

Problems:

Rising land values: Present owners think its great but continuing to farm becomes impossible because nobody can make the payments out of the dirt. Young farmers hate to see it happen while old farmers welcome it.

Urban encroachment: City people have a low tolerance for noise, spray drift, and slow moving vehicles on the roads. Crime, vandalism, and taxes rise.

Labor availability: Our fundamental problem is that we need a huge number of people for a temporary period to do jobs that carry an image of low esteem. Presently, further aggravated by a locally tight labor market

Regulations: We have to post 23 posters advising our employees about 23 sets of work rules from various government agencies. Many other rules require no posting but reporting and compliance. The rate at which new rules come on stream has overwhelmed us. We have no idea what the rules are anymore and are probably out of compliance with most of them most of the time. Some are absurd. e.g. food safety rules say its o.k. to eat unwashed apples 24 hours after spraying with captan but labor rules say the workers can't enter the orchard for three days after using it. We have been cited for dirty refrigerators within 30 days after they were purchased new and placed in new migrant housing for which we charge nothing for rent or utilities. I can't hire my mother or kids without filing and maintaining copies of their proof of citizenship. If I or any of my family were to move out of any of our homes tomorrow none could pass as acceptable for migrant worker housing on not one, but numerous grounds. The banning of Alar by the EPA was not science based but purely political, costing millions of dollars in lost yields and increased wastage from drops. The struggle to comply with government has become very discouraging.

Foreign Competition: For years our bottom line net profit was always about =to the salvage value of our packing house rejects which are used for apple juice manufacturing. Apple juice concentrate is pouring into our country in unprecedented volumes from China at prices 75% below the 10 year average. It was already below the cost of production. Nobody here has any idea what Chinese apples are sprayed with or the rules under which they are produced.

Economic:
Yields: Apple yields are zero for 2 or 3 years then they increase each year until they fill their final production space, normally in the 8th to 10th year at 400 to 2000 bushels/acre depending on planting density, cultivar, light availability during flower bud formation, length of growing season, rainfall and cultural practices including pruning, fertilizing, protection from mice, rabbits, deer, pathogenic bacteria and fungi, and insects. Our yields slowly but steadily increased through 1987 when the EPA banned Alar. For us, yields have declined with its loss in spite of increased planting densities. Further yield reductions are occurring on our farm as we bulldoze out high yielding romes and re-plant with lower yielding but consumer preferred Fuji and Gala. Apple yields begin slowly declining after 25 or 30 years but the trees are almost always removed because of shifts in consumer preferences rather than declining yields.

Financial: Since 1987 I've taken three pay cuts and have generated a negative return on capital invested in the wholesale apple business. For our most recent fiscal year we had sales of $1.3 million and a net loss of $197,000 primarily because of a bad hail storm. In recent years if all goes well we break even on an operation whose net worth, at market value, is about $2,000,000 (mostly land). By removing thousands of trees, downsizing production, stepping up direct retail marketing efforts, and escaping this year's hail storms we are looking at about a $200,000 profit on sales of about $1.6 million.

Externally funded programs: There are no direct payments to apple growers from the government for anything except occasional modest disaster payments for part of the tree losses from wide spread freak storms.

Many years ago we obtained a very low cost "disaster" loan from the Farmer's Home Administration which kept us in business. We fully repaid it and wouldn't have been here with out it. That program has been discontinued in favor of subsidized crop insurance.

The industry is subsidized by the federal government sharing the cost of crop insurance written by private insurance companies thus reducing the cost to apple growers by about 40%. The cost is still so high most growers don't buy it. Apples have always been and will always be a high risk crop.

Research and extension effort with regard to apples in the state of Ohio, while it has not been terminated completely, is being slowly starved into extinction because the value of the crop is so small in relation to the cost of keeping the growers up to speed with the latest information. It is widely believed that a more regional effort whereby apple growers from states with relatively minor production will obtain their information from places with concentrated apple production, like Michigan State or Cornellm will evolve but there is political resistance from multiple sources.

Who buys our apples?
About 90% go to large retail chain store grocers like Kroger. We used to ship apples into 20 states and some foreign countries, but today most go to Columbus distribution centers for Kroger and Big Bear, a local chain about to declare bankruptcy. This part of our business is a loser.

U-pick accounts for about 10% of our apples, but 20% of our apple sales in dollars and is the profitable part of our apple business.

Our U-pick customers also buy 80 acres of pumpkins, gourds, and Indian corn. Fun mazes, hay rides, cookouts and “entertainment farming” seem to be the growing part of our place.

Environmental
Fertilizer: Compared to grain farmers, fruit growers use little fertilizer but when and where needed is extremely important. During the pre-production years we use fertilizer about like a corn farmer but after the trees begin to produce, quality fruit comes from trees grown on the edge of starvation. Apple crops do remove a lot of Potassium from the ground and we replace it with annual applications of Muriate of potash, an 0-0-60 product at the rate of 150 to 300 lbs./a. depending on leaf analysis reports. The nutrient we buy the most tons of is Calcium. We buy pelletized lime and/or pelletized gypsum depending on soil test results. Trace or minor use elements like boron, zinc, manganese, and magnesium are used in very small quantities and applied in foliar applications with pesticides.

Pesticides: Apple crops require protection from a wide range of insects and diseases. Unfortunately, the many different pests come at many different times thus frequent spraying is critical for satisfactory control especially since the industry has wisely converted to pesticides with short life expectancies.

Broad spectrum insecticides are being replaced as rapidly as possible with insect growth regulators, products having a more specific target. The organophosphates are still essential to apple growers for control of most insects because, one in particular (phosmet or imidan) is very effective against targeted insects while leaving thriving populations of predacious mites and insects to naturally control European red mite, a spider that can be devastating to apple trees. Nothing currently available will control plum curculio, a weevil that attacks apples, plums, and peaches except the O-Ps.

After labor and packaging materials, pesticides are our largest expense at about $1.00/bu. or $300/acre.

Best hope for long term reduction of pesticide use will be breeding new cultivars with disease resistance to reduce fungicide and anti-biotic use. Breeding for resistance to foliage feeding insects is a possibility but in most cases resistance among the fruit feeders is a failure simply because if the bugs won’t eat the fruit, neither will the people.

Soil Erosion: Orchards aren’t tilled except for the 2 or 3 years following removal of old trees every 25 to 35 years. Herbicide strips under trees and with under tree mulch on slopes keeps the soil in place. Apple growers, for fruit quality reasons, prefer soils with low fertility, especially with regard to nitrogen and organic matter content.

Water & Energy: The entire operation uses only about a million gallons of water a year for washing apples in the packing house, spraying, cleaning up the equipment and the cider mill, waste disposal and drinking water. Electricity for the refrigerated apple storage buildings and packing line runs about $4,000/month.

PRESENTATION AND DISCUSSION:
I am a 6th generation apple grower. My family has done nothing but grow apples, a few small fruits and peaches since the Civil War, when my ancestors were subsistence vegetable farmers in Mississippi. One of the big changes today is marketing vs. production. Marketing impacts us more. My grandfather direct marketed in Ohio terminal markets with merchants and independent grocers. With time, certain grocers became dominant, such as Kroger Company. As a result of the way Kroger works in the Columbus, Ohio metropolitan area, every thing has changed. Kroger wants large volumes of uniform product. To service accounts with grocers like Kroger, some

farms grew and expanded so that by the 1960s only 30-40 apple farms were left in the state – ours being one of them. Together, realizing the pressures of this new system of dominant grocers, we realized in the early 60s that we needed a different strategy than each of us 30 farmers calling Kroger with different prices. So we formed a cooperative intended not for cooperating with packing-houses, facilities or packing, but only on information issues. We cooperatively bought a desk and phone, and hired a guy to speak for all or us to coordinate sales and prices with Kroger. So was born the Fruit Growers Marketing Association.

The Fruit Growers Marketing Association ended up being good for us and for Kroger, that only wanted large quantities of uniform product with one phone call. We initially custom designed each of our boxes so as not to waste space but then moved to one standardized cooperative box.

The apple industry prospered. Our farm and the coop did well throughout the 1960s-80s until the 1987 crisis. During 1987, we were set back by "the great allar hoax". Apple sales stopped for 2 months. Parents at the time even stopped school buses and took apples out of children's lunch boxes in fear of them getting poisoned. We did manage to recover from this period. During the 60s and 70s, we lived a good life, making lots of money, expanding our farms and planting even more apple trees, mostly Macintosh. But of course we never got to be as big as the 120 million US$ market of Washington State, which grows half of the US apples in 3 little valleys. The other big players are New York and Michigan. Unfortunately, at the rate all of us are planting trees, there is likely to be a disaster coming up in a drop in prices with too much production. We averted this problem before with the export market. Washington and New York began developing export markets in the 1980s to the Far East and Pacific Rim, Columbia, England, Saudi Arabia, Norway, Mexico.

Problems with Losing Export Markets

This gigantic export in apples unfortunately has led to a crisis in apple prices with the great apple collapse of 1989 and more recently this year with the collapse with Asian economies. Exporting has dropped precipitously and "those guys in Washington State" now have bulging storage spaces full of perishable apples with no export destination. They have to find place for them and the prices are falling fast. It is like being an elephant in waiting, as they have "depressed the daylights" out of apple markets for the rest of us in other states. Washington state apple growers have been shipping their Red Delicious "apples of gorgeous mediocrity" east on consignment. Truckload after truckload head for Detroit and Cincinnati without any particular orders. Doing as best as they can with wholesale, apples are now being sold for far below their cost of production. Our cooperative is expected to lose $ 10 million this year. For some this has meant serious close-outs and total loss of export markets in the Pacific Rim. Mexico may well have become the main alternative export destination, but the 10% tariff there has shut many doors despite NAFTA. An "iron curtain" has descended and apples can not get into Mexico. Essentially the apple sector has lost 2 major foreign markets in Mexico and the Pacific Rim, leading to the huge surplus of apples in US. We are left struggling to sell apples that have practically no value.

Labor Problems and Concerns

Labor has also dried up. Unemployment is not too bad, so it is tough to get people interested in apple harvesting and seasonal labor; much labor has moved to California and Washington. Apple growers have huge labor needs for 8-10 weeks in the apple sector, with little employment for the rest of the year. Historically, this problem was resolved by people seeking jobs in different seasons. People, sometimes union workers on strike, would pick our apples and then pick tomatoes in northwest Ohio. Complementary farming activities and industrial labor are gone now. We never hired migrant labor before. We first started hiring migrants at the close of the Vietnam War. They were SE Asians. They eventually assimilated and lost interest after about 8 years in working for us, seeking higher paying jobs. We then bought mobile homes in the 1980s and offered health insurance to attract other Asian and Latin American migrant workers, such as Colombians.

We thought that if we had housing for them, we would have no problem recruiting. We were wrong. Moreover, studies show that 2/3 of these migrant laborers are illegally working in the US. We discovered in 1998 that many have what look like good social security cards, but really they are buying a package of fake documents. If the government were to enforce the immigration law as it is written now, perishable commodities such as apples would be in trouble. Most of the migrant labor is here is illegal. If they are gone, I'd hate to think of the millions of perishable crops that will go unharvested. And even with illegal labor, it is not enough during harvest time. We are still understaffed. Apples can only get picket at the right time - when they have the right pressure and color. If they are not impeccable and you do not pick them "when it is time" – the optimum maturity window being only 6 days or maximum 2 weeks– you will be in trouble. We do not have time in these moments to be sure that everyone working on our farm has legal authorization to work when it is time to pick apples from sunrise to sunset. That is just the way it is.

The Future of Apple Farming: Direct Marketing Solutions?

At times, I want to get out of the business as fast as possible. Should I, as a 6th generation farmer from a family that started out vegetable growing in Mississippi, stop and make a 7th generation not possible? Sometimes I think that if something does not change, there will not be a 7th generation apple grower in my family. Now, 90% of apples that I grow are with migrant work; I use ammonia refrigeration that costs us $400 /month in bills – a huge amount like my health insurance and fire insurance policies. I have an elaborate fork-lift, packing line, cardboard box, bagging set running since the 1980s when things were better. But now most of my money is coming not from this system of monoculture, Macintosh "apples of gorgeous mediocrity". The amount I now make with Kroger is close to zero. I am now moving into the direct UPICK market, in which I can make more money off of 10% of my farm since the public likes it. We are even selling 1/3 of our land, bull-dowsing 126 acres of old apple groves and starting a more interesting mix of heirloom apple varieties grown organically for our UPICK market. I also direct-market pumpkins and have set up hay rides and a space for family farm entertainment to go along with getting city people to learn about how apples grow, what farming life can be like. UPICK direct marketing of a more diverse set of apples will possibly take the place of apples of mediocrity and uniformity. Whereas in the grain sector, the government sends checks to keep grain farmers afloat, their oversupply is still gruesome. I think the market will eventually correct the situation and supply will get back into line with demand. But this is not going to be easy.

Recently, my dad and cousin died. My brother said that if I want to farm, I should pay each family member their part and pay my kids to work for me. I was asked to even pay the price developers pay, which has skyrocketed with urban sprawl. In paying up all of my family and consolidating the farm, I have gotten myself into a $1.2 million debt with interest that working for Kroger will never help me pay up. Everybody that farms loves it – absolutely loves it. It is becoming a disappointment to now be struggling on the phone, computer, with tons of paperwork and volumes of state and federal regulations and laws that are not easy to understand. All my time is spent not really farming when I love farming. Instead I am scheduling workers, reading mail and putting out daily fires that come up. If I did not have UPICK, which is in part successful because of my location near the Columbus metro area, I would be in trouble. I have the luxury of being close to wealthy people willing to come to me and buy a certain farming experience and pay added value for picking a variety of apples.

The Global Economy, Aesthetics and the Industrial Model of Agriculture

I would like to stress three new things in the apple sector. First, with the global economy creating havoc in local markets and forcing prices down unexpectedly and wildly, we are left very vulnerable. Many farmers are not getting to farm any more. China has now planted millions of apple trees this year for apple juice concentrate plants in the US. Their apple concentrate has flooded US markets so that now you can only sell juice if you have connections at $2/ 100 lb., making a real salvage line for juice apples. The government has no protection for this. The apple industry – grocers, plants and processors – are favoring certain growers unfairly and bringing prices way too low?

The industrial model had become the major model for fruit and agriculture in general. There is no difference between Oldsmobiles and Red Delicious apples. The main concept is large volumes of uniform product 52 weeks a year or stored/frozen. We can keep apples in airtight refrigeration for up to 2-3 years now. Convenience for the consumer is now the top priority, along with ideals about cosmetics of expecting pretty apples 12 months a year. We have to be able to deliver to buyers at any time. No defects are acceptable and we reject up to 25% of our apples just for their looks, color and pressure being beyond standards. Corporations buy Chinese apple concentrate and leave us Ohio Apple Growers in the cold. Meanwhile, the American consumer is uninformed about the entire farming system and what it is they are buying, from whom and how it was produced.

Sustainability and UPICK

It is hard for us to think about sustainability in its widest sense, since we are just trying to make it as apple farmers now. We are worried about our debts and running out of money. We are in survival mode and a conjuncture of perhaps leaving farming. The issue is how to market our produce and sell something different. We'd like to move into organic apples and UPICK direct marketing. This all depends on consumers. We are not anti-sustainable for the rest of our farming lands, but it is hard to move from the industrial Macintosh growing to something sustainable and viable for the future.

FRUIT WORKING GROUP: ECONOMIC INDICATORS

BRAINSTORMING SESSION

The Fruit Working Group felt that economic indicators are intimately linked with social indicators, so discussion of both could take place rather than one at a time. The group discussed whether the bottom line is really just financial or whether it includes intergenerational equity and the quality of life. The fruit group divided their indicators into farm-level and policy-level indicators.

Initial issues discussed:
- Stability of income

The farmer is left to pay when things are not going well economically or environmentally. Consumers and government do not seem to pay for what it will take to turn the fruit and apple growing sector around to something viable and sustainable.
- Overproduction of apples
- Government support of farmers
- Hiring local workers
- Land acting as a refuge for biodiversity
- Groundcover as alternative pest management regime
- Use of organic fertilizers
- Genetic engineering of fruit
- Average age of the apple tree

If the average age of trees on an apple farm are around 15-20 years then the need for replanting is near. The ability to invest in new trees is crucial at this time. If the trees are 30 years old, then the apple grower is on the edge of going out of business.
- net farm losses
- existence of breeding programs for alternative apple varieties

Brainstorming List
- **Quality of Life**

Competing in a global marketplace is a problem for US farmers, just as it is for developing country farmers. Being able to sustain oneself in a global market is important, but so is the social quality of family life. Spending time with family and having a stable family that can farm is for many farmers more important than money. Farmers love and value stewardship of their farmland and the farming communities. Thus, economic indicators alone do not get at bigger picture. Being able to be a farmer is just as important as making it financially.

- **Enabling Farmer-Farmer Innovation and Partnerships**

Sustainable industry breeding programs in universities, and better communication among units and with farmers is necessary. Breeding with farmers on farms is crucial, as is support for collaborative university-farmer breeding programs.

Big industry always comes up with solutions that fit the industrial model of profit maximization, mono-cultures and packages necessitating chemical fertilizers and pesticides. Perhaps turning to experimental farmers would be helpful, as farmers can often be more innovative and realistic than researchers in sustainable agriculture. There are a number of self-taught organic farmers, just as there are a number of farmers interested in learning about organic farming. Little grants for alternative research with universities and farmers might help to enable knowledge generation and sharing about sustainability alternatives, particularly in the context of on-farm and farmer-farmer research.

- **Strong local communities**

Innovative partnerships with farmers sharing information on how to do organic and biodiverse farming would be an indicator for sustainable agriculture.

- **Responsible Consumption**

In the US, the industrial model has pushed for a particular kind of eye-catching apple that looks good but does not necessarily taste good. It is made as cheap as possible, regardless of the social and environmental outcomes. When a consumer goes to a store, apple purchases are unplanned. The polished, cosmetically perfect, red apple is what makes a consumer decide in a split second to buy an apple. Farmers must meet the demands of the retailers and the consumers. Shrinkage, spots and bad color will fail, regardless of the taste. It seems that consumers are giving up the flavor and taste for the looks. Consumers, more than farmers alone, seem to be critical in promoting sustainable agriculture. Social value in the US needs to be placed on the food system and consumers must be willing to pay the cost of sustainable farming.

Consumer education is necessary to encourage a move away from the low-cost “industrial model
is direct marketing. In UPICK, the decision to buy apples is planned and people are interested in taste and variety. Flavor and taste can become a consumer priority even if the apples are the ugliest on earth. The distance from consumer to farmer ought to be reduced.

PROPOSED ECONOMIC INDICATORS

Farm level indicators

- Low net farm income losses
- Low % expenditure on pesticides out of total sales
- Low debt to asset ratio
- Low expenditures on insurance out of gross income
- Low cost farmland to keep speculation and urban sprawl out
- High % direct marketing
- High % of disease-resistant apples selected by careful breeding programs
- Labor needs met in an affordable and legal way
- Increased farmer-driven research and farmer-farmer information sharing

Policy level indicators

- High % of consumer income spent on food, especially locally produced food
- High quality of produce (taste and nutrition rather than looks)
- Level of government support (subsidies when prices really low and informational support)
- Dollars spent on alternative organic agriculture and marketing of diverse products, plant breeding programs for disease resistant fruit cultivars, integrated pest management
- Financial support for on-farm research and partnerships between farmers, universities and government

FRUIT WORKING GROUP: SOCIAL INDICATORS

The fruit group combined the brainstorming sessions for the economic and social indicators, and discussion of these indicators is reflected in the previous section. Only the final social indicators are included in this section.

PROPOSED SOCIAL INDICATORS

- High quality of life
- Debt to asset ratio low to keep social and familial stress low
- High community stewardship and involvement in civic life and landscape decisions
- Food system and farming viewed as social values for urban communities
- Creative partnerships in support of local communities and farming
- Money returns to community to support local families
- Having time to be a farmer and not being forced into part-time farming
- Civic pride in beautiful and healthy landscapes
- Public education towards willing to pay for ecosystem services
- Alternative sustainable agricultural education programs, including on-farm research and farmer-farmer information exchange
- High local interest in sustainable agriculture with an interest in sustaining farmers and the wider community
- Establishment of locally based food policy in community
- Social justice
- Health indicators to monitor farm worker exposure to pesticides

FRUIT WORKING GROUP: ENVIRONMENTAL INDICATORS

BRAINSTORMING SESSION

- **Land-use, Landscape and Watershed levels, Population**

Indicators should include land-use level, watershed-level, farm-level, regional(county, state, nation) and policy level

- **Population (not consensus)**

Quality of life is contingent on the number of people around. We do not want more people and houses built in our watershed if it translates into a lower quality of life, e.g. increased crime, complaints, increased costs and more conflicts rather than community solidarity. One alternative to urban sprawl is programs such as the Farm Bureau's and Nebraska's experimentation with attracting people to farm in their communities.

- **Optimization not Maximization**

Sustainability is not about maximization but rather about optimization. Any profit-motives on their own – such as a goal of raising stockholder's profits -- can never satisfy the optimization process entailed. Holistic balance is a far better alternative to ongoing growth. Quality of life is far more important than profits.

- **Real Costs**

There is a need for people to pay the real price for their resources, such as water. Natural resources can not be seen as free and infinite, as the economic growth model assumes.

- **Foodshed - Proximity to Food**

Issues of food, food culture and where foods come from are potential social and environmental indicators.

- **Food Culture**

It is important to have local and regional food cultures (bio-regionalism), geared towards healthy lifestyles that do not deny the history of a place. This issue is contentious, however, if the traditional food culture causes pollution.

- **Relationship to Food**

In the US, 19% of food dollar is spent in supermarkets and grocery stores, 57% of food dollars go to fast foods and 17% to sit-down restaurants. This means that in total, 74% of American food dollars are spent in fast food and restaurants, mostly of processed foods. Only 7% the US food dollar is spent on pick your own, direct marketing, cooperatives and village garden produce. Our food culture has changed nationally in the past 100 years, thus a whole new food culture needs to be built around pest-resistant, wholesome fruits. There needs to be a reduction of fast food expenditures and eating patterns with an increase in unprocessed foods and home cooked meals.

- **Local Food Policies**

The group was unanimous on the need for local food policies that enhance local trade in sustainably produced foods. Knowledge-sharing with consumers is important so that they know where their food comes from and how it is produced.

- **Fossil Energy Use**

It might be worth tracking the fossil fuel energy cost of a typical food basket. There should be an increase in the amount of food produced per unit of fossil fuel consumed.

- **Urbanization**
    - the number of grocery stores per population
    - the amount of agricultural and country-side lands lost to urban development
- **Waste**
    - number of cubic yards of trash transferred to landfills
    - % of organic foods transferred as food scrap wastes into composting sites rather than landfills

The group decided that biological, water, air, soil and biodiversity indicators be developed.

- **Biological Indicators**
    1. Number of plant insect beneficials and predators
    2. % of acres of fruit trees that are pest resistant

    Pesticides are not just an economic issue, but also one of cumulative effects on life

    3. Amount of ground covers as an alternative to pesticides

4. The % of land in native cover

The spatial distribution and spread of various land use types

5. Landscape aesthetics and beauty -
6. Diversity of fruit crops

Groves can somewhat mimic older forests and have a lovely spring smell with bees and birds. However, they are usually not diverse enough to be compared with forests.

Species diversity indicators depend on particular land use. People tend to opt for diversity as opposed to the industrial model when asked about aesthetics. However, forest patches are not really habitat refuges if there are not ways of getting at substantial areas of uninterrupted forests incorporated into any landscape.

♦ **Water-Biological Indicators**

Water should be monitored for pesticides, since pesticides are the biggest problem with tree fruit growing. The biodiversity of stream life and communities should also be monitored. Beyond streams, entire riparian systems need to be diverse and monitored. Children and communities could get involved in tracking fresh water vertebrate activity and stream life through simple bioassays of species such as spring tails. Any sustainable natural hydrological water context is better to support than industrial, irrigation water models. The group agreed that water indicators would have to be both chemical and biodiversity oriented, on the surface and underground.

♦ **Soil-Biological Indicators**

One possible soil indicator is the number of nematodes, which can easily be detected in any farming system. Enriching soil with composted materials also can be a sustainability indicator. Increases in microbial biomass can and should be measured, but this is not as stable an indicator as nematodes or the ration of bacterial feeders to plant parasitic feeders. Soil sustainability indicators could also include soil trophic structure and activity in terms of bacterial and fungal feeding nematodes.

♦ **Air/Climate-Biological Indicators**

Air quality is rarely an issue with fruit growing, but climate concerns related to urbanization and the greenhouse effect are important to track. Carbon sequestration, the amount of paved urbanity and the ways in which local climate enables agriculture all need to be monitored, along with other ecosystem services offered by fruit groves.

Indicators of total pesticide particulate in the air are relevant to the fruit sector. Herbicide and pesticide drifts can and do destroy fruit harvests. Moreover, acid precipitation needs to be measured, as do the incidences of skin cancer due to ozone depletion.

♦ **Land Use Indicators**

The group also agreed on a number of land-use indicators: natural hydrological cycles rather than industrial irrigation forms of agriculture; the presence of natural systems and natural features inventories to maintain and enhance landscape biodiversity; the presence of watershed management plans and the diversification of crops (annual and perennial).

The group agreed that their environmental indicators were very much concerned with multiple time and spatial scales, including issues surrounding land use in watersheds and landscapes, regional food systems and the diversity of locally produced products and food cultures.

PROPOSED ENVIRONMENTAL INDICATORS

The group stressed several general issues in interpreting indicators:

- Tracking change is important. Thus indicators are not of indices of where you are, but how you are changing and in what directions you desire to move.
- Ironically, consumers and market structure may be more important than the actual production process
- On farm issues alone are not enough.

- The scale of analysis that is most appropriate is probably much larger, such as the watershed and landscape (these also include the farm).
- Considering all ecosystem services is important, and many environmental agencies are now understanding this, as opposed to focusing only on pollution prevention and containment. The sustainable agriculture outlook is one interested in optimizing all natural resource uses and aspects of social life. Ecosystem services are thus not just about negative impacts but also positive contributions. For example, in the fruit sector, despite pesticide use and reduced species diversity, a perennial orchard still more closely resembles a forest in its landscape ecosystem services than a city or annual cropping scheme.
- Optimizing the quality of life in all indicators is crucial, rather than maximizing only one aspect, such as profit.

Land Use and Policy Indicators

- ♦ Energy cost of food budget, fossil fuels necessary for food budget (purchases and production)
- ♦ % impervious surfaces (better to have an orchard than a parking lot, urban suburban encroachment part of our calculus in looking at landscapes)
- ♦ Diversity of production systems in any particular region or landscape
- ♦ % natural cover of natural systems such as forests

Air Quality Indicators

- ♦ Pesticide particulates above fruit orchards
- ♦ Methyl bromide use in strawberries as soil fumigant needs to be abolished since it is a totally nonselective agent

Water Quality Indicators

- ♦ Chemical water quality, monitoring of pesticide levels in surface and ground water
- ♦ Balanced hydrological use, preferably without irrigation and industrial use, to allow for recharge
- ♦ Measures of acid precipitation
- ♦ Biodiversity of aquatic and riparian habitats

Soil Quality Indicators

- ♦ Total amount of organic matter should be high, e.g. High Carbon/Nitrogen ratio
- ♦ Carbon storage in soil and cover crops should be measured to get a dollar value of CO_2 per acre
- ♦ Soil biodiversity should be enhanced
- ♦ Soil trophic structure ought to include more bacterial feeding nematodes than plant feeding nematodes
- ♦ Measures of soil erosion and loss

Biological Indicators

- ♦ Population and diversity of beneficial insects and organisms should be high
- ♦ Breeding of resistant varieties of fruits and increase in acreage of these pest resistant varieties
- ♦ Reduction in total pesticide use
- ♦ Use of organic amendments for soil such as compost or manure
- ♦ Cover crops to decrease erosion
- ♦ Riparian biodiversity

Beauty and Aesthetics Indicators

- ♦ Visual and olfactory optimization of landscapes and land uses to avoid the smell of pesticides and encourage gardening and varieties of apple and fruit trees to be in bloom
- ♦ Development of a philosophy and culture of aesthetics

4.3 GRAIN WORKING GROUP

Facilitator: David Pimentel
Case Study Farmer: Dean McIlvaine
Participants: Catherine Badgely, Larry Dyer, Ravi Duggirala, Anne-Marie Ezanno, Bob Fogg, Gene Ford, Susan Houghton, Allen Krizek, Devdatt Kurdikar, David Macarus,
Rapporteur: Kara Moore

TIME LINE

Note: The grain working group integrated discussion of current trends into the discussion of the timeline.

1945

Around 1945 to 1948 the New Commodity Price Support for grains and other crops began by congressional decision. This had a major impact on farming. In order to receive price support compensating for the loss of high war time prices, farmers had to grow a single crop. Governmental regulations focused on simplicity in the agricultural system which would make it easier to regulate. This program protected farmers when the market narrowed after World War Two ended and added to rural votes. The legislation did not have its roots in the farm community but the farmers were desperate for the aid.

Late in the 1940s the first hybrid crops hit the market, beginning with corn. Chemical fertilizers came out of the war effort and were implemented in 1945, administered at 7 kilos nitrogen per hectare. Their use grew rapidly. Pesticides and herbicides followed, including DDT and 2,4 D. There were little pesticides used on grain but many herbicides. In this time period recycling of manure decreased, separating livestock from the production of grain because of the Commodities Support Bill. This legislation also pushed technology as part of receiving support. The industry of mechanization was driven by Congress. Also, subsidies made the industry boom possible. Before the war livestock was included with grain production, but during and after the war the farms became increasingly mechanized in order to meet the production needs of the war itself. The war and its end also caused labor migrations and other changes in farming.

The Soil Conservation Service also began in the 1940s. Its purpose was production control rather than soil conservation.
1949 **-** Aldo Leopold published *A Sand County Almanac*

1950

Ammonia fertilizers used

1955

1958 **-** The Soil Bank program took land out of production and gave price supports.
1958 **-** Miller Act-gave food tolerances on residues
1959 **-** Fluid Milk Act-livestock drove the grain industry; increase in population required more milk and eggs

1960

There was discussion of when supermarkets became part of town life. It was suggested that this occurred in the 1960s or perhaps earlier. Supermarkets began as privately owned. Later, TV imagery fueled the industry and privately owned stores went out of business due to an influx of larger corporate stores. It was decided that the supermarket boom occurred in the 1950s.
Subsidies for commodities
1962 **-** Rachel Carson published *Silent Spring*, but this did not have and immediate effect

1965

Expansion of farm size in the mid to late 1960s changed the culture and quality of farm life. Also, externalities increased, giving an increase in yield per acre and increase in supply, therefore a decrease in prices.

1970

The Green Revolution-increased yields, decreased prices

1970 - The EPA was formed by Nixon's administration. The first big thing they did was ban DDT in 1972

1973 - Fence row to fence row planting was instituted. Get big or get out. America took on the responsibility of feeding the world.

1972 or 1973 - *Diet for a Small Planet* raised general public awareness of food issues. Ecology connects food, policy, poverty and ecodamages. A beginning to alternative food approaches.

1975

Back–to-the-land movement

1980

1983 - PIK program-payment in kind. Farmers were paid in corn not to plant it.

Urban sprawl an issue

1985

1985 - Milk Diversion Program-reduce the production on enlisted herds by 30% over three 15 months. Farmers paid based on previous production rates at $10 a hundred for 100 lb. of milk

1988 - SARE began as part of the USDA. LISA began a little before that fueled by EPA action

1989 - National Academy Committee on Alternative Agriculture

1990

GATT and NAFTA-international trade agreements

Agribusiness rather than agriculture

Freedom to Farm Act allowed crop rotations, no more set aside and diversification

Organic Labeling issue which is in progress. The 1998 draft received high criticism and great reaction by the public.

Genetic engineering-BT began in the early 1990s, herbicide resistance

RBGH-early 1990s

The group voted on the period of greatest industry change with the following results:

1. 1940s-1950s Technology and policy, government role in agriculture increased through policies during and after war time. Pesticides, fertilizers and mechanization were on the rise in the 1950s
2. 1970s-Agribusiness replaced agriculture, get big or get out, US took on feeding the world
3. 1980-Agriculture policy including subsidies and low grain prices

GRAIN CASE STUDY: DEAN MCILVAINE, WEST SALEM, OHIO

FARM PROFILE

Twin Parks Organic Farm is located in Northeastern Ohio, about 50 miles south of Cleveland, along I-71 at West Salem, Ohio. The 1200-acre farm is a mix of woodland and gently rolling fields divided by several roads. About 850 acres are tillable, 150 of those are in the Conservation Reserve Program. The yellow clay loam soils produce crop yields that are slightly below average for Wayne County.

Twin Parks employs two other individuals who earn about $20,000 annually. At least half of their efforts focus on adding value to the crops raised. The surrounding community is predominantly agriculture with a few small manufacturing businesses in West Salem. The area also serves as a rural bedroom community for people employed around Cleveland and Akron. Interactions with this community is limited but neighborly, depending upon the interests and personalities involved.

Economic success is not measured by yield, since the food grade varieties of grains yield about 25 percent less than commercially grown varieties. Thirty bushel per acre soybeans and fifty bushel per acre spelt is typical. Twin parks' economic success stems from reduced input costs, adding value to the grains produced and personalized marketing. Our main buyers are natural foods processors who appreciate the care we take in growing the varieties they prefer and delivering them in the condition they need when they need them. We have replaced expensive inputs with increased management and time in the fields. Prices for our grains have escalated rapidly in recent years, but show signs of leveling off or declining as supplies have increased and the economic strength of many buyers is questionable.

We pay ourselves instead of the chemical and fertilizer companies, by spending more time on seed be preparation, rotary hoeing and cultivating. Fertility is enhanced through timely, shallow incorporation of cover crops, compost and lime. Soil structure is improved through tilling wet areas and shallow incorporation of crop residues when the soil is moist, not wet. Most pests and weds are controlled by rotating small grains and cover crops with row crops. A steady diet of cover crops feeds the natural biological life in the soil, choking out weeds, building humus and organic matter, reducing erosion, enhancing water use and reducing energy consumption. Every facet of our farming operation is related to the next, like the links of a chain that must be in order and that are necessary to support and produce the desired result- an ethically, environmentally and economically sustainable food production system.

PRESENTATION AND DISCUSSION

West Salem is in the heart of dairy country, with poor soils and located on the edge of development. In the 1970s and 1980s the thin yellow clay soil was eroded and depleted and the farm was planted in end-to-end monoculture of 1000 acres of corn which was shifted to soybeans. In the 1980s, prices fell and more needed inputs meant more debt.

Mr. McIlvaine began to work with his father on the family farm, bringing home new ideas about food and farming from college. He was influenced by *Diet for a Small Planet* and the movement for organic foods. In 1983 the farm was enrolled in the PIK program which allowed them to leave some acreage out of production that year, but the next year they returned to the old conventional production system including investment in more chemical inputs as before. In 1985, recognizing that the conventional system was not working, Mr. McIlvaine decided to experiment with a year of no spray. They had a decent crop that year and the year after decided never to spray again.

The farm had consistent good crops and the farmers learned quickly from their experiences going cold turkey from chemical inputs. They eliminated fertilizers and pesticides at once, and suspected that initial success was due to chemical carryover. The transition to organic would not have been possible without government programs such as

PIK and CRP which allowed set-aside land and lowered the work load. With the transition to organic, diversity of crops is important and labor increases. Capital needs also increased with new management and labor needs. Drought in the 1980s threatened the farm but also increased determination that more environmentally friendly practices were necessary. After the farm became certified as organic markets opened up for their products.

Mr. McIlvaine plants diverse crops: cereal, grass, row crops, legume rotations such as soybeans, clover, then small grains. They have no large livestock but have come to recognize that small livestock, microorganisms in the soil, are their livelihood. They work to promote soil life by increasing cover crops and residues. It is of utmost importance to build the soil for the long term and thus become sustainable.

GRAIN: SECTOR OVERVIEW AND COMPARATIVE CASE STUDIES

Henry Miller, Constantine, Michigan
Although their farm is not organic, the Millers focus on using safe chemicals in minimal amounts. The farm is located on sandy soil with irrigation. Seed corn was historically the major crop. They have experienced both weed and insect problems.

Eight to ten years ago the farm went to complete rotation with cover crops after every cash crop. An example of a rotation is: potatoes, seed corn, green beans, seed corn or oats, turnips to rye. The Millers have also increased soil quality through a partnership with Upper Peninsula dairy farmers. The dairy farmers bring down their herd to graze the Miller's cover crops over the winter. They have also come to measure soil quality by looking at their weed spectrum.

Bob Fogg, Leslie, Michigan
In the 1970s Mr. Fogg's farm was primarily poultry with a small dairy herd. In 1984 he sold the herd. The herd had health problems related to the high protein diet so they went to a 75% forage rotation and eliminated protein supplements and silage. Mr. Fogg made use of the PIK program to set aside land to cover crops and make the conversion to organic.

The first four or five years of organic they suffered high losses but the herd offset losses. Green manure became an important component of the farm to support soil microbes. In 1986-1988 the herd was half replaced. In 1989 the farm became certified organic and in 1993 they sold their herd for the last time. The farm now markets small grains and soybeans for soymilk. They also have an on farm health food store and market and a building to be used for farmer education.

Gene Ford, Blissfield, Michigan
In the late 1960's Mr. Ford's father "lost" the family farm, but Mr. Ford still decided to be a farmer. He rented a small acreage and built up from there, buying a farm on land contract in 1980. He started farming hogs but ran into trouble with that with debt which forced him to find a way to eliminate fertilizer and feed bills. He did that by making the transition to organic which was a great salvation. The organic grain market has been tremendous. The biggest problem he sees is urban sprawl. It was suggested by the group to look at Leelanau county for land protection ideas which have been effective there.

GRAIN WORKING GROUP: ECONOMIC INDICATORS

BRAINSTORMING SESSION

Note: The grain group first listed components to each phase of production. The draft economic indicators were grouped into categories: land, water, energy, biodiversity and labor.

Land

- **Megagrams/hectare (acre?) : soil/hectare (acre)** or **units product/acre/year : soil loss(lb.)/acre/year**

This indicator was intended to measure the rate of product removed with the rate of soil loss. With current technologies, Dr. Pimentel added, the sustainable rate is 1 ton of soil/hectare/year.

Water

Water is a major factor affecting actual yield.

- **Yield/gallon water/acre/year**
- **Soil loss/gallon water/acre/year**
- **Income/gallon water/acre/year**
- **Tillage method/yield -** This compares mechanical tillage in field to chemical methods and others. Organic takes more time to get the same yield.
- **Man hours/acre -** The more sustainable the farm, the more management time should be expected, so more labor time could be an indicator of sustainability.
- **Acres/equivalent farm laborer -** This indicator considers farm labor and farm size. – number of people supported from a given acreage

- **Income/hours human labor** or **livelihoods/acre -** also have to figure in the livelihoods of input industry workers
- **Amount of irrigation water/unit yield**

Energy

Oil, natural gas, coal etc.

- **Yield/units of fossil energy/dollar sale of crop**
- **Fossil energy/dollar sale of crop** or **fossil energy/unit of crop**
- **Fossil energy/energy equivalent of crop (kilocalories)**
- **Fossil energy/renewable energy ratio,** such as solar panels or wind power. Biomass fuel, solar
- **Total kcal energy input (including crops use of the sun)/kcal output**

Biodiversity

In considering biodiversity, the group included five important areas in which level of biodiversity could be used as an indicator for sustainability, specifically listing organisms whose economic benefit we measure in some way.

- **Soil macrobiota-**such as earthworms, which reduce soil erosion and increase water percolation
- **Soil organic matter-**increases nutrient availability
- **Microbes**
- **Beneficial natural enemies**
- **Nitrogen fixers-**also necessary to figure in the nitrogen credit from the previous crop here, perhaps measurable as **nitrogen fixers/nitrogen credit**

It was suggested that we put each of these into economic terms in several ways:

- **Number of species of the beneficial category/unit area**
- **Dollar value/acre for each beneficial category**
- Other biodiversity indicators were discussed that did not relate to the previous five beneficial types of organisms.

- **Proportion of the year ground has living cover -** This indicator could be used as a measure of nitrogen production. The dollar equivalent for production of 100 lb. Of nitrogen synthetically is around $20-$24, whereas you can produce your own through cover crops. You can purchase nitrogen fertilizer at $15-$18/100 lb. Is this because of a subsidy? Group consensus is that nitrogen is cheap at $90/ton.
- **Amount carbon sequestered-**This indicator figures in the carbon credit. Here it was also suggested to somehow include pollution and hedgerows in some sort of credit system and to measure soil organic matter levels in comparison to erosion.··
- **Percent input from local sources-** Define boundaries of “local.” This would be a good measure of support for local communities.
- **Percent of sales to local sources -** measures support for local economies
- **Runoff amount in dollar value/amount crop produced in terms of reduced crop productivity** or **lost yield/runoff amount -** increase in runoff decreases the amount used in crops. This also relates directly to detrimental effects off site.

Labor
Considering labor as an input into the farm system.
- **Amount of labor, time spent in field**
- **Labor satisfaction, willingness**
- **Product appreciation**
- **Employee turnover rate**
- **Employee stress management level or costs**
- These indicators were very important to the group, especially the farmers who ranked higher job satisfaction and product appreciation as indicators which would be greatly increase farm sustainability.
- **Amount of machinery used in production**
- **Debt load**
- **Return on capital invested**

Greater soil organic matter improves machinery efficiency and may be used as an indicator in that respect, but other group members did not agree.
The group then voted. Each of the twelve group members present we given three votes to place throughout the categories.

PROPOSED ECONOMIC INDICATORS
1. Units crop/acre/year : soil loss/acre/year-6 votes
2. Biodiversity (general) services provided as dollar value/area-6 votes
3. Return on capital investment-5 votes
4. Crop yield/fossil energy/dollar sales of crop-3 votes
5. Fossil energy/renewable energy-3 votes
6. Debt load-2 votes
7. Livelihoods/acre-2 votes
8. Hours human labor/acre-1 vote
9. Income/hours human labor-1 vote
10. Yield/fossil energy consumed-1 vote
11. Soil organic matter dollar value /area-1 vote
12. Percent of year with living cover dollar value/area-1 vote
13. Water runoff amount in dollars or kilograms/amount crop produced-1 vote
14. Percent precipitation retained

GRAIN WORKING GROUP: SOCIAL INDICATORS

BRAINSTORMING SESSION

This group of indicators were not grouped into categories as before. There is some overlap between these and the economic indicators.

- **Farmer job satisfaction**
- **Number of livelihoods per acre**
- **Number of freedom to farm complaints-**an indicator of neighbor satisfaction, also as an indicator of reduced erosion
- **Number of zoning disputes**
- **Number of small farms/county** or **number of farmers/county-**increase in this increases quality of life
- **Percent of the year farmers are employed**
- **Amount biodiversity-**another measure of satisfaction
- **Percent of species in the county on the farm**
- **Recreational use of land**
- **Percent inputs from local sources**
- **Food safety level**
- **Percent sales to local community**
- **Number of contaminants in food**
- **Amount of packaging/sales**
- **Nutritional value/crop yield**
- **Amount of participatory harvesting-**u-pick, CSA, etc.
- **Local 4h and future farmers of America activity**
- **Percent of school age children in FFA or 4h**
- **Number of new farmers/year**
- **Average age of (active) farmers in the community**
- **Cultural diversity among farmers**

PROPOSED SOCIAL INDICATORS

Note: Each group member was given three votes to cast for any of the indicators resulting from the brainstorming session.

1. Livelihoods/acre-9 votes
2. Percent sales to local community-6 votes
3. Job satisfaction-4 votes
4. Percent inputs from local sources-4 votes
5. Farm size, number of farms/county-3 votes
6. Average age of active farmers-3 votes
7. Number of contaminants in crops-2 votes
8. Participatory harvesting-2 votes
9. Number of new farmers/year-1 vote

GRAIN WORKING GROUP: ENVIRONMENTAL INDICATORS

BRAINSTORMING SESSION

In discussing environmental indicators it was noted that the economic and social indicators had been highly environmental in nature. The strong relationship of all indicators to the environment was recognized. The importance of soil was emphasized: a farmer's livelihood beings with the soil. We are 'humus' beings. Environmental indicators were addressed in categories similar to those used in the economic indicators.

Soil

- **Soil organic matter** This was the number one indicator for some of the farmers in the group.
- **Soil biota, nematodes**
- **Absence of synthetic chemicals and natural heavy metals**
- **Absence of soil compaction**
- **Soil moisture and aeration, water holding capacity**

Aside from the USDA soil quality kit, a group has been applying alternative methods that may be more practical for farmers as well as more comprehensive indicators. One method is to measure decomposition of cornstalks buried in different areas as a measure of overall biological activity and productivity in the soil. The group is working in finding overall indicators. Also mentioned here was the Web of Life company in Oregon which measures organism diversity rather than nutrients. Other methods include feeling soil blindfolded and smelling soils. Good soil has a sweet smell.

- **Nematode ratios**

Comparing plant parasitic to other nematodes may be a good indicator. No till has its costs and benefits, as does no spray. Fertilizers and pesticides are harmful overall because they hurt soil life which maintains the soil. No till reduces the ability to have cover crops, which can be a negative for soil health.

Water

- **Soil moisture**
- **Holding capacity**
- **Reduced runoff -** relates to erosion and water life.
- **Health of aquatic habitats and systems**
- **Biota**
- **Percolation**
- **Availability of water**
- **Sound irrigation**
- **Safe drinking water**
- **Ground water chemical contamination**
- **Surface water contamination**
- **Microbial contamination**

There is an obvious interrelationship between water and soil with interesting habitat consequences.

Biodiversity - "Diversity is the spice of life."

- **Habitat diversity/monoculture**
- **Crop diversity** - In relation to the whole farm and companion planting.
- **Enterprise diversity -** Crops and livestock. Soil organic matter encourages biodiversity and interconnects here. Monsanto could help farmers by the development of biological control and looking at natural systems.
- **Hedgerows**
- **Crop rotations** -This aides overall biodiversity and is easily measured.
- **System integration -** seasonal diversity.
- **Temporal and spatial diversity -** Accounting for seasonal changes.
- **Cover crops, companion planting, green manure planting**

- **Weeds -** The weed spectrum, indicator species for soil type, weed density and diversity.
- **Exotic species, alien species**

Energy

More fossil energy use is necessary the farther our agricultural systems stray from natural systems.

- **Energy efficiency**
- **Animal labor** the extent to which animals labor for the farmer by spreading manure or grazing the cover crop
- **Renewable energy/fossil fuel use**
- **Amount of fossil energy invested per solar energy harvested**
- **Ratio of inputs to outputs in energy terms**
- **Multifunctionality of animals**
- **Biomass production**
- **Conservation of energy**
- **Human labor** because other forms of energy can be substitutes for this.
- **Level of mechanization** this should include the energy to produce machinery and the amount of machinery.
- **Percent energy coming from renewable and non renewable sources**
- **Pollution/energy/costs** we pay for pollution prevention in processing costs and pollution clean up through our taxes and health costs.
- **Waste (through pollution or otherwise) per calorie produced -** There is an underlying power structure which supports pollution by the chemical industries and the conventional farming industry and keeps pollution costs external to the system.

Health

We are aiming for the health of soil, animals, humans, wildlife, plants, bacteria (microbes), air and water.

- **Pesticide, phosphate and nitrogen levels** All of these can be used as health indicators. Nitrogen levels in ground water are a good indicator. For example, nitrogen levels could be measured as amount of nitrogen introduced that is lost to the environment. Both nitrogen and phosphorus should be measured in relation to natural levels.
- **Nitrogen -** We need an accounting system which includes natural and applied. Nitrate pollution can also be caused by cover crops and green manure.
- **Biodiversity -** Plant, animal and soil biota diversity are all important. We need to work on indicators specifically to cut across these areas, looking for those that most directly measure impact.
- **Incidence of cancer in the community -** Cancer is a big concern and we need to look at the commonalties of conditions in which high rates occur. We need to look closely at areas in which human health issues are clustered. There is an obvious correlation between cancer and farming. But we can’t formally prove those causes and effects.
- **Soil organic matter -** Measures biodiversity. Can be measured as a percentage of soil. Also the quality of soil residues and soil productivity can be measured.
- **Water quality**
- **Carbon/ nitrogen ratios -** Both long term and short term pools should be evaluated.
- **Health in general (rather than cancer)**
- **Number of species and diversity of soil organisms**
- **Respiration rate**

For our final environmental indicators the indicator categories were ranked with each member having one vote, then within those categories each member had two votes to place to rank the indicators themselves.

PROPOSED ENVIRONMENTAL INDICATORS

Indicator categories:

1. Soil**-** 6 votes
2. Biodiversity**-** 3 votes
3. Health**-** 2 votes

<u>Health</u>

1. **Human health-** 5 votes
2. **Biodiversity-** 3 votes
3. **Wildlife, water** and **pesticides-** each received 1 vote

<u>Soil</u>

1. **Soil organic matter quality and quantity**
   Biological activity- each received 5 votes
2. **Productivity-** 2 votes
3. **Biota-** 1 vote

<u>Water</u>

1. **Ground water contamination**
   Health of aquatic communities-both received 5 votes
2. **Reduced runoff, erosion-** 2 votes

<u>Biodiversity</u>

1. **Species number**
   Crop diversity- both received 4 votes
2. **Habitat diversity**
   Enterprise diversity- both received 2 votes

<u>Energy</u>

1. **Energy efficiency-** 6 votes
2. **Ratio of inputs to outputs-** 5 votes
2. **Biomass production-** 1 vote

4.4 PORK WORKING GROUP

Facilitator: Paul Dietmann
Case Study Farmer: Mike Natvig
Participants: Jonathan Bulkley, Charles Cabbage, David Cappaert (Saturday only), Jerry Dewitt, Russ LaRowe, Susan Smalley
Rapporteur: Shawn Severance

TIMELINE

Late 1940s
Hogs are considered converters of milk when cream is sold. Lots of hogs raised on small scale to convert ”waste”. Most farms had a few hogs.

1950s
Meat-type Hog transition
Lard was a commodity at one point. Then in the 1950s there was a focus on the meat of animal. People wanted a hog with meat on it.

1960s
Packer consolidation begins
Beginning in the 60s, and becoming popular in the 80s: consolidation of packing plants.

1967
Voluntary checkoff
The producers pay into a pool that finances research on the product. Most major commodities have checkoff programs. It is not clear whether checkoff programs are beneficial. Currently, prices of corn, soybeans and hogs are right on the bottom. Some wonder if the research programs help ADM more than the guy growing the corn. The USDA and universities, both private and public, do the research.

Late 60s
Surgeon General’s warning on cigarettes-hogs were an alternative crop to tobacco. Warning on cigarettes brought about a transition to hog farming in North Carolina. Hogs lent to that environment.

Late 60s
Better harvest equipment resulted in less corn ears dropped. This eliminated the need for hog gleaning.
Corn growing became more mechanized in the late 60s. Framers no longer had to hog down corn. Industry responded.

1970s
Transition from outdoor to indoor production, which resulted in less seasonal production. In the 70sthere was a transition from hogs raised outside to confinement systems. When the industry went to confinement systems it evened out production over the year.

Early 1980s
Increasing emphasis on lean hog meat. They used to use everything but the squeal. In fact, that was the Swift slogan in the early 1900s.

1980s
Ground water quality concerns & water regulations impacted the industry. The consolidation of packing plants continued.

Mid 1980s
The farm crisis of the mid-80s affected agriculture broadly.

1986
Voluntary checkoff to mandatory checkoff

Mid-1990s
The social implications of industry like odor, size and consolidation become concerns.
In the last 5-6 years, the social implications of the industry have assumed importance among farmers and non-farmers. Issues like Not In My Back Yard, the war between small and large farms, driving the little guy out of business. Consolidation in production and packing were increasingly seen as a threat. The number of hog farms has diminished over the years. In Michigan, 20% of the producers make 80% of the hogs and these numbers are more skewed nationwide. It's a trend throughout agriculture

1990s
The advent of hoop structures and other alternative swine production methods. Hoop structures for hogs are easier for a farmer to purchase than larger confinement structures. These structures are jokingly referred to as the "tent out of Canada." People are concerned and excited. Other alternatives in swine production and management such as pasture farrowing are increasingly practiced.

Mid 1990s
International trade becomes more important. Trade agreements (NAFTA and GATT) fostered international trade. They leveled the field and allowed the United States to compete. For the first time in 50 years we became a net exporter of pork in 1994.

Fall 1998
First time we did not have excess packing capacity. Last fall was the first time that we had slaughter excess. We were gearing up to produce for world demand and didn't end up having the production to meet it. It was the first time consumer demand increased 10% without having the slaughter capacity. Record numbers of hogs were produced last year but we didn't have the ability to kill everything that was out there.

1998
Industry response to environmental concerns. EPA's total maximum daily loading regulations have had an increased impact on the industry since 1998. These measures were in the act since 1972 but were not enforced by the EPA. The MDL places constraints on how much more growth a farm can foster. USDA has also produced guidelines on resource management planning over last 18 months.

January 1999
Interim Organic Meat Label was introduced.
Mike: In January of 99 we were allowed to use an interim organic meat label.

CURRENT TRENDS

1. Packer consolidation (8 votes)

2. Fewer producers (8 votes)

300,000 or 3000 head? Is it preferable to have many small or a few large producers? Is having just a few large producers good for the industry, rural America or Michigan pork producers? The only way to not move towards the efficiency of large producers is to institute production controls. The number of people in the industry is dropping. There are fewer owner-operators. The production increases represent expansion of existing farms rather than addition of new farms. Nationwide there is an ongoing war between large & small producers, but this is not really true in Michigan. In Michigan we have farmers with 50 sows contract finish for the larger guys. A 250-500 sow operation is considered small. Michigan has the necessary water, land base and grain for large-scale production. High labor cost and environmental regulations have kept out the

ADMs. There are large-scale producers, Michigan falls in 3rd after North Carolina and Iowa, but they are family corporations. A lot of farmers are not too old. There is a trend towards coordination between small farms for more efficient operation, though this is a tough sell because they need to give up independence.

3. Impact of environmental regulations (6 votes)

There's an increasing impact of environmental regulation. Solutions to environmental concerns include: Water quality trading for non point source generators, more voluntary techniques to meet environmental regulations, a market driven program for nutrient runoff control. Big corporations are moving from places of high regulation to places of low regulation, even if it is farther from feed supply and market. The odor problem will be addressed by society.

4. Consumer concerns about food safety (5 votes)

Trends in consumer tastes are changing. The customer desires quality and consistency. There is a growing concern about purity that is leading to testing standards for drugs. Food safety and food quality can become a new marketing angle. Major retailers are keenly interested in this as a marketing niche. It is an area where independent producers can out-perform larger producers.

5. HAACP (3 votes)

Irradiation by the USDA is in place for other red meats, driven by concerns over HAACP. It will come up in the next couple of years as an option for pork. The product is getting better, leaner so you can't cook it like your mom used to and have it taste good. We'll have samples and people will ask how we make it taste so good. The only difference is that we don't cook it forever. But people still cook it to death because of that god-awful worm.

6. New ideas in waste management (3 votes)

New opportunities for waste management mentioned were composting by the producer and packer to handle waste material on site. In Michigan, there is a system being worked on for paunch waste composting at packing plants that looks promising.

7. Bottleneck in processing capacity (2 votes)

Market signals are indicating increased production, but we need better coordination to prevent bottlenecks.

8. Niche marketing (2 votes)

Name brands in pork. Product "branding" will move the industry away from marketing generic pork items. The new organic standards will also create a niche market.

9. US as a net exporter of pork (1 vote)

Is pork a commodity? We have marketed it as such. Now producers are starting to market pork as a food item. Will America continue to be a player in the commodities market? Commodity production may become an industry for other countries; we will become higher tech producing mainly value-added products. (There was not general agreement on this point.) NAFTA and GATT leveled the playing field, driving market to be determined by least cost producer.

10. Contracts not directly available to small producers (1 vote)

There are contracts that lock you into a price you know you can make a little on. The contracts are not directly available directly small-scale producers because the packers want to sign mainly with the big producers.

11. More integrated system (1 vote)

Commodity producers and niche markets will become more integrated into the system. Producers will be controlling product further down the line. Is it a good trend to control the product? Good or bad, the economics of the situation is driving us this way. It is this or production controls, right or wrong.

PORK CASE STUDY: MIKE NATVIG, CRESCO, IA

FARM PROFILE

General Farm Description

My farm is located in Howard County, Iowa, in the North East corner of the state. The farm is 160 acres, of which 120 acres are tillable, and 40 acres of which are timber, ponds, and permanent pasture. The farm has been in the Natvig family since the 1880s. I also rent 80 acres of cropland from my uncle, one mile from my home, and 180 acres that connects to my farm, that is owned by the Iowa Natural Heritage Foundation. The livestock that I own are 44 beef cows and their calves, 20 organic sows and their offspring, 3 draft horses, and a flock of chickens. I also own tractors and farm machinery to do field work.

The area of Iowa in which I live is the transition zone between the Eastern hardwood forests and the tall grass prairie. My farm was once an oak-hazel savanna before settlement. Today the majority of the land in my area is privately owned farmland and woods.

The nearest town is five miles away, and has a population of 4,000 people and a fair amount of agricultural-based manufacturing. Eighty miles in any direction will get you to cities of 50,000 in population.

The labor on my farm is provided by me, some part-time help in the summer, and some by my father who lives next door. Each summer I hold a farm tour field day with the Practical Farmers of Iowa, an organization doing sustainable on-farm research. I also help out on the Northeast Iowa Organics Association Outreach Committee, and am on the board of my county's Soil and Water Conservation Commission.

Production levels on my farm average 8 pigs/litter, with two litters/year. 97% calf crop, organic crop yields are on average 50 bushel soy beans, 140-150 bushel corn, and 50 bushel oats. Buyers for my crop include two businesses in the county that process organic soy beans, corn, and wheat. Feed grains can also be sold to other organic livestock growers. Organic pork will be marketed mainly with Organic Valley Coop, and the rest will be marketed to local consumers. Organic prices at this time are hogs $.70 live weight, corn $500, soybeans $18.00, and oats $2.00 per bushel.

Feeding methods for my organic hogs are very basic, self-feeders or limit fed by hand. In the early fall, some standing corn in the field is "hogged down," or directly harvested by the hog. In the summer, gestating sows are rotationally grazed. Most feed is farm grown corn, oats, or "succotash"(oats, wheat, barley, Canadian field pea) mix, and locally processed soybean meal.

My hog facilities are simple A-frame huts for summer pasture farrowing, pens in barn for winter furrowing, and hogs fed out in open-front buildings. No confinement buildings are used.

I have a solid manure handling system that includes a tractor with loader, manure spreader. When the animals are on pasture, they spread it themselves. Most of the livestock manure contains a large amount of straw that absorbs liquids and is a carbon source needed in the composting process. In the winter, manure is stock piled and composted, giving me a much valued source of organic fertilizer for my own crops. Very little is considered a "waste product" on my farm.

Sustainable Practices

On my farm, some of the practices that I believe to be sustainable from an economic, social, and environmental perspective are rotational grazing of my beef cow herd and sow herd. Integrating native species of plants on my farm, such as prairie grasses and forbs for pasture and wildlife habitat, and hazelnuts for windbreaks and nut production. Other practices that I use on my farm are grass-based organic crop rotation, and sustainable forestry management with horselogging.

Some of the greatest challenges in day-to-day management of my farm is finding the time and energy to learn new ways and practices that I think might benefit my farm's long-term health. For instance, how to manage several enterprises together as a whole, in a way that they won't conflict with each other or the seasons of the year. The greatest challenge is learning how to manage for diversity in a radically simplified ecosystem. These challenges are similar to other farmers in the region who I know are trying to make sustainable choices.

Some of the changes that I and other small family farms in the region have experienced in recent years are fewer available markets for conventionally raised livestock and grains, along with lower prices and increased input costs, increased biotechnology and genetically modified crops and the direct threat these have on organic farming. Positive changes have been the growth of organic farming and organic market expansion for livestock and crops. That should bring increased farm profits and a better environment.

Changes likely in the coming years include increased division among large corporate farms and smaller, diverse, sustainable farms. Small family farmers will realize that to survive they cannot be small-scale versions of factory farms and sell their produce on the same market.

PRESENTATION AND DISCUSSION

Mike began with a quote by Wendell Berry, "Expensive solutions to agricultural problems are almost always wrong." In the spirit of this quote, the Practical Farmers of Iowa group (PFI) is developing innovative ways for farmers to cut costs. On-farm research involves the use of cover crops, manure management, and ways to manage nitrogen, phosphorous and potassium rates. Narrow strip intercropping research is aimed at maintaining corn yields while reducing nitrogen runoff levels. Rather than imposing ideas from top down, PFI works with farmers from the ground up. Other activities of PFI include on-farm plot tours, on-farm demos and family socials. Overall, visiting other farmer's plots has been an excellent educational tool.

Over the last several years, Mike has returned to traditional livestock production methods that minimize waste. He did not enjoy conventional farrowing methods and has implemented a traditional pasture farrowing system. This method has low associated cost and energy input. 3-4 huts are placed in a field surrounded with a temporary electric fence. Putting sows in the field allows forage to be utilized in crop rotation. Sows are also used to hog down corn. The corn is grown just for hogs. It ripens in September and there is no need to combine. The sows get protein from legumes in the pasture. In this method, the farmer need only supply water and minerals.

At one time, Mike finished out all his hogs in a Cargill-style building. Mike now houses the hogs in hoop structures. They look like huge covered wagons with an arched metal frame supporting a synthetic canvas top. Permanent walls can be built at the ends or they can be enclosed with bales of corn in winter. Hoop structures cost ten to twelve thousand dollars to build and the canvas top has approximately 15 years of useful life.

Not only is the hoop structure less financially risky than a conventional confinement system, it is also healthier for the hog and the farmer. It is naturally ventilated and the hogs have room to roam around and chew on the bedding straw. Mike says his hogs love it-overall, they seem happier. There is an increased need for bedding for which oat straw or corn stocks are used. This is a useful feature also. Because of the additional bedding, the carbon to nitrogen ratios of the manure from hoop structures is nearly perfect for composting and manure is a valuable nutrient on an organic farm.

Alternative farming techniques also used on Mike's farm include shelterbelts, interplanted crops and nut crops. For example, a field windbreak of hybrid poplars and hazelnuts protects livestock and helps control wind soil erosion. He also uses native grasses and legumes for grazing. These methods are not highly dependent on technology, but do recognize that managing the mineral and water cycles are the key to soil surface management. There is also a wetland restoration and prairie remnant on the farm. Not only do these natural systems provide useful biodiversity, but also they are a benchmark for ecological health. In assessing the soil quality of his fields, Mike will take a handful of soil from the prairie and compare it to the soil in the field for color, texture and smell.

Mike finished with the statement that the most important difference between the agroecological worldview and that of western science is that agroecologists perceive people as a part of evolving local systems.

PORK: OVERVIEW OF SECTOR AND COMPARATIVE CASE STUDIES

Sam Hines, Michigan Pork Producers Association

Demand drives the direction of the pork industry. Back in the 70s, pork demand eroded dramatically as public tastes shifted.

With the exception of the last 6 months, hog farms by and large were profitable. No other agriculture enterprise comes close to return on investment. The top 1/3 farms transition to the kind of animal people wanted. There was an interest in lowering cholesterol and fat in late 70s and 80s. In fact, the pork farmers may have had the product the consumer wanted, but the message didn't get out. Their market share dropped as consumer tastes shifted from pork to poultry.

Then an astute advertising executive noted that 8 existing pork products compared to skinless chicken breast in fat, calorie and cholesterol content. Pork producers had assumed they were part of the red meat market, but in fact they also had white meat cuts to offer the consumer. So it was suggested that pork reposition in the marketplace as a white meat. They anticipated challenges, but Webster's itself describes pork as a white meat and the industry stood up to challenges. Now when someone mentions pork, the natural response is "the other white meat". Though shrewd advertising has had a significant impact on regaining market share, the industry is still not back where it was before the 70s. Poultry is the major competitor at the meat case.

Domestic demand is only part of the picture. Pork is the most consumed meat around the world. This amounts to a tremendous opportunity in world market. Major export destinations include Japan, and other countries in Asia/Pacific area that have a pork focused diet. However it was tough to compete with the least cost producers, for example heavily subsided exporters like the Danes. In the 80s, GATT and NAFTA leveled the playing field. Now the United States is a net pork exporter. But NAFTA and GATT have also caused problems. The Canadians based their markets on ours and when the Asian depression drove commodity prices down We ended up processing 20% of Canada's production, at a time when we could ill-afford it. We didn't have enough slaughter capacity to handle our own production. Producers now want an antidumping initiative against the Canadians. Thorn Apple Valley and other plants closed down-they are just not going to slaughter any more. This part of their operation was not profitable. They have an 18% return-this is better than some aggressive mutual funds. This drives investment capital into the industry. All of the signals indicated that the market could absorb more production but we just didn't have the slaughter capacity. Domestic demand was up 7% last year, but there was a bottleneck in the system. The single thing that created the bottleneck of last year was that the production increase was larger than predicted. And we didn't have good information.

There is some indication now that pork prices are more inelastic than before. It seems like at a predetermined price pork will sell a constant amount. Price doesn't change it much because the average consumer spends a very small amount of their income on pork. The exact price per pound doesn't affect consumption rate.

Q: Did the reduction in packing capacity involve the advent of different regulatory constraints, specifically hazard analysis?
A: Reporting on sanitation methods has changed the entire packing industry. Some plants were looking at significant reinvestment to comply. In the case of the Thorn Apple Valley plant, however, the region as a whole has decreased supply. They were attempting to compete with an inefficient operation and were not making money in that sector of their business.

Producers are considering a more integrated system. In other words, they will be keeping their arms around the product further down the chain by contracting with packers and retaining ownership. However, some of these contractual arrangements can have a downside. If pork is selling under the contract price, the producer will build up a ledger to packer. The packer will pay the farmer the contract rate and the farmer will be going into debt. Trends for the future include: more contracts, niche markets and hanging on to the product longer. We can not continue to put generic products on the street; we need to identify marketing niches. There are still more questions than answers and the last six months have seen a lot of human misery, but there still are opportunities.

PORK WORKING GROUP: ECONOMIC INDICATORS

Note: These indicators were developed through group discussion and reflect the opinions of the group as a whole. The group did not vote on their relative importance, and did not eliminate any of these for the final indicator list.

It was agreed that pork farming is not currently economically sustainable for anyone. The recent relationship between supply and demand had resulted in a lot of human misery. Though consumer demand rose and exports were at an all-time high, packing capacity was lower than necessary. It was the first time in years that production exceeded slaughter capacity. As a result, the price paid to the farmer was driven down sharply.

PROPOSED ECONOMIC INDICATORS

♦ **Relative price farmers receive for hogs**

Return on investment is the most obvious measure. The price farmers receive relative to production costs. Every segment needs to get its profit.

♦ **Increasing return on investment.**

A vast amount of investment is needed at the production level. Competitive return on investment at production level.

♦ **Stability in price cycles, less volatility in market.**

Not consensus, because many producers live on price cycles.

♦ **Money is being put aside during good times.**

A safety net, trust fund, or revolving fund to give low interest loans for start-ups and during hard times. This mechanism recognizes that economic cycles take place.

♦ **Flexibility in capital investments**

We need to have capital investments with flexible uses. Capital investments are the fixed and durable cost of production such as concrete and steel. If fixed cost is high, you have marketing clout. But you don't need marketing clout if you don't have high fixed cost.

♦ **Ability to maintain market access**

Who is funding the big operations? Processors would rather not.

♦ **Source of capital is not controlling production choices.**

Bankers perhaps are driving farmers' decisions.

♦ **If a variety of money sources are willing to invest.**

If the community at large is willing to invest, this would indicate a high level of confidence in the industry.

♦ **Must have low-cost ways of entering business**

♦ **Reflecting the true cost of production, including externalities.**

A system that has minimal cost associated with meeting externalities. This effectively reduces cost to the producer.

♦ **Demand for product**

♦ **Increased organization around a cooperative structure.**

There is a fundamental disjunction between quarterly profits and ecological natural systems. Unstopped growth is not natural. It is hard to see how corporate structure is compatible with sustainability. Increasing organization around a cooperative structure.

♦ **More profit is returning to the farm.**

The division of profits needs to be shifted towards those with a long-term outlook. With money goes control.

PORK WORKING GROUP: SOCIAL INDICATORS

Note: All of the indicators discussed during the brainstorming session were proposed.

PROPOSED SOCIAL INDICATORS

- **Adequate opportunity for new producers to enter the business**

- **Stewardship for the long term, considering long term values**

- **Activities taking place based on people values rather than corporate values. Family control**

- **Just, fair , and appropriate compensation for labor**

- **A shared burden of meeting costs of externalities between farmer and community**

- **A socially acceptable production system, one which meets community standards**

- **A willingness to try different systems, alternatives**

- **Regional differentiation of products, unique to a local culture**

- **Production system should link to its community**

Producers should not be an island, but contribute to community economy. Money changes hands locally

- **Consumer awareness of sources of food,** so the consumer is more aware of the challenges facing farmers.

- **More hog farmers**

So a single event in a single location won't have such a large impact. More processors. De-consolidate.

- **Consumer awareness of food is a trend, not a fad**

Has this whole thing has gone full circle? Old timers have seen it all happen before. Is this a trend or fad? Is it going to naturally evolve into more small farms and packers?

- **An increased proportion of owners/investors living on farm. An increased eyes to land ratio**

PORK WORKING GROUP: ENVIRONMENTAL INDICATORS

The group accepted all of the indicators discussed during the brainstorming session.

PROPOSED ENVIRONMENTAL INDICATORS

♦ **Air quality impacts on animal and worker**

On-farm air quality issues include particulate matter, ammonium and carbon dioxide, especially inside the hog facility. Odor is an issue with the neighbors. Off-site effects were not discussed.

♦ **Carrying Capacity**

The environmental concerns about water, nutrient loading, odor are all subsets of carrying capacity. It is the concentration of animals that is the issue, because the number of hogs have not increased, but the problems have. We must consider cause and effect, and effects will be variable from place to place.

♦ **Manure is seen as an environmental asset rather than a liability**

To handle pollution, we need to use and mimic natural systems as much as possible. The group discussed how to deal with waste in a different way, rather than liquid handling systems. The idea to use manure as nutrient cycling was suggested as appropriate terminology, as opposed to a man-made word like "management plan" to describe an environmental indicator. A valuable indicator would be a measurement of the amount of waste being recycled internally, used as input to the same system. If used in this way, waste can be seen as an environmental asset instead of an environmental liability.

♦ **Surface and ground water is clean, as measured by biological and chemical indicators. Nutrient and pathogen levels should meet or exceed the best quality standards**

Water quality may be measured by dissolved O2 levels, nitrogen and phosphorous, types of life found. Ground water and surface water are both important, particularly farm wells to protect families from exposure. Q: do we accept a sustainable system allows a certain level of contamination (up to the standard) or is the goal zero contamination. All water level pollution standards are currently set to the highest use (toxicity for total body contact, drinking water). The goal would be to meet and exceed or improve standard -not to make it worse and perhaps to make it better. The clean water act's goal is to achieve zero discharge. Nutrients are necessary in aquatic ecosystems, but need to not impair ecosystem function. Standards for nutrients are evaluated in a different light than for synthetic chemicals. A lot of these chemicals are safe for humans but not for other biota.

♦ **Production, processing and consumption are in a relatively small geographic area**

How widely can elements of a system be dispersed before it becomes unsustainable? Infrastructure should be on local geographic scale to reduce energy costs. Foraging scheme for cows: have cows do as much work as possible. Have livestock do work that would normally be done by fossil fuels. This is a measure of the degree to which a production system performs ecosystem functions.

♦ **Organic matter is stable or increasing on farm soils and soil erosion is decreasing**

Soil erosion is not directly a problem for pork farmers but it is a concern for feed production. We need to look at the system and identify net change. Farmers do not always use the NRCS soil loss equation. Farmers watch organic matter content and are trying to increase this. If we can increase organic matter content we are building topsoil. The problem with soil erosion is not just the loss of soil but the things that go with the soil into the receiving water (runoff). Most farmers are watching soil erosion. Organic content would be an indicator of soil growth, loss and health. Organic matter has a big effect on the resilience of a farm. Soil microbiology can be analyzed for diversity of life. Elaine Ingham at Corvallis at Oregon State does microbiology.

♦ **Increased use of on-farm, farmer-based soil tests**

Ability of producer to look at soil and know a difference. A farmer can simply take a handful of soil from a natural system like a prairie remnant and compare the color and smell with soil from the field. You have got to have something the farmer can look at and say this is better. One of most infective activities is visiting other farms and seeing their practices.

♦ **Availability of risk insurance for adopting sustainable practices**

What is in sustainable agriculture for industry? Currently they offer insurance for farmers not using rootworm pesticide, to pay if they have root worm loss. So if you use a practice and have a loss, it will pay just like regular insurance.

Increased biodiversity on farm.
Biodiversity of fauna and flora and diversity of farm production. Diversity is also necessary economically and socially. Could fail in the economic test. There needs to be efficiency in the overall system. Incorporating scotch pines into soybean fields reduces pest control. Perhaps a 500-sow operation with 600 acres of corn soybean would be a manageable amount of diversity. Diversity beyond that may detract from economic indicator of sustainability. Need to consider necessary profit margin. Also need diversity of insects. In Michigan integrated pest training is required for all pesticide applicators. At Cass high school in Detroit, no pesticides are being used. Kids bought it and pushed administration.

- **Increase in the proportion of food dollar going to the people with a vested interest in environmental protection (farmers)**

Monsanto is almost completely divested of the chemical business. Now they mostly own seed companies. The market is going to work because large companies are being pressed, we will see a lot of changes.

- **Expanded vision of the environment**

Reduction in use of therapeutic and preventative medication in Swine. Antibiotics, for example- Sweden has eliminated these. This will lead to fewer health problems. Eliminate endocrine disrupters: Very minute changes in blood chemistry can be very disruptive.

- **Increased availability and adoption of alternative practices and structures like hoop structures**
- **FFA adopts sustainability as a theme**

Sustainable agriculture needs to be acceptable to the broader audience. Government and academics should publish information on alternatives and alternative practices should be reflected in published standards. This is a key point to move forward. Theories need to be supported by scientific method before this happens.

- **Processing plants are dealing more effectively with waste, managing them as a resource**

So much of the impacts are in the processing and consumption level. There are enormous inefficiencies and use of fossil fuels. One current solution is a composting operation for paunch waste, which can be used back on the farm as a nutrient. Waste management during processing should use waste as a resource. To what extent can by-products be used as inputs? To what extent is the packing plant being a good neighbor? Are they aware of community concerns? Concentrated processing is a pollution problem. Increased number of processors would disperse wastes more.

5. PLENARY DISCUSSION: NEXT STEPS: ACTIONS TOWARDS SUSTAINABILITY

The workshop concluded with a discussion of concrete actions to be taken by each stakeholder group in order to progress towards sustainability.

Farmers

- Utilize the information on indicators that already exists
- Host field trips of schoolchildren. You can charge them depending on what sorts of things they want to see
- Sponsor and encourage apprenticeship programs with local youth through schools or other agencies

Educators / Academics

- Publish this information in scientific journals
- Organize high school debates about sustainable development.
- Establish a kindergarten through high school educational program that involves sustainable agriculture
- Change the way research funds are allocated to enable smaller state organizations to obtain funds for local research
- Encourage exchange and greater collaboration among University departments, such as Natural Resources and Environment, Public Health, Business Administration, and Biology.
- Encourage colleagues to challenge traditional relationships with chemical, biotechnological and agribusiness corporations

Policy

- Implement labeling laws to inform the consumer of what they are consuming
- Use a systems approach to draft policy
- Include an assessment of sustainability in the development of any sort of policy in a similar way to how policy is submitted to cost/benefit analysis
- Evaluate research and policies on basis of sustainability in addition to economics
- Draft the indicators that we have come up with more specifically and present them as possible policy for legislators
- Citizens should have more say over where their tax dollars are allocated – away from defense spending towards more sustainable policies
- Make presentations at the Future of Agriculture Policy Task Force held by Senator McMannis in meetings that he is holding around the state
- End all subsidies to non-local agriculture
- Diversify state policies instead of having blanket policies that are supposed to apply to all agriculture around the state
- Take political action locally in the form of referendums such as Proposition 1 in the last election

Individuals / Consumers

- Buy local and organic – each person's example is the best educational tool
- Get a worm bin
- Get to know your grocer and farmer
- Educate your local government representatives about what is going on in your local agricultural community so that government does not just hear from the corporations but also from individual constituents
- Talk to industry and establish a dialogue with them so that differences are at least understood. There can be no progress until both sides understand each other which will never happen if both sides refuse to talk to each other
- Write a letter to the editor and to the White House. The White House regards each letter they receive as representative of a view shared by 10,000 people

The Center for Sustainable Systems (former National Pollution Prevention Center)

- Continue to involve and update all of these stakeholders here at the conference and represent all these interests at the National Town Meeting
- Publicize the conference and continue it via the Web.
- Consider having Stage 2 of this conference either with these same people or conduct the same conference with different participants
- Use university connections to forge an alliance with academics involved in the department of Public Health so that there is a strong coalition of various interests with a convincing case for sustainable agriculture. Perhaps there is a link that could be made between the current health care crisis and food production
- CSS (NPPC) should come to the Great Lakes Sustainable Development conference because there are only a few representatives from sustainable agriculture and they could use the support and validation
- Develop these indicators as practical tools that can be referred to by citizens, farmer organizations, neighborhood groups and educators
- Consider forming a coalition with the Michigan Citizens Against Toxic Substances who have recently purchased a large tract of farmland, which could be transformed into a model of sustainable agriculture
- Continue to explore parallels between systems thinking in industrial ecology and sustainable agriculture.

Communities

- Encourage community-wide education and outreach: inject the issue of food production into the public discourse. A head of lettuce that provides 50 kcal to diet takes 400 kcal to produce in CA and uses 1800 kcal to ship. This represents a huge energy loss; food should be produced locally so that there is a net increase in energy, not decrease. Another example of this is that 75% of the food in New England supermarkets comes from outside this country.
- Take advantage of this moment in history to espouse the dire need for sustainable food production. Food safety has received a lot of press lately, as has genetically modified foods, increasing resistance to pesticides, and the weakening of environmental standards due to international trade treaties. We should take advantage of the depressing news to showcase the benefits of sustainably produced foods.

6. ATTACHMENTS

1. Workshop Agenda
2. List of Participants
3. Updated Resource List
4. Additional Papers
5. National Town Meeting Poster

WORKSHOP AGENDA

A Life Cycle Approach to Sustainable Agriculture Indicators
February 26-27, 1999
Michigan League, University of Michigan
FINAL AGENDA

FRIDAY, 26 FEBRUARY, Henderson Room

8.00 Registration and breakfast

Background: LCA and Agriculture

9:00 Welcome and Introduction to the NPPC/ CSS
Dr. Jonathan Bulkley, NPPC
9.20 Overview of Life Cycle Assessment and Its Application to Sustainable Agriculture
Dr. Greg Keoleian, NPPC
9.45 Sustainable Agriculture
Dr. David Pimentel, Cornell University
10.15 *Break*
10.25 Welcome to School of Natural Resources and Environment
Dean Daniel Mazmanian

Future Vision: Dimensions of Agricultural Sustainability

10.30 The Economics of Sustainable Agriculture: It is More Than Just Money
Dr. Mike Duffy, Iowa State University (read by Dr. Dennis Keeney)
11.00 The Social Dimensions of a Sustainable Agri/Culture
Dr. Gerry Campbell, University of Wisconsin
11.30 Linking Soil Quality, Water Quality, and Ecosystem Health
Dr. Dennis Keeney, Iowa State University
12.00 *Lunch - Koessler Room*

Working Groups: Overview of Sectors and Case Studies

1.00 Presentation of working group process
Ms. Guntra Aistars, NPPC
1.15 Discussions in working groups - past events and present trends
Dairy: Room D; **Fruit:** Henderson Room
Grain: Henderson Room; **Pork:** Room C
1.45 Case Study Farm Presentations
Dairy: Wayne Craig; **Fruit:** Mitchell Lynd
Grain: Dean McIlvaine; **Pork:** Mike Natvig
2.15 Sector Overviews and Comparative Case Studies
Dairy: Tom Kriegl **-** Center for Dairy Profitability and Eldon Christophel, Michigan Dairy farmer; **Fruit:** Hugh Bowling
Grain: Bob Fogg, Gene Ford, Henry Miller; **Pork:** Sam Hines
2.45 *Break*

Sustainability Indicators: Economic and Social

3.00 Brainstorm and draft Economic Indicators in Working Groups
4.00 Brainstorm and draft Social Indicators in Working Groups
5.00 Plenary: Reports from Working Groups
6.00 Conclusion

SATURDAY, 27 FEBRUARY, Room D

8.00 Continental Breakfast

Sustainability Indicators: Environmental

8.30 Panel Discussion : "Multiple Perspectives on Environmental Sustainability"

9.45 *Break*

10.00 Working Groups: Environmental Indicators
Dairy: Room D, **Fruit:** Room B, **Grain:** Room A, **Pork:** Room C

11.00 Working Groups: Review and confirm all indicators

12.00 *Lunch* (All rooms- discussions may continue)

1.00 Plenary: Reports form Groups. Discussion and questions on all indicators

Next Steps: Actions Towards Sustainability

2.30 Plenary Discussion: "Actions Towards Sustainability"
Identify changes in practices/ technologies to be implemented by each stakeholder group in order to progress towards sustainability

3.30 Feedback, Future Meetings

4.00 Conclusion

This event is affiliated with the National Town Meeting for a Sustainable America being held in Detroit, Michigan from May 2nd through the 5th, 1999. The National Town Meeting, together with its Affiliated Events, including a series of Journey to Detroit events that have been held over the last year, is drawing together thousands of people from across the country to recognize and focus attention on a national movement towards a Sustainable America, focusing on sustainable solutions that are available today and ways to take advantage of them. The National Town Meeting will mainstream sustainability and communicate a message that we can meet our environmental and social goals while achieving economic vitality. Hosted by City of Detroit, the National Town Meeting is being co-sponsored by the President's Council on Sustainable Development and the Global Environment & Technology Foundation.

Sustainable America

A National Town Meeting
Detroit, Michigan and Points Across America
The National Pollution Prevention Center for Higher Education, A Proud NTM Partner

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UPDATED RESOURCE LIST

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Sustainable Agriculture Network, USDA Sustainable Agriculture Research and Education
http://www.sare.org/san
North Central Region Homepage - http://www.sare.org/san/ncrsare/

USDA Economic Research Service: *Agricultural Resources and Environmental Indicators* - http://www.sare.org/san/ncrsare/

USDA Draft Unified National Strategy for Animal Feeding Operations - http://cleanwater.gov/afo/

EPA Environmental Indicators Site - http://www.epa.gov/Indicator/

Pesticides: Ecological Incident Information System(EIIS) - http://www.epa.gov/indicator/county/aboutpes.html

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Core Values- Apple Pesticide Reduction and Green Marketing- www.corevalues.org

University of Wisconsin at Madison’s Center for Integrated Agricultural Systems – www.wisc.edu/cias

ADDITIONAL PAPERS

Wisconsin Dairy Grazing Profitability Analysis

Preliminary Third Year Summary

DRAFT

Tom Kriegl
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Presented at the Life Cycle Approach to Sustainable Agriculture Indicators Workshop
Ann Arbor, Michigan
February 26, 1999

Is grazing or conventional dairying more profitable? Many are eagerly awaiting the definitive study to prove that one of the systems is clearly superior in most if not all ways. Not only will we wait a long time for that study, but the expectation for it distracts us from the more important question of –"Which system is best for your family and

There will never be a study to determine for once and for all and for all conditions that grazing is more or less profitable than conventional dairy farming in the humid part of the US. This is because the "state of the art" allows some practitioners of each strategy to be successful. Secondly, management continues to be the single most important factor determining business success in farming (and in many other businesses too). We can see the evidence of the importance of management everyday.

We are all very aware that many variables affect productive performance, and economic performance is subject to all of these variables plus the added uncertainty of price variability.

We know that grazing is the "conventional" system in New Zealand, Ireland and other places.

Even before the Wisconsin Dairy Grazing Analysis (though we lacked the on farm financial data we desired), we knew that some graziers succeed while others fail. We knew the same was true for conventional operations. There have been more studies addressing the economics of grazing than most people realize but all of these studies have limitations, most of which are due to the scarcity of graziers with several years of good data. Graziers in Wis with several years of good data are quite scarce relative to conventional dairy farmers. The same is true in most other states.

Still, most of these studies and the Wisconsin Dairy Grazing Analysis confirm the above observations-that Grazing (Management Intensive Rotational Grazing- MIRG) is an economically viable alternative for many Wisconsin farm families.

STUDYING GRAZING PROFITABILITY

The key to profitability in any business, including a farm, is to maximize the positive difference between price and cost on as many production units as possible. This is easy to say in general terms but more difficult to accomplish in practice. Grazing proponents believe that grazing helps accomplish this objective at least in part by reducing costs.

As with conventional farms, one size does not fit all in grazing operations. So in addressing the question "Is grazing more profitable than conventional dairying?" it's important to address the question in a couple of different ways and to define the type of operations being compared.

If the absolute relative potential profit level of the system is being compared, then operations that are well designed for one system should be compared with other operations well designed for the other system. A number of modeling studies have done this.

Yet the largest number of potential graziers in Wisconsin are farmers who currently dairy conventionally (mechanical harvest, year round feeding and milking). Most of these dairy farms who switch to grazing will retain the financial obligations of their conventional system, probably for several years after grazing begins to the extent that if grazing enhances profitability, this enhancement will likely be less for these transitional graziers vs. the "ideal" grazing situation. These transitional farms must be studied too.

Only recently has it been possible to get access to enough actual farm data to compare the profitability of an "ideal" grazing operation with transitional grazing operations and with conventional operations. The following definitions will be applied with judgement since there is so much variation among grazing operations. In fact, the following may more appropriately be called descriptions than definitions.

<u>To be included in the study, a dairy farm practicing management intensive rotational grazing (MIRG)</u> had to be big enough to potentially support a family in exchange for family labor (this doesn't preclude hired help.) Dairy and forage (often grass) are the major enterprises and the dairy cows graze about half of the forage they consume. Cows are rotated daily in most cases. "Winter" forage is likely to be raised on the farm in a typical year. Grain is likely to be fed in near conventional amounts although grain is less likely to be raised on the farm. Being a low or high input operator alone doesn't eliminate someone being considered a grazier.

Youngstock are likely to graze on the farm. The grazing operation may or may not practice seasonal calving.

<u>A "typical" low capital grazing operation</u> then is loosely defined for Wisconsin as one in which the assets are more or less ideally suited for grazing and where the livestock harvest at least half of the forage consumed in a typical year. The investment (and fixed costs per cow) represented by land, buildings, and equipment is less than in a conventional or transitional grazing operation for several reasons: 1) much of the land <u>may</u> be steeper, stonier or wetter than class I, II or III soil, 2) there is less machinery and/or it's older, 3) there are fewer buildings and are usually older, 4) or if the operation has the land, buildings and equipment that would allow it to be farmed conventionally without much additional investment, the grazier bought it for a discounted price.

<u>Transitional (high capital) graziers</u>

Any farm with enough land, buildings and equipment to farm conventionally but also has chosen the grazing practices described above recently enough to have the investment structure of a conventional farm is considered a transitional grazier because it has a foot in both systems.

Also important to the definition of this category is that the land, buildings and equipment were not obtained at a discounted price.

The typical transitional grazier probably has been grazing for a shorter period of time than is the case for "pure graziers". The transitional grazier is more likely to raise and feed grain in larger quantities and is less likely to practice seasonal calving.

Categorizing graziers into the low capital and transitional categories still relies heavily on judgment. However, the key difference is that the "ideal" low capital grazier has very little invested beyond what is needed for a grazing operation. Therefore their profit potential should be greater than for transitional graziers.

Appendix one provides some information about the two (low capital and high capital) groups of graziers in the study in terms of how well that they fit the definitions. Investment data from appendix two provides additional data.

The average low capital grazier averages fewer years of farming experience but more years of grazing experience. However, if two long time graziers were omitted from this group, the remaining low capital graziers would only average 8.5 years of farming and 3 years of grazing.

The average low capital grazier has fewer cows, and fewer harvested acres. The low capital graziers are less likely to harvest any forage mechanically or grow grain. They harvest one-half less acre of land per cow.

The low and high capital graziers harvest 3.6 and 4.1 acres per cow respectively despite the fact that most of them buy some if not all of their grain. This compares with the old thumb rule of needing 3 acres per cow in Wisconsin to provide all the feed needed for a cow and her share of the youngstock except for mineral and protein supplement. Only one grazier in the study feeds little or no grain.

BENCHMARKS

One of the original purposes of the Wisconsin Dairy Grazing Analysis was to provide financial benchmarks for graziers. Developing reliable benchmarks requires much information. It's also very important to understand how to use the benchmarks. Unfortunately that understanding is seldom gained easily or quickly.

To effectively use benchmarks to project the success of any business including a grazing dairy, its important to have a good understanding of enough benchmarks to project and monitor the relationship of income generation and the control of investment and operating cost.

Benchmarks can be used to summarize the many important underlying details of a part of a farm business financial situation. They can be used individually as indicators of strengths and weaknesses of a business. They can be used together to assess the overall financial performance of a farm business. To do this effectively, one must have at least a decent understanding of the type of business being analyzed. Its not good enough just to know if a key financial measurement deviates significantly from a benchmark value. You need to know why it deviates. Not until one knows why it deviates can one accurately say whether it's a problem or not, and if its a problem, what could or should be done about it.

Never use one benchmark to make important decisions and don't think of benchmarks as absolute values. In other word, no single benchmark will guarantee success or failure. Still, some benchmarks are more important than others.

Fortunately we have universally reliable values for the two most comprehensive and therefore most important benchmarks, which are the rate of return on assets (ROROA) and rate of return on equity (ROROE).

The benchmark values for ROROA and ROROE are the same for all types of dairy operations--in fact for all businesses. Both should be higher than the rate of inflation and higher than the interest rate one is paying on borrowed money. For those who are debt free, ROROA and ROROE should be higher than inflation and higher than one's opportunity cost.

Two other important features of ROROA and ROROE are that they can be used to compare businesses (farms) of different sizes. Secondly once you calculate one, calculation of the other one is easy.

The third year analysis of this study is more ambitious than the first two years and more ambitious than most if not all other grazing profit studies because of the intent to compare two types of graziers with each other and with conventional farms, in addition to comparing the top with the bottom performers in each group. This is one of the reasons the third year analysis isn't complete. However the study has already provided a lot of interesting and useful information that is described briefly as follows and in the appendix tables.

A preliminary three-year analysis indicated that ROROA and ROROE values for the low capital graziers in the study exceeded the interest rate on borrowed money in 1995 and 1996. The ROROA and ROROE for low capital graziers in 1997 and for the average high capital graziers in all three years were close to the interest rate on borrowed money. Neither the actual ROROA and ROROE numbers nor a direct comparison with conventional Wisconsin dairy farms is being provided yet because adjustments still must be made to insure that the values calculated for graziers are based on the same assumptions as used for calculating these values for conventional farms.

Net farm income from operations per cow (NFIFO/cow) is another benchmark that can be used to make "apples to apples" comparison of financial performance between businesses of different sizes. It also directly measures the impact of two of the three most important components of profitability-operating income and operating expense.

In this comparison, NFIFO/cow for the low capital graziers was higher than the NFIFO/cow for the high capital graziers in 1995 and 1996 but not in 1997. The conventional farms were lower in all three years. Interestingly enough, the NFIFO/cow trends upward for the high capital graziers and downward for the other two groups from 1995 to 1997.

The $2160 range from the lowest to highest NFIFO/cow value from grazing is astounding especially from a group as small as 20 farms.

In terms of investment per cow, the high capital graziers had the highest level in two of three years. The low capital graziers had investment levels that were considerably lower but probably higher than most people expect. The high/low range in this value for the graziers in the study is also large have influenced profitability.

The comments made about investment per cow apply to debt per cow with one addition. Looking at the individual graziers data, the debt level has been influencing profitability much more than investment levels.

Basic cost per hundred weight of milk produced (hereafter referred to simply as basic cost), is another useful measure. Basic costs are all the cash and non-cash costs except interest, depreciation, labor, and management. The fact that some farms have only unpaid labor while others pay family members or non-family hired help makes it difficult to compare farms fairly on a total cost basis. The costs of interest, depreciation and management also have characteristics that make direct comparisons difficult. That is why a concept such as basic cost (this concept has been popularized by Dr. Gary Frank of the U.W. Center for Dairy Profitability) is so useful.

Unfortunately an average basic cost value is not calculated yet for each grazing group but the high and low basic costs for the 20 graziers in the study can be compared with the average basic cost of the 800 plus conventional dairy farms in the Fox Valley and Lakeshore Farm Management Association (FFAMIS) data set.

Physical Performance Indicators

The average herd size has increased in all three groups but the conventional herd average is about twice as large as the low capital graziers with the high capital group fitting almost half way in between.

In pounds of milk sold per cow, the average confinement farm was consistently higher than the high capital graziers and the low capital graziers who were consistently lowest. However production per cow increased for the average conventional farm and decreased for both grazier groups from 1995 to 1997.

Economic Impact of Selected "Low Input" Practices

Those who promote seasonal calving, organic farming, and non use of DHI often describe these strategies as low input. Promoters often predict that these practices will enhance profitability because of their "low input" nature.

In addition to having separated all the graziers into low and high capital groups, the 20 graziers were also separated six other ways to calculate the average financial performance of seasonal vs. non-seasonal calving; organic certified vs. non-organic certified; and DHI use vs. non-DHI use herds in the study.

It's important to recognize that even three years of data from 20 farms still represents a very small number of observations on which to base solid conclusions. So when dividing an already small number into smaller numbers still, one must be even more cautious about conclusions. Still in the absence of better information one can make some comparisons knowing that they fit those specific farms in those specific circumstances.

As luck would have it, all of the graziers in the study which are fully seasonal in calving strategy as well as all of the organic producers are within the low capital category. Four of the eight low capital graziers are fully seasonal. Three of the low capital graziers are certified organic producers. Two of these graziers are both fully seasonal and certified organic. None of the fully seasonal herds use DHI but the only all-year calving strategy herd that is certified organic does. This is a long way of saying that in this low capital grazier data set, those graziers which are fully seasonal are quite likely to be certified organic and unlikely to use DHI. They may be the least conventional (conventional in this case being traditional WI confinement dairy) group among the graziers in the data set.

Among the low capital graziers group, those which are not fully seasonal, are not organic certified, or use DHI have higher net farm income from operations per cow NFIFO/Cow than their fellow graziers who follow the alternate practices.

This also holds true when the high capital graziers are brought into all three comparisons, even though the amount of difference decreases in financial performance for the three practices in question.

A careful study of all of these comparisons within the low capital group shows that the fully seasonal, organic certified, non-DHI herds also tend to have substantially more debt per cow despite having a lower investment per cow. When compared to their opposites among all the graziers in the study, these graziers using the "minority" practices had slightly less investment and debt.

While MIRG has provided economic performance to most of the twenty graziers in the study that was competitive with conventional farms, the graziers in the study using at least one of the “three low input” strategies were less competitive.

The three year analysis of top and low performing graziers hasn’t been completed yet but the second year analysis did this using the first two year's data from 26 individual farms. Only one of the participants that dropped out of the study at the end of the second year is not farming today.

Here are some of the highlights from the 1996 Annual Report (second year) of the Wisconsin Dairy Grazing Analysis.

Comparing the top 33% versus the bottom 33%, the following observations can be made from the 1996 data (<u>recognize that some low and some high capital graziers fit into each extreme</u>).

1) Financial efficiency was higher among the top 33%. In other words, operating interest, and depreciation expenses were each a lower percentage of gross farm income (GFI) for the top 33%.

2) The top 33% had more cows, higher production per cow, received a higher milk price, <u>had similar per cow expenses and lower per cwt. expenses</u>.

3) The top 33% owned a larger percent of their business assets and had a lower percent of debt.

4) The top 33% had a greater total investment per cow but less debt per cow.

5) For the top 33% profit farms, 1996 and 1995 compared this way: profit (NFI, ROA and ROE), cash expenses per cwt., milk price and net worth were higher in 1996; debt per cow declined in 1996.

To summarize the above points with an added observation, graziers in general are controlling costs and controlling investment a bit better than "conventional" farmers. However, "conventional" farmers tend to be better at generating income. The graziers (and "conventional" farmers too) that enjoy the best financial performance focus on optimizing the relationship between income generation and the control of cost and investment. Graziers who cut costs and investment without regard to impact on income are taking a different road to the same dismal place as conventional farmers who maximize income without regard to cost and investment levels.

Several individual graziers in this study that are doing extremely well can be found in both the low and the high capital group. They are the graziers who balance the relationship between income generation and the control of cost and investment. They are also combining the best financial performance features of both systems. These graziers seem to be more concerned about making a profit than they are in fitting any kind of a stereotype.

There are also participants in the study that are not doing well because they are so focused on cutting costs that they are willing, consciously or not, to give up more than a dollar of income when they save a dollar of cost. They are combining the worst financial performance features of both systems. There are other graziers in the study that are not doing well financially because of liabilities left over from their old system.

Some additional insights (these may or may not be surprising) include;

The grazing system is more economically flexible than the confinement system. For example someone who invests in a well planned grazing operation will likely be able to recover most of their investment in assets if a few years later they decide to switch to a confinement system or quit farming entirely. In contrast, if you invest "from scratch" into a new confinement system, and decide to change or quit in a few years, you will be lucky to recover half of what you invested in the confinement system.

Because of a significantly lower investment requirement, on the average for a given number of cows, a grazing operation may generate more dollars of net farm income with a higher percent of that net farm income in a more liquid form. This suggests that funds available for annual family living desires could be higher on a grazing farm of the same size and same net farm income level.

Grazing is most attractive to new dairy farmers who wish to minimize their total capital investment and wish to remain relatively small (less than 300 cows), but grazing can be adopted successfully by conventional farmers too. Not everyone who tries grazing will be successful. This is true for anything else.

Grazing systems may be the only viable (vs. confinement) choice for a beginning farmer starting "from scratch" at herd sizes less than 300 cows. Grazing systems should be competitive at larger herd sizes too.

Acknowledgement

I am very grateful to the Wisconsin graziers who are participating in the study survey, and to Wisconsin County Extension Agricultural Agents, the Soil Conservation Service, and Grazier Networks for all of their help in providing data. I also thank Arlin Brannstrom, Gary Frank, and Jenny Vanderlin for their help in providing the conventional farm data, Larry Baumann, Sandy Costello, Rick Klemme, Lee Milligan, Stan Schraufnagel, Terry Smith and Michelle Weighart for initiating the study, and Bruce Jones, Director of the Center for Dairy Profitability for his support of the project.

Appendix 1 - Comparing Selected Characteristics of Two Types of Graziers in the Wisconsin dairy Grazing Profit Study.

	Low Capital Graziers		High Capital Graziers		All Graziers with 3 Years Data	
	#	%	# of farms %	% of farms	# of farms	% of farms
Number of Graziers	8	40	12	60	20	100
Calve All Year	3	37.5	6	50	9	45
Calve Semi-Seasonally	1	12.5	6	50	7	35
Calve Seasonally	4	50	0	0	4	20
Average Number of Cows for Three Years	41	0	64	0	53.55	0
All Holstein Herds	3	37.5	8	67	11	55
Herds with no Holsteins	2	25	0	0	2	10
Organic Producers	3	37.5	0	0	3	15
Use DHI	3	37.5	8	67	11	55
Farming Experience and Acres refer to 1995	#	Acres	#	Acres	#	Acres
Average Years of Farming Experience	14.63	0	0	20.4	0	18.1
Average Years of Grazing Experience	10	0	0	3.3	0	7
Ave. # of Acres Owned	0	137.5	0	229.5	0	192.7
Ave. # of Acres Rented	0	52	0	65.6	0	0
Ave. # of Acres Tillable (Even if Pastured)	0	130.4	0	227	0	188.3
Ave. # of Acres Forage Harvested Mechanically	0	37	0	57.8	0	51
Ave. # of Acres Pastured	0	91	0	52.6	0	67.9
Ave # of Farms Growing Small Grain for Forage	0	0	1	5	1	5
Ave. # of Acres of Small Grain/ Farm in Group	0	0	0	1.7	0	1
Number of Farms Growing Corn Silage	2	10	5	25	7	35
Average Acres of Corn Silage/Farm in Group	0	1.9	0	16.7	0	10.75
Average Total Forage Acres Harvested	0	180	0	188.3	0	165
Number of Farms Growing Corn Grain	1	5	4	20	5	25
Average Number of Acres Corn Grain /Farm in Group	0	9.4	0	33.8	0	24
Number of Farms Growing Soybeans	0	0	3	15	3	15
Average Acres Soybeans Grown/Farm in Group	0	0	0	5.2	0	3.1
Number of Farms Harvesting Small Grain	0	0	5	25	5	25
Average Acres Small Grain	0	0	0	7.2	0	6.1

Number of Farms with Non-Forage Harvested Acres	1	5	0	46	0	33
Average Total Non-Forage Acres Harvested	0	13.9	5	25	6	30
Average Forage Acres Harvested/Cow	0	3.23	0	3.4	0	3.35
Average Non-Forage Acres Harvested/Cow	0	0.37	0	0.7	0	0.55
Average Total Acres Harvested/Cow	0	3.6	0	4.1	0	3.9

Appendix 2 - Comparing Selected Financial Performance Two Types of Graziers and Conventional Farms

NFIFO = Net Farm Income from Operations
FFAMIS = Farm Financial Analysis and Management Information System which is the name of the Computer system used by the Fox Valley and Lakeshore Farm Management Associations. There are data from over 800 farms on the FFAMIS system.

	Ave. of 8 Low Capital Graziers	Ave. of 12 High Capital Graziers	FFAMIS	Highest Among 20 Graziers	Lowest Among 20 Graziers
NFIFO					
1995	37,623	40,877	32,496	97,450	(4,444)
1996	33,312	42,452	37,263	109,707	(11,504)
1997	28,770	52,605	34,186	105,595	(2,827)
NFIFO/Cow					
1995	959	694	426	1662	(193)
1996	795	645	448	1832	(338)
1997	689	792	370	1627	(83)
Basic Cost/Cwt.					
1995			7.85	9.72	5.00
1996			8.55	14.65	5.70
1997			7.41	11.19	4.84
Invest/Cow					
1995	4,877	7,798	7223	11,439	1,384
1996	4,992	7,154	7630	9,689	2,947
1997	5,294	7,045	6752	9,795	3,557
Debt/ Cow					
1995	1,366	2,695	2507	4,664	0
1996	1,442	2,662	2604	5,872	0
1997	1,592	2,910	2748	5,583	0
Number of Cows					
1995	39	59	76	104	23
1996	42	66	84	130	30
1997	42	66	92.5	132	27
lbs Milk/Cow					
1995	15,708	17,861	18436	23,702	6,478
1996	14,354	16,737	18493	23,508	3,531
1997	14,260	16,747	19057	24,000	4,412

Appendix Three -- Comparing Selected Financial Low Capital Graziers Separated by Use of Three Other Management Practices

NFIFO = Net Farm Income from Operations
FFAMIS = Farm Financial Analysis and Management Information System which is the name of the computer system used by the Fox Valley and Lakeshore Farm Management Associations. There are data from over 800 farms on the FFAMIS system.

		Average of 4 Non Seasonal Low Capital Graziers	Average of 4 Seasonal Low Capital Graziers	Average of 5 Non Organic Low Capital Graziers	Average of 3 Organic Low Capital Graziers	Average of 3 DHI Low Capital Graziers	Average of 5 Non DHI Low Capital Graziers	Average of 8 Low Capital Graziers
NFIFO								
	1995	44,650	30,596	40,877	32,200	46,045	32,570	37,623
	1996	45,271	21,354	39,571	22,881	48,831	24,001	33,312
	1997	43,823	13,717	33,640	20,652	45,354	18,819	28,770
$ NFIFO/Cow								
	1995	1,110	787	1,006	852	1,173	814	959
	1996	1,093	521	957	558	1,195	574	795
	1997	1,057	352	796	552	1,113	460	792
Invest/Cow								
	1995	5,980	3,774	4,509	5,491	6,607	3,839	4,877
	1996	5,728	4,257	4,626	5,604	6,368	4,167	4,992
	1997	5,923	4,667	4,846	6,042	6,559	5,336	5,294
Debt/Cow								
	1995	1,248	1,483	985	1,834	1,078	1,555	1,366
	1996	1,095	1,788	1,184	1,724	935	1,712	1,442
	1997	1,061	2,123	1,308	1,925	964	1,937	1,592
Number of Cows/Farm								
	1995	39.5	39	40	38	38	40	39
	1996	41	43	44	39	40	43	42
	1997	41.25	43	44	38	40	43	42
Lbs Milk/Cow								
	1995	16,670	14,747	16,127	15,010	16,865	15,014	15,708
	1996	15,973	12,735	14,414	14,253	16,287	13,194	14,354
	1997	15,875	12,646	14,609	13,678	16,493	12,920	14,260

Appendix Four -- Comparing Financial Performance of 20 Graziers when Separated For Calving Practice, Organic Certification, DHI Use

	16 Non Seasonal Graziers	4 Seasonal Graziers	17 Non Organic Graziers	3 Organic Graziers	11 DHI Graziers	9 Non DHI Graziers	Average of 20 Graziers
NFIFO							
1995	43,157	30,596	40,877	32,200	49,927	28,113	39,576
1996	50,263	21,354	41,605	22,881	49,927	25,191	38,796
1997	17,564	13,717	46,679	20,652	48,954	26,681	42,569
NFIFO/ Cow							
1995	780	787	769	852	852	694	781
1996	770	521	749	558	848	564	720
1997	814	352	748	552	852	575	716
Invest/Cow							
1995	7,343	3,774	6,830	5,491	7,011	6,163	6,629
1996	6,798	4,257	6,411	5,604	6,683	5,809	6,290
1997	6,746	4,667	6,358	6,042	7,011	6,016	6,308
Debt/Cow							
1995	2,333	1,483	2,192	2,000	2,354	1,929	2,163
1996	2,270	1,788	2,227	1,871	2,251	2,079	2,174
1997	2,417	2,123	2,409	2,066	2,354	2,266	2,355
Numbers of Cows							
1995	54	39	53	38	61	39	51
1996	60	43	59	39	66	44	56
1997	60	43	59	38	61	45	56
Lbs. Milk Sold/Cow							
1995	17,564	14,747	17,351	15,010	18,871	14,714	17,000
1996	16,546	12,735	16,054	14,253	17,866	13,239	15,784
1997	16,515	12,646	16,079	13,678	18,871	13,324	15,700
Annual Ave.Milk Price							
1995	13.1	13.89	13.24	13.32	13.15	13.38	13.26
1996	14.83	15.84	15.01	15.17	15	15.07	15.03
1997	13.27	13.61	13.44	12.83	13.53	13.14	13.34
3 Yr Ave.	13.73	14.45	13.90	13.77	13.89	13.86	13.88

POSTER EXHIBITED AT THE *NATIONAL TOWN MEETING FOR A SUSTAINABLE AMERICA*,

May2-5, Detroit, MI

IS U.S. AGRICULTURE IN CRISIS ?

"A Life Cycle Approach to Sustainable Agriculture Indicators"

February 26-27, 1999

The Center for Sustainable Systems
University of Michigan, Ann Arbor

AGRICULTURE TODAY: SUSTAINABLE?

In 1997, 37% of farmers were 60 or older[1]

The number of farms has decreased by 300% since 1950[2]

Soil is being eroded 13 times faster than it can be formed[3]

Michigan alone loses 100+ acres of farmland to development every day[4]

1. USDA 1997 Census. http://www.nass.usda.gov/census/census97/volume1/us-51/us1_16.pdf.
2. Pimentel, David. "Farms and Greenbelts." *Sustainable Agriculture*. Ann Arbor: National Pollution Prevention Center, 1997.
3. Ibid.
4. Dixon, Jennifer." Decline in Farmland Erodes No. 2 Industry." *Detroit Free Press*, 3 February 1999: 4B.

WORKSHOP STRUCTURE

Sixty participants, including representatives from universities, farms, corporations and government agencies, attended the workshop "A Life Cycle Approach to Sustainable Agriculture Indicators."

Objectives

1. To introduce the concept of Life Cycle Assessment as it applies to agriculture and to enhance the use of NPPC's Sustainable Agriculture Compendium.
2. To initiate a dialog among key stakeholders in the Midwest about the key concerns in agriculture today.
3. To develop an initial set of economic, social and environmental performance indicators for sustainable agriculture.

Life Cycle Indicator Framework

Life Cycle Assessment is a quantitative method used to measure energy and material flows associated with all stages of a product life cycle, from cradle to grave. The table below was used to demonstrate the agricultural life cycle stages and the economic, social, and environmental dimensions of sustainability. Participants focused on filling in the second column of the table, developing indicators for agricultural production.

Life Cycle Stages ____________ Impact Categories	*Resource Origin* (breeding/ genetic engineering of seeds and livestock)	*Agricultural Production and Growing* (nutrient and chemical inputs, animal feed; tilling, harvesting)	*Agricultural Processing* (food and product processing, packaging)	*Use of Agricultural Product*	*End of Life* (waste production, utilization)
Economic: Productivity, Profitability, Externalities					
Social: Quality of Life, Healthcare, Employment					
Environmental: Resource Use and Quality; Impacts and Burdens					

Agenda

Plenary Presentations

The Friday morning session featured six presentations by scholars in the field to introduce trends and concerns in the economic, social, and environmental dimensions of sustainable agriculture.

Panel Discussion: "Multiple Perspectives on Environmental Sustainability"

Farmers, policy-makers and educators engaged in a discussion of their respective understandings of sustainable agriculture and the main environmental challenges they face. Each shared information on successful environmental programs and initiatives.

Working Groups: Dairy, Fruit, Grain, Pork

Case study farmers presented profiles of their farms. Groups discussed current trends in their sectors and drafted economic, social, and environmental indicators. Group reports were compared at the final plenary session.

Plenary Discussion: "Actions Towards Sustainability"

The workshop concluded with a discussion of concrete actions to be taken by each stakeholder group to progress towards sustainability.

PROPOSED SUSTAINABLE AGRICULTURE INDICATORS

DAIRY WORKING GROUP

Note: Indicators produced by other working groups are available in the workshop proceedings.

Economic

- Return on investment
- Exit / entry ratio of farmers to business
- Flexibility of the production system
- By-product utilization

Social

- Average age of farmers
- Consumer willingness to pay for sustainable products
- Social equity / community inclusion of agriculture
- Quality of life for farming families
- Share of disposable income of consumers spend on food

Environmental

- Use of renewable resources relative to total resource use
- Tons of soil erosion per unit of production
- Earthworm and microbial activity per acre
- Share of open-pollinated plants relative to hybrid and genetically modified varieties
- Balance between number of animals on the land and ability of land to use nutrients

Photo: Community Farm of Ann Arbor

Sponsors

The workshop was sponsored by the Center for Sustainable Systems, the US EPA Region V and the North Central Region of the USDA Sustainable Agriculture Research and Education program.

http://www.umich.edu/~nppcpub/resources/compendia/agworkshop.html

To obtain the proceedings and additional information, please visit our web site or contact Ms. Guntra Aistars at:
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