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AN EVALUATION OF COMMUNITY-BASED INTEGRATED FARMING SYSTEMS
CREATING CONDITIONS FOR SUSTAINABILITY

By

Tracy Veronica Dunbar

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ABSTRACT

AN EVALUATION OF COMMUNITY-BASED INTEGRATED FARMING SYSTEMS: CREATING CONDITIONS FOR SUSTAINABILITY

By

Tracy V. Dunbar

Traditional approaches to rural community development have not adequately addressed the production and consumption needs of some small limited-resource farm communities. Community-based Integrated Farming Systems (IFS) provide an approach that focuses on the unique conditions and interrelationships that exist in small limited-resource farm communities.

Community-based IFS projects have been adopted in some areas in the U.S. and abroad. Whether these projects are creating conditions for economic and environmental sustainability is still to be proven.

A framework is needed to help assess the extent to which farming practices are changing, the kinds of changes most commonly made, and the reasons farmers give to explain why they have or have not made changes. A framework is needed also to help assess the resulting economic and environmental outcomes the IFS projects help to generate.

Such a framework is set forth and is used to evaluate an IFS project located in Brinkley, Arkansas. The conclusions reached are that this Community-based IFS fosters continuation and increases in the production practices that advance agricultural sustainability and it fosters increased awareness of farm production practices to increase agricultural sustainability. However, the analysis found little change in either the cost of production or the income generated by farm operators.

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This publication is dedicated to my grandmother, Ms. Dorothy Mae Stephenson; my aunt, Ms. Aubrey Mae Stephenson and my uncle, Mr. James Stephenson. If it were not for these dedicated family members, I would not have had a chance at life.

In addition, I would like to express my appreciation for the patience, understanding and encouragement shown by other family members--Gwanna Day, Jack Day, James Stephenson Jr., Regina Stephenson and Rockfeler P. Herisse.

During the course of my studies at Michigan State University, I was introduced to family members that I did not know existed. However, these family members have played a very significant role in my life as well as my accomplishments. I cannot remember what my life was like without Thelma Dunbar, Elmyra Dunbar-Smith, Rufus Dunbar Jr., Betty Dunbar, Thelma Campbell, Arnold Smith, Gloria Boswell, Rosetta Betts and Tonya Watkins just to name a few.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Background and Statement of Problem

1.1 Introduction

Conventional approaches to agricultural research and extension have focused on commodity or discipline-related research (Fridgen, 1985). Technological innovations based on the propositions generated through conventional agriculture have led to extraordinary agricultural productivity (Bawden, 1991). However, many of the technological innovations are applicable and beneficial only to large-scale operations, not the small limited-resource farms.

Today's small limited-resource farmers need to assess the integration of their farm production unit in creative new ways. Conventional approaches to agricultural research and extensions' emphasis has been on increased agricultural production generated by intensive chemical use. These practices have increasingly become environmentally and economically unsustainable (Coward, 1987). An interdisciplinary, multi-objective and holistic approach to agricultural research and extension is needed that integrates the environmental, sociological, political and economic aspects of farming (Fridgen, 1985). This appears particularly needed in the case of survivability of limited-resource small farms and farmer communities.

American farmers are experiencing many economic and environmental problems. These problems include, but are not limited to the following:

- Financial difficulties--increased costs of inputs and significant interest charges.
- Biophysical constraints--constraints on soil, air and water resources.

- Soil erosion.
- Pest, weed and moisture control problems.
- Increase in the rate at which farmers are going out business.
- Decreased support of institutions (i.e. research done by land grant universities is done for the most part "by commodity") (Fridgen, 1985).

1.2 Possible Corrective Actions

Families on farms face severe production and consumption challenges. Making small-farm agriculture more efficient is difficult because improved production, consumption and marketing require coordinated interaction among a large number of farms operating under a wide range of circumstances, constraints and objectives. These tasks are shared by farmers, policy makers, academics and agricultural research and extension professionals (Tripp, 1991). Use of Integrated Farming Systems (IFS) is one means of coordinating agricultural research, development and extension efforts. Integrated Farming Systems consist of planned agricultural change organized around an understanding of the farmers' conditions and priorities.

The Arkansas Land and Farm Development Corporation's (ALFDC) Integrated Farming Systems project has identified a number of production practices enterprises, and activities that it fosters. They include:

- Integrated nutrient management.
- On-farm composting for the enhancement of soil fertility and reduction of chemical fertilizers.
- Crop varieties adapted to low soil fertility.
- Biological pest control practices.
- Pest resistant and drought tolerant varieties.

- Crop rotation to build soil fertility and control weeds and often pests.
- Integrated pest management.
- Alternative crop (greenhouse) and livestock (rotational grazing) systems.
- Alternative irrigation systems.
- Woodland management and woodland enterprise development.
- Farmer training in post-harvest technology and marketing systems.
- Farmer training in farm business plans, enterprise budgets, evaluation of on-farm profitability, access to non-traditional finance/investment capital and proper use of credit.

The focus of various community-based IFS projects is to encourage the adoption of more-sustainable farming systems. The potential contribution of IFS projects is debatable. There is demand for evidence that helps judge whether community-based IFS projects create conditions for economic and environmental sustainability as well as address the specific needs that are unique to the small limited-resource farmer.

1.3 Components of Sustainability

There are different components or conditions of sustainability as defined by different groups of scholars. However, there are identifiable central themes that express the main criteria of sustainability. The Food and Agriculture Organization of the United Nations (1989) recognizes the centrality of human needs in sustainable agriculture by stating that sustainable agriculture should "satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources".

Harwood (1990) defines sustainable agriculture as a system of agriculture that can evolve indefinitely towards greater human utility, greater efficiency of resource use and a balance with the environment that is favorable both to humans and to most other species.

Francis (1988) sees sustainable agriculture as a "management strategy," the goals of which are to reduce input costs, minimizing environmental damage, and provide production and profit over time.

Numerous other authors define sustainability as the ability of the agroecosystem to maintain productivity when subject to major disturbing forces or shocks (Conway 1991, 1990, 1986; Marten, 1988; Mackay, 1989).

Douglas (1985) defines and discusses sustainability as having three different components. These components, related to economic and environmental factors, include the following:

- **Sustainability as Food-Sufficiency**--supplying enough food to meet everyone's demand. From this perspective agriculture is viewed as a primary instrument for feeding the world with a special interest in feeding those who can afford to buy food on the world market.
- **Sustainability as Stewardship**--sustainability is measured by the average level of output over an indefinitely long period of time which can be sustained without depleting the renewable resources on which it depends.
- **Sustainability as Community**--focus is on the effects of different agricultural systems on the vitality, social organization, and culture of rural life. The primary interest is in promoting vital, coherent, rural cultures that encourage the values of stewardship, self-reliance, humility and holism. Emphasis is on income as well as the quality of living of the farm family and the rural community.

The Arkansas Land and Farm Development Corporation (ALFDC) is one of a number of IFS projects that are being funded in part by the W.K. Kellogg Foundation (WKKF). The WKKF, through its IFS Initiative, is supporting a cluster of community-based IFS projects. The goals of these projects are: (1) to encourage farmers to adopt more integrated and resource-efficient farming systems that maintain productivity and profitability while protecting the environment and the personal health of farmers and their families, and (2) to assist farmers and others in rural communities in addressing the barriers associated with adopting more resource-efficient and integrated systems (Hesterman and Thorburn, 1994).

1.4 Problem Statement

The problem is that many small limited-resource farms in Arkansas and the U.S. are using farming systems that contribute to the loss of topsoil, to contamination of surface and groundwater with fertilizers and pesticides, and to lack of profitability and income for farmers. There is growing concern for the safety of a food supply system that relies heavily on agrichemicals, and for the health and safety of farmers and their families who are exposed to these toxic chemicals. Additional troublesome trends include decreases in farm and rural population, the lack of opportunities for young and entry-level farmers, and the economic and environmental demise of many rural communities (Hesterman and Thorburn, 1994).

An expanded approach to conventional agricultural research and extension is needed. For the most part, the emphasis in conventional agricultural research and extension has been "by commodity"--to achieve increased agricultural production (Fridgen, 1985). There is an increasing sense of unease about degradation of biophysical environments, distortions of socio-economic environments, and dislocation of cultural environments associated with conventional agricultural practices (Bawden, 1991).

Science is reductionist in the sense that the real world is so rich in variety, so messy, that in order to make coherent investigations of it, it is necessary to simplify it, to select some terms to examine out of all those which will be observed (Checkland, 1984). In the past, agricultural researchers have taken a reductionist approach to conducting and evaluating research in agriculture. They have dealt with complexity by simplifying it into "manageable bits". However, this approach may fail to come to terms with the real issues facing society--questions about the way we interrelate with our environment (Bawden, 1991).

As suggested by Axinn (1991), reductionist conventional researcher-oriented approaches in agriculture emphasize large-scale, high-input, specialized, market-oriented commercial agriculture. The small limited-resource farmer has been largely ignored. Production increases based on intensive inputs are becoming increasingly environmentally and economically unsustainable (Coward, 1987). And, there should be an alternative to reductionist science that deals with the problematic relationship between agriculture and the environment (Bawden, 1991).

The systems approach, seeing a host of formerly unrelated activities and processes as all parts of a larger, integrated whole, is not something technological in itself. It is, rather, a way of looking at the world and at ourselves" (Drucker, 1967). Churchman (1968) contends that systems are made up of sets of components that work together for the overall objective of the whole. The systems approach is simply a way of thinking about total systems and their components.

Systems approaches in agricultural research are farmer-oriented, recognizing the significance of responding specifically to farmers' needs (Conway, 1987). The intent is to conduct on-farm research that consistently involves the farmer in the whole research process. Researchers serve mainly as advisors. This particular component of the systems approach is characteristic of Integrated Farming Systems projects.

In addition, social and ecological problems are interconnected in the food and agriculture systems. The sustainable agriculture movement has effectively demonstrated conventional agriculture's problematic treatment of the environment at the expense of equally pressing social problems--hunger, poverty, racial oppression and gender subordination. We must widen our definition of sustainable agriculture to include these problems (Allen, 1993). Also, we must go beyond the narrow focus on production to include processing, distribution, recycling and waste disposal relationships (Dahlberg, 1993). In contrast, Redclift (1993) argues that the concept of sustainable development needs to be recognized as an alternative to the prevailing view, rather than a modification of it.

Federal policies remain nearly as unsupportive of sustainable agriculture as they were when sustainable agriculture emerged in the mid-1980's (Buttle, 1993). Overcoming social and ecological problems requires technical and ecological changes as well as, changes and actions that confront social and political economic causes (Thrupp, 1993). Political implications are significant in terms of how thay can effect the life possibilities for those traditionally underpriviledged in the global food and agriculture system (Allen, 1993).

1.5 Objectives and Hypotheses

The overall objectives of this study is to determine whether or not community-based IFS creates conditions for (1) the sustainability of individual farm family ventures and (2) the sustainability of the community of farmers--the broader community from which they function. For individual farm family ventures and the community of farmers to be sustainable, an acceptable level of productivity and profitability, and an adequate level of environmental protection must be demonstrated.

The assumptions are: (1) Increased incomes to farm families will enhance the individual farm family venture as well as the community of farmers; (2) Improved production practices that are environmentally friendly can serve to increase income, particularly over time, over environmentally unfriendly practices; (3) Alternative enterprises complementing and substituting for traditional enterprises, provide added income possibilities.

The formal hypotheses to be tested in this study are as follows:

1) Farm operators involved in the IFS project have adopted more environmentally and economically sustainable agricultural production practices than they did before entering the IFS project.

2) Farm operators in the IFS project have undertaken more alternative enterprises, complementing or substituting for traditional enterprises, than they did before entering the IFS project.

3) Farm operators in the IFS project have attempted more profitable combinations of current (traditional) enterprises and alternative (new) enterprises with improved practices and value added activities than they did before entering the IFS project.

For purposes of this study, more economical and environmental sustainable agricultural production practices include the following:

- **Making use of minimum tillage, sometimes called no tillage, on certain crops to reduce stress on the soil associated with conventional tillage methods.**
- **Making use of cover crops (i.e. wheat, clover and hairy vetch) as a more integral part of the farming system.** Cover crops reduce soil loss, add nutrients and suppress weeds.
- **Making use of green manure for fertilizer as an alternative to intensive chemical use.**
- **Crop rotations as an alternative to intensive chemical use.**
- **Decreased use of chemical fertilizer.**
- **Increased use of animal manure (chicken manure) as an alternative to intensive chemical use.** The use of animal manure decreases production costs over time. Livestock farmers engage in the recycling of nutrients on the farm.

- **Improved value-added in production.** The idea is for farmers to become more involved and gain control of the storage, processing and marketing of their products. There is also emphasis on the use of the computer as a management and marketing tool; and increased access to information through the use of on-line computer technology.

One indicator of profitability is an increase in income. An increase in income may be explained in part or by any combination of the following: (1) decreased operating costs, (2) increased yield, (3) increased prices or availability of markets (4) increased awareness/information, and (5) increased crop diversity. Some or all of these may be greater because of the IFS project.

A decrease in fertilizer and pesticide use and an increase in cover cropping and crop rotations would be indicators of the adoption of agricultural production practices that are environmentally sensitive. Another would be increased use/distribution of animal manure versus intensive chemical use.

A more detailed literature review is presented in chapter 2. The two-part framework used as a basis for economic and environmental analysis is presented in chapter 3. Chapter 4 reports the results obtained from the survey and related analysis. The framework for analysis is revisited in Chapter 5 along with other conclusions. Limitations of the study and specific and general recommendations for further studies also are included in the final chapter.

Chapter 2

Literature Review

2.1 Chapter Introduction

In the United States the government policies and governmental research institutions support industrial agriculture rather than the small farmer. Thousands of small farmers cannot afford to farm because of high costs of land, interest, and equipment (Berry, 1981). The view that "bigger is better" is prevalent, therefore, the nation may be headed towards concentrated ownership of farmland, more industrialized agribusinesses, and more economically unstable farms. In addition, it is increasingly difficult for young farmers to begin farming (Soule and Piper, 1992).

Modern agriculture in the USA has been accompanied by many social problems (elimination of the farm family, concentration of land, resources and production; growth of agribusiness and its domination over farm production) (Altieri et. al., 1990).
It is a growing concern whether or not USA agriculture is sustainable, either ecologically or economically. There are connections between ecological, economic and social consequences of modern agriculture (Soule and Piper, 1992).

There are other serious problems that have a demonstrable connection with industrial agriculture (Berry, 1981):

- Soil erosion,
- Soil compaction,
- Soil and water pollution,
- Pests and disease resulting from monoculture and ecological deterioration,
- Depopulation of rural communities,
- Decivilization of the cities.

This chapter begins with a discussion of measures of sustainability. The next section includes a review of sustainable agriculture research that supports the contention that more practical (sustainable) production practices and related actions by farm families may help to contribute to the solution of the aforementioned economic, environmental and social problems, or at least serve as a partial deterrent to them.

In addition, there will be a discussion of farm family adjustment strategies involving use of farm resources off-farm. In order to determine whether or not IFS creates conditions for the sustainability of the individual farm family venture as well as the sustainability of the farm community, a more holistic approach will be used rather than limiting attention only to farming practices. This holistic approach considers current and new agricultural strategies as well as off-farm use of farm resources and off-farm enterprises that are non-agriculturally related.

Essentially, the purpose of this chapter is to provide a platform of insights and observation by others on which to build a framework for evaluating whether an IFS project enhances the economic and environmental sustainability of the individual farm family venture as well as the sustainability of the community of farmers. This will be done by drawing on those in the research community and practitioners involved in sustainable agricultural practices, research and evaluation; in value-added enterprises and actions; and in agricultural adjustments by farmers.

2.2 Measures of Sustainability

A framework for measuring economic and environmental sustainability was presented by Faeth (1995). Physical and economic indicators of sustainability were developed for the field, farm and nation. Field level physical indicators of sustainability included current and long-term crop yields, soil erosion, nitrate losses, phosphate losses, changes in soil carbon, greenhouse gas emissions, and intensity of fossil energy use. The economic value of the change in crop yields resulting from increases or decreases in soil quality is used as a measure of the depreciation (or appreciation) of soil productivity. Standard economic indicators included prices, production levels, land use, and farm income.

A study conducted by Bajgain (1993) suggests that a new evolving paradigm in agricultural research and extension related to sustainable development has six defining features. These features include the following: (1) systematic descriptions and analysis of the components of the farm and the linkages among them; (2) farm client partnership with researchers and extensionists; (3) collaborative mutidisciplinary research; (4) environmental and common property integrity; (5) gender integration; and (6) sustainability considerations.

A systems approach is the study of an entity, its components and their relationships with the environment (Beets, 1990). The systems perspective to alternative agricultural research and extension is applicable to Integrated Farming Systems. However, we need to understand the existing systems before attempting to improve upon them (Castillo, 1992).

Small limited-resource farms have complex systems, and diverse environments (Chambers et al., 1989). An analysis of small limited-resource farms must include: (1) Physical Characteristics--climate, soil, topography, physical structure; (2) Biological Characteristics--crops, livestock, weeds, pests, diseases; (3) Endogenous Variables--family composition, health and nutrition, education, food preferences, risk aversion, attitudes/goals gender relations; and (4) Exogenous Variables--population, tenure, off-farm opportunities, social infrastructure, credit, markets, prices, technology, input supply, savings opportunities/factors) (Beets, 1990).

Systems approaches suggest that in order to improve the small limited-resource farmers economic and environmental sustainability, a collaborative relationship is needed between farmers, researchers and extensionists (Axinn, 1991; Rhoades, 1989; Chambers et al., 1989; Galt and Mathema, 1986; Norman, 1980). Therefore, Integrated Farming Systems should constitute a partnership with researchers and extensionists.

Various authors suggest that conventional approaches to agricultural research and extension cannot meet the needs of small limited-resource farmers (Chambers, 1989; Farrington and Martin, 1987; Rhoades and Booth, 1982; Richards, 1985). Alternative agricultural research and extension should be based on problem analysis and the priorities of farmers, with farmers being a central part of the process (Chamber et al., 1989).

In addition, alternative agricultural research and extension should include a multidiscliplinary approach to sustainability (Tripp et al., 1991). Therefore, a distinguishing characteristic of Integrated Farming Systems should be multidiscliplinary research.

Another method that can be used to measure sustainability is Trend Analysis. Field, regional or national trend levels of yields or other outputs of interest may be collected over time. However, there are some problems associated with sustainability that may not be easily detected using this method. For example, productivity growth from higher input levels, could mask declining resource quality (Harrington, 1991).

Total Factor Productivity (TFP) is another means by which to measure sustainability. Total Factor Productivity may be defined as the total value of systems outputs over one time period divided by the total value of inputs to the system for the same period (Lynam and Herdt, 1989; Harrington, 1991). Total Factor Productivity is presented by Herdt and Lynam (1991) as an economic measure, however, TFP may be used with energy units as well.

Total Factor Productivity is primarily a measure of efficiency. Thus, this method cannot distinguish between productivity changes due to technology, input levels, or resource quality, nor does it address the demand for system outputs. In addition, it would be difficult to use this method at the regional level--its focus is on the plot or farm level (Lynam and Herdt, 1989; Harrington,1991).

Sustainability can also be measured by the direct estimation of the contribution of different factors to yield. This method identifies positive and negative factors affecting yields, land types, and input levels. Direct estimation also interprets sustainability in terms of efficiency. Techniques/studies interpreting sustainabiliy in terms of resiliency are lacking (Conway, 1991; Harrington, 1991).

Energy analysis used in the comparison of agroecosystems is also a method used to measure sustainability. The emphasis in energy analysis is on the direct energy inputs and the amount of fossil fuel embodied in the other inputs as well. By using standard accounting procedures, energy requirements within production systems may be determined. In this sense, the possibilities for energy conservation may be revealed (Stanhill, 1984).

In addition, public and private industries may use information obtained from energy analysis to plan for the consequences of different scenarios of energy availability and prices (Stout, 1990; Stanhill, 1984). This information may also be used in economic cost/benefit analysis studies. It is important to jointly study energy and labor flows. Energy inputs and outputs into the whole-farm system and subsystems are measured, and the efficiency of farm production, labor use, and energy transformation are reported (Dobbs et al., 1988).

Sustainable farming practices and related actions considered for this study encompassed the central themes and main criteria of sustainability, indicators of sustainability and methods of measuring sustainability used in previous studies. For purposes of this study some of the more sustainable farming practices and related actions by farm families include the following:

- Crop rotations as an alternative to intensive chemical use,
- Making use of cover crops (i.e. wheat, clover and hairy vetch) a more integral part of the farming system,
- An increased use of animal manure as an alternative to intensive chemical use,
- Improved value-added enterprises and increased crop diversity in production,
- Improved farmer/community leadership, education, and development in sustainable agricultural practices.

These farming practices and others were utilized in the Arkansas Land and Farm Development Corporation's (ALFDC) IFS project and a number of other IFS case studies presented at the W.K. Kellog Foundation, Integrated Farming Systems Cluster Evaluation Meeting on October 5-7, 1994. Some of these case studies also will be reviewed within this section (See: Section 2.4).

2.3 More Sustainable Agricultural Practices

Crop rotation may be defined as a system in which different crops are grown in recurrent succession and in definite sequence on the same land. Crop rotations, properly designed, suppress insects, weeds and disease by effectively breaking the life cycles of pests and unwanted plants (Altieri et al., 1990).

Crop rotations influence plant production by affecting soil fertility and survival of plant pathogens, physical properties of soils, soil erosion, soil microbiology, nematodes, insects, mites, weeds, earthworms and phyto-toxins (Altieri et. al., 1990).

Research by Crookston and Associates (1988, 1991) at the University of Minnesota shows that yields of corn are 10 to 15 percent higher after soybeans than after corn, and that yields of soybeans are 8 to 17 percent higher after corn than after soybeans.

The work of Crookston and Associates (1988, 1991) indicates that yields of soybeans are potentially highest with (3-year or longer) rotations, such as might be achieved with small-grain crops, in addition to corn and soybeans.

A study conducted in the Pacific Northwest on the effectiveness of winter-wheat suggests that crop rotation is nearly as effective as soil fumigation as a means of achieving high yields (Cook, 1991). Crop rotations provide a means of eliminating root disease as a production constraint. This biological effect takes about two years to achieve (Cook, 1991).

As still another example of the significance of crop rotations, a 200-acre farm in western Minnesota managed with little to no use of chemicals. Average corn yields increased from 100 to 110 bushels/acre, soybeans from 30 to 40 bushels/acre and wheat from 35 to 40 bushels/acre. Crops also cost much less to grow without chemicals. The most significant reason given for this progress in yields has been the use of crop rotations for weed control without herbicides (Cramer, 1991).

Consider, for example, a study of corn yield responses to nitrogen and rotations conducted on a research farm at Iowa State University in Ames, Iowa. A four-year rotation of corn, soybeans, corn and oats, where corn is grown every other year, was observed. Corn grown every other year had almost identical average yields regardless of the crop followed or the level of nitrogen available. Because of the nitrogen fixation by legumes, the corn in a corn, oats, alfalfa, alfalfa rotation produced almost identical results with and without nitrogen fertilizer (Duffy, 1991).

An Arkansas farmer (Glenn Brown) who grows soybeans, wheat and milo in rotation said, "I don't spray unless it's economical to do so". He saves per acre on herbicides and keeps chemicals out of groundwater without sacrificing yields (Cramer, 1991).

Crop rotations are an integral part of most sustainable agriculture systems. The crops in the rotation have several impacts, which can include nitrogen fixation and reductions in pest populations (Duffy, 1991).

Cover Crops

Cover cropping may be defined as the practice of growing pure or mixed crops of annual or perennial herbaceous plants to cover the soil for part or all of the year. These plants are incorporated into the soil by tillage as a seasonal cover crop or retained for one or several seasons. Researchers have found a number of benefits in the use of cover crops. The benefits of cover crops are summarized below(Altieri et. al., 1987):

- **Improved Soil Structure and Water Penetration.** Adding organic matter and roots improves soil aeration and the percentage of water-stable aggregates. Soil compaction and tillage pan are reduced as a result of decreased tillage requirements and equipment travel. During wet periods, vegetative cover can support machinery better. Crust formation is prevented because cover crops intercept water drops and reduce their force.

- **Prevents Soil Erosion.** Cover crops prevent soil erosion by spreading and slowing the movement of surface water, reducing runoff and holding the soil in place with root systems.
- **Improves Soil Fertility.** Cover crops improve soil fertility by adding organic matter to the soil during decomposition and making nutrients in the soil more available through nitrogen fixation.
- **Controls Wind Erosion and Dust.** Cover crops help reduce wind erosion and control dust by breaking the force of air movement and holding the soil in place with root systems.
- **Controls Insects and Weeds.** Undesirable insects are controlled in part because cover crops harbor beneficial insect predators and parasites. Cover crops also serve to break the life cycle of unwanted plants.
- **Modifies Microclimate and Temperature.** Cover crops modify the microclimate and temperature by reducing reflection of sunlight and heat and by increasing humidity in the summer.

Consider for example, the importance of cover crops in vegetable growing. Hofstetter (1991) observes that vegetables are very hard on the soil. By adding a grass or legume to vegetable rotations, the producer can maintain or increase productivity while often reducing or eliminating pesticides and purchased Nitrogen at the same time (Hofstetter, 1991).

In Lake City, Minnesota, Steven Schwen uses an oat/pea cover-crop to mulch his winter squash and other vine crops. In addition to smothering weeds, the cover crops help control erosion, build soil, and even appear to reduce pressure from pests (Cramer, 1991). Steven Carnody in Marne, Michigan says he doesn't need any herbicides in his strawberry production because of his use of cover crops (Cramer, 1991).

Dr. Alan Putnam, a horticulturist at Michigan State University, found that cover crops make a tremendous difference in controlling weeds. He suggests that cover crops offer the same benefits as chemicals but at a lower price. Use of cover crops with horticultural enterprises reduces cost an average of $100 per acre while helping produce better than average yields (Cramer, 1991).

Dr. Putnam also found that fall seeding of grain rye or hard red winter wheat between strawberry rows actually controls weeds, prevents soil erosion and reduces frost damage as well as, or better than, mulch and chemicals combined (Cramer, 1991).

Animal Manure Use

The effective use of animal manure on soils and plants can result in a balanced and complete supply of nutrients, enhance nutrient cycling and a well-aerated soil structure. Plants grow under healthy conditions in which a diverse microlife helps to check pests and pathogens. This sets the stage for lasting improvements of the soil. However, the full benefits of animal manure are attained only when manure is applied correctly (Koepf, 1987).

Some research suggests that animal manures are a factor in contamination, especially from nitrate accumulation in water bodies. This is true mainly in instances where large or concentrated quantities of manure have to be disposed. It occurs anytime application exceeds uptake and volatilization. Intensive crop and livestock farming systems can be a problem concerning nitrate increases in water supplies (Koepf, 1985).

A buildup of nitrate in ground water depends on 1) the ratio of cropland vs. semi-permanent crops and forest, 2) specialized cropping vs. rotating crops, 3) the length of fallow periods during the year, 4) chemical fertilizers vs. organic fertilizers and the excessive use of either or both in combination, 5) waste disposal from large-scale animal operations vs. decentralized animal husbandry, 6) permeability of soils and rainfall characteristics, and 7) mode of using manures. Experiments conducted by Koepf in 1973 on a farm in Central Illinois suggested that manure and composted manure properly applied will reduce nitrate leaching when compared to customary practices used on intensive crop and livestock farming systems.

When manure is properly handled, it is hygienically safe. Proper storage improves the biological effectiveness of manure, preserves nutrients, and decreases the viability of weed seeds in the manure. This can be achieved with reasonable labor and energy inputs. In contrast, poorly handled manure from animals consuming feed additives, such as antibiotics, may breed resistant pathogens and flies (Koepf, 1987).

More practical (sustainable) production practices include better husbandry of cropland, more frequent rotation, better timing and increased and improved use of manure. However, manure must be returned at the right place at the right time in the pattern of the farm. Manure must not contain toxic materials; the quantity must not be too great; and not too much energy or money should be expended on transporting it (Berry, 1981).

Value-Added Production and Crop Diversity

Value added production is a strategy for bringing in additional revenue and ensuring economic sustainability (Pinard, 1996). Information, knowledge and action needed for "value-added production" and "commercialization" include the following (Pinard, 1996):

Value-added Production--Information, Knowledge and Actions:

- Recipes and systems for food processing,
- Type of wrapping, conditioning and storage of food products,
- Processing equipment (for small and medium enterprises),
- Legislation for food processing (e. g. processing permits, installment of equipment and labeling),
- Cost of production and product price,
- Product research and development,

- How to manage a processing operation,
- Training and qualification of employees,
- Networks of contacts for processing activities (i.e. equipment suppliers),
- Financing programs for value-added projects and support to small and medium enterprises,
- Environmental management of processing by-products,
- Integrated quality control and management in processing operations,
- Factors influencing food quality (e. g. soil and crop quality, animal health and feeding),
- Characterization of regional food products,
- Techniques for establishing cooperatives or companies for processing activities.

Commercialization--Information, Knowledge and Actions:

- Research on niche markets and market studies,
- Consumers' food habits and market trends,
- Food product "positioning", promotion and publicity,
- Marketing channels specific to each niche market,
- Distributor and wholesaler networks,
- Direct sales strategies and methods (i.e. pick-your-own, farm boutiques, farmers' markets, catalogue orders),
- Business plans,
- Establishment of cooperatives or companies for marketing group work,
- Techniques for informing consumers about regional food products,
- Institutional support for the promotion of regional food products,
- Agro-tourism development,
- Creation of market structures for the commercialization of regional food products,
- Development of a certification system for regional food products.

Value-added enterprises in market places provide additional outlets for production, (i.e. having a canning or fresh frozen food facility increases the demand at the farm for vegetable crops) (Farm Forum, 1994). Farmers can better withstand the uncertainties and fluctuation of commodity prices, over which they have little control, by producing more for local consumption (Hollander, 1985). The intention is not to stop producing traditional crops altogether. Rather the objective is producing more for local consumption which places farmers in a better financial position overall. The value of traditional row crops (i.e. corn, soybeans and cotton) has continued to fluctuate over the years (Hollander, 1985). By increasing the production of vegetables (i.e. peas, beans, okra, potatoes, etc.) farmers will no longer be relying on single crops or a few traditional crops for their livelihood.

An example of valued added in production is the sale of second grade carrots on the farm at a low price, as a supplement to first grade carrots sold for commercial markets. Growing more vegetables desirable for increasing farm revenue can, in turn, yield even more second grade vegetables for farm sale. On-farm processing of vegetables provides a way to capture their value and find a new marketing avenue (Pinard, 1996).

As another example of value-added in production, a Wisconsin vegetable grower has been processing vegetables on his farm for three years. He recognizes the need to take produce to an end-product state. Markets are limited because he is not located near a big city. Seconds, culls and over production are handled by making preserves for sale. Other products include pressed oils, mustards, salsas, pickled cucumbers and asparagus, other relishes, apple butter, vinegars from malted and cultured juices, honey, and some experimental dried fruit and vegetables. In the off-season, grains are ground into flour and fresh baked bread is marketed. The greatest constraint identified is the expense of labor. (Sustainable Farming, 1996).

Still another example of value-added production is provided by a medium-sized Ontario based cheese factory. The factory operates 255 days of the year making both cows' milk and goats' milk cheese. Two million liters of cows' milk is processed into 420,000 pounds of cheese and 2,000 liters of goats' milk is processed into 400 pounds of goat cheese (Sustainable Farming, 1996).

However, marketing has been a weak link in this business. Another of the constraints identified is equipment costs. Limited financial support and the controls or limitations placed on small businesses by financiers are also constraints (Sustainable Farming, 1996).

A rural Ontario family operates a milling operation concentrating on milling and roasting of oats. The operation evolved from a background in dairy into the only milling and roasting operation of its kind in Canada. No other processor uses dry heat for heat stabilizing oats. All other processors use a two step process involving steam stabilizing (Sustainable Farming, 1996).

Farmer/Community Leadership, Education and Development

Farm families can benefit greatly from becoming informed about the array of actions they might consider to enhance their income while sustaining their resources (MacRae, 1996). Work is required to enhance leadership, education and development in sustainable agricultural practices and value-added enterprises. Needed are approaches that facilitate the interaction of those holding differing perspectives on these matters. Evidence indicates that farmers and the broader community can gain an understanding of the complexities in decision making related to sustainable agriculture. This requires training in general skills and sustainable agricultural practices. Examples of this process are highlighted below in the following IFS case studies.

2.4 Case Studies of Different IFS Projects

In general, the following categories will be used as a basis for discussion of IFS case studies that utilize some or all of the aforementioned more sustainable production practices:

- Project name and purpose,

- Major collaborators,
- Project description,
- Major features of the project.

IFS Case Study I--The Heartland Network

The Heartland Sustainable Agriculture Network helps to empower farmers and rural communities in Kansas to develop and use integrated farming systems that are intended to effectively balance farm profit with resource conservation. Twelve communities developed their own goals, work plans and budgets to form innovative farming systems that promote land stewardship. These systems emphasize cutting production costs and adding value to farm products to increase profitability in agriculture. Four features of the project merit special consideration here (Heartland Sustainable Agriculture Network, 1995):

- **On Farm Demonstrations**. The demonstrations highlighted include: (1) Cover crops to improve soil fertility and reduce erosion; (2) Crop rotations to add diversity and break pest cycles; (3) Manure and compost to improve soil fertility; (4) Fish emulsion used as fertilizer to raise wheat protein; (5) Riparian filter strips to improve water quality; (6) Alternative forages in grazing systems; (7) Management of intensive grazing systems to improve profitability, resource conservation and quality of life; (8) Organic beef feedlot production.
- **Leadership Development**. A "servant leader" model of leadership is used based on cooperative empowerment, team building, constructive openness, self-effacement, character development, modeling, creating teachable moments and visualization that help shape the project. Activities that were used to promote leadership include: (1) Group development of common goals, decision making process, work plan and budget in the grant making process; (2) Presentations of goals and grant proposals to the project's advisory team; (3) Farm cluster meetings, tours, walks and public presentations; (4) Holistic

Resource Management workshops to develop management skills; (5) Collaboration with Kansas State University in conducting farm demonstrations; (6) Participation in the Farming Systems conferences; (7) Communication and cooperation with media to publicize cluster activities; (8) Shared book and video libraries; (9) Iterative process that builds better critical thinking and planning skills; (10) Group management of budget and direction to paid local organizer; (11) Quarterly meetings of local organizers to refine the mission, priorities and implementation of the Heartland Network; (12) Farmer participation in project evaluation; (13) Participation by key leaders in the IFS Networking conferences; (14) Team building among the Heartland Advisory Team that includes farmers and institutional collaborators.

- **Community Development**. Adding value at the "farm gate" keeps more dollars circulating in the local communities. Building on this idea one community cluster weekly "direct markets" fresh produce in a local health food cooperative store. Preliminary sales at the store have increased creating a "win-win" partnership for both the growers and the store. In addition, this weekly venture has brought new people in to inquire about ways to prepare healthy meals using this fresh produce for their families. Another farmer cluster is collectively marketing organic grains. Sales have jumped significantly due to the short supply of soybeans. This farmer group is looking into ways to recycle an abandoned elevator and re-equip it to clean their own grain. A third farmer cluster is marketing through an independent farmer-owned mill that provides the main source of employment in the community. Still another cluster, this one comprised of ranchers, is in the formative stages exploring the potential of a grass-fed beef market.
- **Innovative Education Programming**. A first-ever joint symposium between the Kansas Rural Center and Kansas State University on sustainable

agriculture drew 250 people and stimulated subsequent private and public communications that significantly advanced the respectability of sustainable agriculture in Kansas (Heartland Network, 1995).

IFS Case Study II--Wisconsin Integrated Cropping Systems Trial

The Wisconsin Integrated Cropping Systems Trial (WICST) is a learning center for studying alternative production strategies. Major Collaborators are: University of Wisconsin College of Agriculture and Life Science, Michael Fields Agricultural Institute, Lakeland Agricultural Complex, University of Wisconsin Arlington Agricultural Research Station, Columbia and Walworth County Farmers, and University of Wisconsin Center for Integrated Agricultural Systems (Wisconsin Integrated Cropping Systems Trial, 1995).

The objectives of the (WICST) are 1) to investigate the benefits and limitations of alternative crop production strategies and 2) to provide a community focal point for discussing the importance of a prosperous and environmentally sound agriculture to the future of farming. This trial began in 1990. It has been comparing the effect of alternative rotations on short and long-term crop production, profitability, ground water contamination, soil health, soil fertility, soil insects, soil nitrates, and weed control (Wisconsin Integrated Cropping Systems Trial, 1995).

Education has been a primary goal of this project. Components include education of students and the general public about the basics of crop production and the challenges farmers face as they attempt to produce high quality, low-cost food, protect the environment, and make a reasonable profit. They also include introducing farmers to alternative crop production systems and effective management strategies in these systems.

Several Major features of the project warrant special attention here (Wisconsin Integrated Cropping Systems Trial, 1995):

- **Field Day and Group Tours and Presentations**. Tours of the plot areas have been given to large and small audiences from bleacher wagon and on foot. Audiences have included farmers, foreign visitors, University of

Wisconsin researchers and visiting researchers, university students, primary and secondary school students, state extension professionals, Federal agency personnel, and others interested in farming and crop production. On and off-field presentations explaining project objectives, measurements being made and early results have been given to a wide variety of people including farmers, researchers, ag-business representatives, and urbanites.

- **Formal and Informal Education of Children and Adults**. A fourth grade teaching unit has been developed with a text book and teacher's manual and includes a visit by the students to the learning center. Besides visiting the plots, area adult residents also are reading about this project and the things being learned via newspaper articles and a quarterly WICST newsletter.
- **Collaborations--learning from each other**. Combined Audubon/WICST field days have helped farmers and conservationists better understand and appreciate the importance and challenges of producing food while protecting the soil and groundwater.

Researchers, by working together, are becoming aware of the many complex interactions within an agricultural system rather than only focusing on the area of their own expertise.

IFS Case Study III--The Future Harvest Project

The Future Harvest Project fosters widespread adoption of sustainable agriculture throughout the Chesapeake Bay region (especially Maryland and Delaware) by building a strong alliance among diverse groups, enabling them to work collaboratively on issues that integrate farming, the community, and the environment (Future Harvest, 1995). Major collaborators include University of Maryland Cooperative Extension, Accokeek Foundation, American Farmland Trust, Chesapeake Wildlife Heritage, Delaware State University Cooperative Extension, William Doepkens, Maryland/Delaware Sustainable

Agriculture Association, and Maryland Organic Food and Farming Association (Future Harvest, 1995).

Three farm boards provide direct links to individual farmers. Each board has 10-12 members representing diverse perspectives on agriculture. The three boards are divided according to farm size (small, medium, large) in order to allow a "whole farm" approach, which recognizes that the production and marketing, and the stewardship needs of a farm are influenced to a large extent by farm size. In addition, there are plans for a preservation board whose function it is to develop strategies to prevent the loss of farmland in the region (Future Harvest, 1995) . Six major features of the project are included here (Future Harvest, 1995):

- **On-Farm Demonstrations**. The three boards are responsible for finding ways to promote adoption of sustainable practices, especially through the implementation of on-farm demonstrations of specific practices and through dissemination of the findings.
- **Farmland Preservation**. The preservation board will identify strategic farmland and develop strategies for farmland protection and preservation.
- **Poultry Initiative.** This sub-project seeks to foster better nutrient balance for poultry on the Delmarva peninsula by eliminating barriers to widespread use of composted poultry litter as fertilizer.
- **Farmer Network**. This sub-project aims to develop a formal farmer-to-farmer network to transfer information on sustainable practices effectively and efficiently.
- **Newsletter**. A newsletter from the Future Harvest Project communicates information about sustainable agriculture to diverse audiences in the region. It includes a "viewpoints" section to encourage broad discussion of controversial topics.

- **Revolving Loan Fund**. A pilot project provides "seed money" to help farmers make the transition to sustainable practices.

2.5 Farm Family Adjustment Strategies

Literature beyond that focused on sustainable agricultural practices and that focused on value-added strategies provides additional insights about possible adjustments by farm families to continue farming. For example, Moser and Vlasin (1990) conducted an analysis in Michigan to identify what adjustments farm families made in the 1985-89 period in response to the farm financial needs, and what adjustments they might make in response to future financial needs. They surveyed both farm operators and spouses, and received over 300 responses from each group.

Among the results, Moser and Vlasin found that augmenting income through off-farm employment was common. Some 42 percent of the operators and 36 percent of spouses had taken off-farm employment to augment family income, while an even larger percent were involved in some form of off-farm employment--for 1988, some 52 percent of the operators and 49 percent of the spouses reported off-farm employment (Moser and Vlasin, 1990).

Farm operators were asked to indicate the adjustments they made to reduce risk in the past (1984-88) and would make in the years ahead (1989-1993). Among the actions they identified were paying closer attention to marketing, postponing major farm purchases, reducing debt, sharing machinery and labor with neighbors, reducing expenditures for hired help, seeking off-farm employment, reducing machinery inventory, diversifying the farm by adding new crops, diversifying the farm by raising livestock, and buying crop insurance. Nearly one-eight indicated they had started a business (not farming) in the past and nearly one-eight indicated they would consider starting such a business to diminish their agricultural risk in the future (Moser and Vlasin, 1990).

Clearly, some of the actions taken by Michigan farmers in time of risk, and those they intend to take in adjusting to future risk, are consistent with actions identified by researchers focusing on sustainable farm practices and value-added enterprises to enhance farm family income. Off-farm income influences the stability of farms and the quality of life for the farm family, thus, recirculating the local economy. Farms and the surrounding rural communities are economically interdependent. Crisis on farms, often result in crisis in rural towns (Soule and Piper, 1992).

2.6 Findings From the Review of Literature

Lessons learned from prior research on sustainable agriculture and IFS programs suggest that some of the economic, environmental and social problems being experienced by US farmers (especially the small farmers) may be diminished through the adoption of sustainable practices, value-added actions, and resource use options such as have been described above. Environmental problems such as soil erosion, decreased soil fertility, impacts of insects and pests, and soil and water pollution may be resolved at least in part by making cover crops and crop rotations, instead of chemicals, a more integral part of the farming system. Cover crops and crop rotations also reduce the costs that chemical applications impose. The adoption of animal manure practices also permits a reduction in the cost of chemical.

Improved value-added activities and increased crop diversity provide sources of additional revenue and can help to ensure economic sustainability of individual farms and the farm community. Such adjustments can enhance the ability of farmers to stay in business. Rural communities will be stronger and depopulation of the rural areas will be retarded.

Community leadership, education, development and participation in sustainable agricultural practices were demonstrated as desirable actions in the aforementioned IFS projects. The worth of sustainable agricultural practices, such as crop rotations and cover cropping, were demonstrated in the IFS projects as well. Thus, the focus of this study will be to take a systems (holistic) approach to evaluating an individual IFS project to determine whether or not that IFS creates conditions for the sustainability of the individual farm venture as well as for the sustainability of the community of farmers.

The review of literature provides a useful platform of concepts and approaches on which this evaluation will build. Previous evaluation techniques used in addressing IFS operations have been largely economic, excluding social and environmental effects. The main concern has been with assessing productivity. Non-economic externalities must be taken into consideration (Dahlberg, 1986). Therefore a more holistic approach will be used.

Chapter 3

Framework for Analysis

3.1 Chapter Introduction

The purpose of this chapter is to set forth an **initial framework for analysis**. This framework will be used to help assess the extent to which one IFS project fosters sustainable agriculture or creates conditions of sustainability for individual farms or the farming community. The initial framework will introduce components of the framework used in this study. A later chapter will suggest additions to the initial framework that would make the framework a more comprehensive tool or model of analysis.

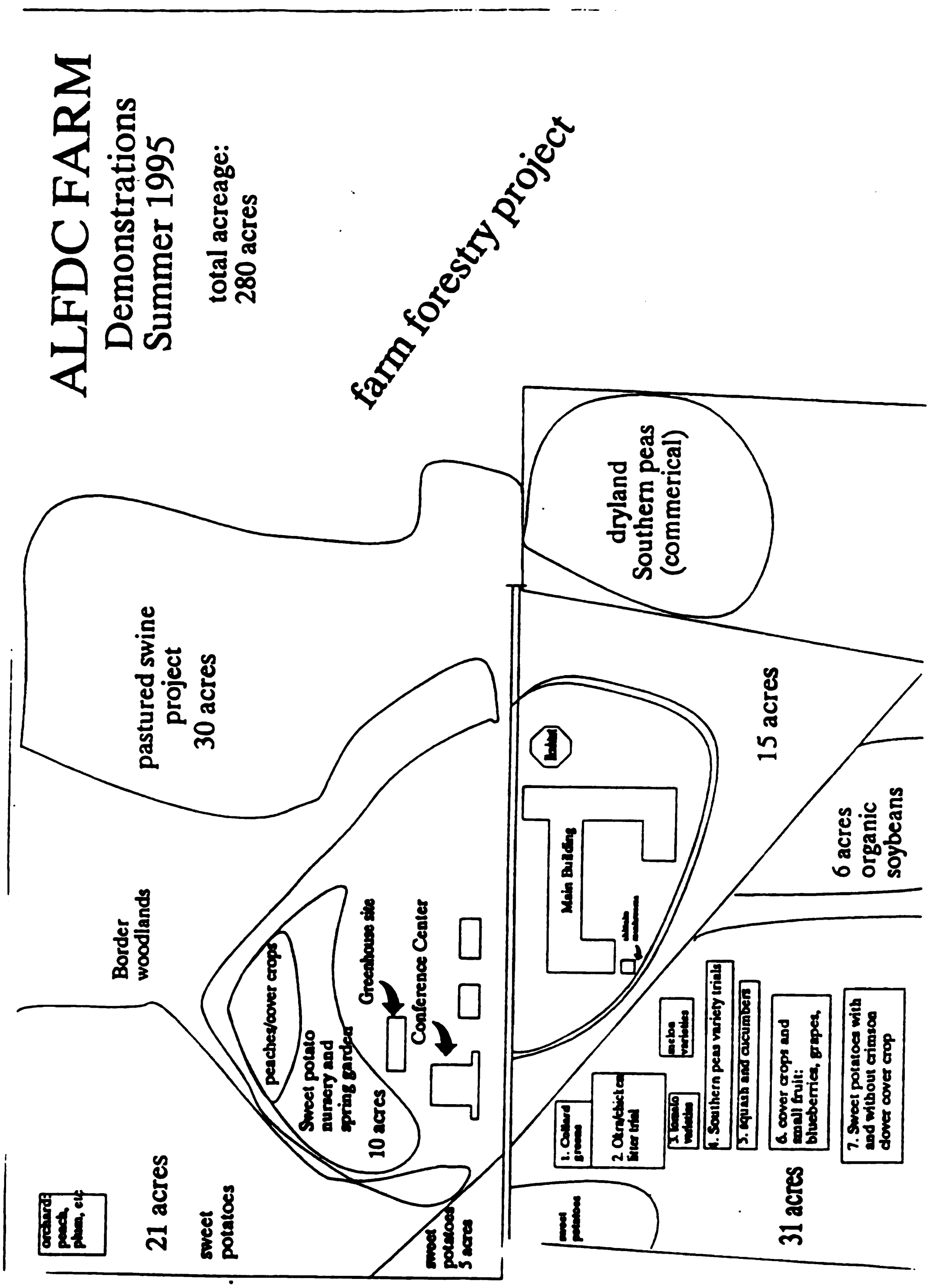
3.2 Description of ALFDC' s IFS Project

This community-based organization is headquartered in Brinkley, Arkansas and involves thirty-three (33) active farm operations, five paraprofessional farmer trainers, and a number of organizations and agencies. The farms are networked together by common interest even though they are spread over a sizeable geographic area.

The farms in this IFS project are crop and poultry farms. The farms range in size from approximately ten (10) acres to three thousand five hundred (3,500) acres, with the average size of farm being approximately two hundred (200) acres. Most of the farms are owned by the operator and his family. Most farms have a member of the household that works off the farm.

The ALFDC is organized around four types of collaboration or collaborative organizations. These include: 1) ALFDC, a community-based farm outreach organization serving limited resource and minority farmers (**a map of the IFS Headquarters, Facilities and Farm Demonstrations is presented below in Figure 1**);

Figure 1. ALFDC Farm Demonstrations Summer 1995



(Source: Arkansas Land and Development Corportion, 1995)

2) The University of Arkansas at Pine Bluff (UAPB), a historically black university and 1890 Land Grant research, education and extension institution; 3) Soil Conservation Service (SCS), now called the Natural Resource Conservation Service (NRCS), a United States Department of Agriculture (USDA) agency that promotes and provides financing, education, and technical assistance, concerning water and soil conservation practices; and 4) community based farmer-to-farmer networks headed by paraprofessional farmer trainers **(profiles of the five Paraprofessional Farmers are presented in Chapter 4)**.

These stakeholder organizations are intended to provide effective communication and feedback channels which accelerate timely access to information and training in production, management and marketing involving sustainable agriculture practices. They also are intended to contribute to rural economic development through cooperative development, value-added processing and agribusiness infrastructure improvements (ALFDC, 1994).

A key objective of this IFS project is to foster a more decentralized service and delivery support system for small limited-resource farmers. The limited-resource community of farmers constitutes a key stakeholder group in this project. The IFS project vision sees existing peer and social relation networks among farmers at the county level being expanded to include even more farmer-to-farmer networks throughout Arkansas and ultimately to national and international farmer-to-farmer networks (ALFDC, 1994).

A farmer or a trained Paraprofessional Farmer forms a network with 5 to 10 other farmers who live in close proximity. The skills, knowledge and attitudes acquired by the paraprofessional farmer are disseminated and demonstrated among the farmer-to-farmer network members by the paraprofessional. The Paraprofessional Farmer is provided a stipend by ALFDC to recover some of his farm and personal costs while he provides community service--gives on-farm demonstrations, serves as an advocate, mentors youth in agricultural work experience programs, and attends training of trainer workshops and field trips.

3.3 Framework for Analysis--Phase I

The following "framework of analysis" was created to help evaluate whether or not one community-based IFS project headquartered in Brinkley, Arkansas creates conditions for sustainability. **Phase I** of the framework involves the specification of the activity, the projects inputs, the project outputs, the process by which inputs lead to outputs, and the relationship of outputs to development goals. It draws upon the impact assessment steps of Herdt and Lynam (1991) as set forth in their writings on sustainable development. And, it specifies a set of initial questions to be addressed about changes in practices, changes in costs, and changes in income as a result of participating in the IFS project.

- **The Activity.** The activity to be assessed is one Integrated Farming Systems project involving thirty-three (33) farmers, networked together but located in various different counties, and the conditions the project fosters to increase productivity of enterprises and to increase farm family income.
- **Project Inputs.** Project inputs are provided by research and extension professionals, other IFS collaborators, IFS administrators, Paraprofessional Farmers, and other farmer members of the project.
  - **Inputs by Research and Extension Professionals**--The IFS Project includes agricultural research and extension. Agricultural research and extension professionals enter into partnerships with farmers, providing them and the paraprofessionals with production, management and market information. In addition, the agricultural research and extension professionals provide a systems approach to agricultural development comprised of an integration of perspectives from different disciplines in the biological, social and physical sciences.
  - **Inputs by other IFS Collaborators**--Key among the other IFS collaborators is SCS (now NRCS) and the technical information and assistance its professionals provide on an array of soil and water

conservation matters. Other collaborators include UAPB research, education and extension professionals. They provide knowledge inputs to the project as well as technical assistance. They also serve as educators on occasion for Paraprofessionals and other farmers.

- **Inputs by IFS Administrators**--The IFS administrators also provide a range of inputs to the project. Primary among these are the service and delivery support systems. Specific inputs they provide include dissemination of information on alternative production practices, budgeting and marketing. Other inputs include research and demonstration trials, technical assistance in alternative production practices and training and supervision of the Paraprofessional Farmers.
- **Inputs by the Paraprofessional Farmers**--The paraprofessionals give their time and talents to provide their assistance and knowledge to the farmers in their network. They give on-farm demonstrations, serve as advisors and advocates for improved and alternative practices, mentor youth in agricultural work experience programs, attend training or trainer workshops, and participate in field trips.
- **Inputs by Farmers in the Networks**--They help create on-farm demonstrations and contribute their time, knowledge and labor to them. They also help serve as advisors and advocates for improved practices, help mentor youth in agricultural work experience programs, participate in educational/training programs and participate in field trips.

- **Project Outputs.** The project outputs intended, in the broadest sense, include agricultural systems that are economically and environmentally sustainable. The IFS Project is expected to increase incomes through the development and adoption of more productive practices including new enterprises that take account of the whole farm and see farm family welfare as dependent on a wide range of variables. Among the stakeholders involved, the limited-resource community of farmers and the special concern for the individual farm family venture are central.

The specific project outputs intended, those contributing to agricultural systems that are economically and environmentally sustainable, include the following:

- **Outputs by Farmers in the Networks**--Among the project outputs intended by farmers are increased sustainable agricultural practices, increased use of a combination of enterprises that will enhance farm family income, and use of farm and family resources both on and off the farm for increased farm family income. Expansion in the number of farmers' networks and an increase in the usefulness of those networks can be viewed as outputs to which farmers are key contributors.
- **Outputs by IFS Administrators and the Paraprofessionals who assist them**--The IFS administrators hope to create a decentralized service and delivery support system for socially disadvantaged and limited-resource farmers. A key component will be networks of 5-10 farmers functioning together in a cooperative mode, with each network served by a trained Paraprofessional Farmer. Other important components intended are research, demonstration, technical assistance and training aspects of the service and delivery support system.
- **Output by IFS Collaborators**--IFS collaborators hope to join with IFS administrators, and paraprofessional farmers in fostering the service and delivery support system. In addition, the research results, demonstrations, technical and training assistance and financial assistance intended give content to and reinforce the system. They also would help establish the climate and other conditions necessary for

sustainable agriculture and enhanced income for farms and farm communities.

- <u>**Project Output Measures**</u>. Specific output or outcome measures are a third dimension of the framework. Needed are output/outcome measures that will help the analyst determine:
  - Whether agricultural production practices have improved on participating farms;
  - Whether agricultural production has increased on participating farms;
  - Whether the cost of production improved on participating farms;
  - Whether the farm family income improved for participating farms.

The following set of questions will be addressed, in order to obtain specific measures of outputs. Analysis of the answers obtained from use of these questions will constitute the core of the study.

- **The precise population of interest to be questioned**:
  - What is the precise population for this analyses?
  - What approach will be used to obtain the information?
- **Development of better agricultural production practices**:
  - What are the pre-project agricultural production practices?
  - What are the qualities and characteristics of these practices?
  - What are post-project agricultural production practices?
  - What are the qualities and characteristics of these practices?
- **Improved agricultural production by participating farmers**:
  - What is the cost of agricultural production pre-project?
  - What is the cost of agricultural production post-project?
- **Increased income of participating farmers**:
  - What is the level of income before participating in the project?
  - What is the level of income after participating in the project?

3.4 Framework for Analysis--Phase II

Phase II of the "framework for analysis" addresses several conditions, supplementing those addressed in Phase I. These additional conditions involve: (a) On-farm agricultural contributions to achieve sustainability of the individual farm family venture and the sustainability of the community of farmers; (b) Off-farm use of farm family labor and creativity; (c) Broader collective actions to strengthen the rural communities (i.e. enhance markets, business and industry, hospitals, schools, nursing homes, doctors' services, pharmacies, etc.). Information available about the IFS project will allow some of the Phase II conditions or elements to be addressed in this study. However, most go well beyond the scope of this study. The final chapter in this dissertation will revisit both Phase I and II elements in an effort to readdress the usefulness of this comprehensive framework for future analyses of IFS projects' effectiveness.

The following additional conditions are intended to serve as supplements to the initial framework for analyses, represented in Phase I. The additions are:

- **<u>On-farm agricultural contributions and creative use of farm family labor to achieve sustainability of the individual farm family venture and the sustainability of the community of farmers.</u>**
    - **Current (traditional) enterprises for income on farms**:
        - Was there a change in income from improved practices for current/traditional agricultural enterprises?
        - Was there a change in income from value-added activities for current/traditional agricultural enterprises?
    - **Alternative new enterprises on farms for income--ones complementing or substituting for current agricultural enterprises**:
        - Are the farms using improved practices in their new enterprises?.
        - Are the farms using value added activities in their new enterprises?

- **More profitable combination of current traditional and alternative new enterprises**:
  - Are the farms adjusting to more profitable combinations of current traditional enterprises and alternative new enterprises with their improved practices and value added activities?
  - What was the change in income that resulted?
- **New uses of farm family labor and creativity**:
  - Are the farms undertaking new enterprises on farm (farm-based) outside of agriculture to utilize farm family labor and creativity (e.g. making of quilts, handbags, wood crafts, resale of wholesaled items, machinery repair for others, welding, small engine repair etc.)?
  - What was the change in income that resulted?

- **<u>Off-farm use of farm family labor and creativity.</u>**
  - **Labor of farm operator**:
    - Was the farm operator employed in off-farm work on other farms? What was the change in family income that resulted?
    - Was the farm operator employed off-farm (not on another farm) in agribusiness or non-agricultural activities? What was the change in family income that resulted?
  - **Labor of other farm family members**:
    - Was labor of other farm family members used on other farms? What was the change in family income that resulted?
    - Was labor of other farm family members used off-farm (not on another farm) in agri-business or non-agricultural activities? What was the change in income that resulted?
  - **Combined effects of off-farm use of farm family labor and creativity**:

        - What was the combined change in income from the off-farm use of all farm family labor and creativity?
        - Did the off-farm employment result in other valuable benefits, such as health, dental and eye care benefits, etc.? If so, what was the approximate value of the additional benefits to the farm family?

- **Broader collective actions to strengthen the rural communities (i.e. markets, business and industry, hospitals, schools, nursing homes, doctors' services, pharmacies, etc.)**.
    - **Fostering visioning or strategic planning to enhance the rural communities**:
        - Did any of the IFS project stakeholders (farmer networks, paraprofessionals, IFS administrators and collaborators) foster, facilitate or participate in such planning activities as visioning, strategic planning, or comprehensive community planning to strengthen rural communities serving the farm family participants in the IFS project?
        - Did any of the IFS project stakeholders help implement plans developed to strengthen rural communities serving the farm family participants in the IFS project?
    - **Advancing a particular sector of the local community and economy**:
        - Did any of the IFS project stakeholders help advance a particular sector of the local community and economy serving the farm family participants in the IFS project? If so, what sector (e.g. development of markets for products or services; retention or expansion of business and industry, including agri-business supply and processing cooperatives or firms; creation or attraction of new business or industry; expansion of tourism enterprises or employment; increasing or upgrading of other employment opportunities; retaining, enhancing or

attracting professional services for farm families and others--health care, education, financial, other)?

- Did any of the IFS project stakeholders help advance any other farm sustainability or quality of living conditions? If so, what actions (e.g. preservation and protection of agricultural land and open space; protection and wise use of other natural resources--water, forests, wildlife, etc.; improvement and protection of the aesthetics, history, or culture of the communities that serve the farm families in the IFS project)?
- Did any of the IFS project stakeholders take any other actions that increased the sustainability of the farms through enhancement of the community context in which the farm families in the IFS project live, work, seek employment and income, seek services, recreate and retire?

3.5 Concluding Comments

The initial framework for analysis is presented above. Its purpose is to provide a tool that can be used to help assess the extent to which the community-based IFS project in Brinkley, Arkansas fosters sustainable agriculture or creates conditions of sustainability as defined in this study, for individual farms or the farming community.

Part I of the framework was developed first, and in its earliest form it served as a guide in the design of the survey instrument that was used to obtain information from participating farms. As such, it focused on questions that would indicate:

- Cropping practices used before and after participating in the IFS project that would enhance environmental and/or economic sustainabiltiy.
- Cropping enterprises grown before and after participating in the IFS project;

- Chemical fertilizer and pesticide use, and whether it increased, decreased, or remained the same after participating in the IFS project;
- Operating costs before and after participating in the IFS project;
- Income before and after participating in the IFS project.

Chapter 4

Findings

4.1 Chapter Introduction

This chapter reports the results of the evaluation of the Arkansas Land and Farm Development Corporations' (ALFDC) IFS project. Sources of information are discussed in section 4.2. The results of the study are presented in section 4.3 through 4.6. Covered are the results of the survey of participating farms, profiles of paraprofessional farmers, results of assistance by IFS collaborators and results of assistance by IFS administrators. Based on the findings from these various sources, the hypotheses are addressed in section 4.7.

4.2 Sources of Information

Data for this study were obtained from both primary and secondary sources. A survey instrument was designed and distributed to collect information from farmers (See: Appendix). Research scientists and research administrators also were contacted for information about the project and reviewed the survey instrument before it was given to farmers. Interviews were used to obtain sensitive information and clarify questions that would otherwise be impossible to obtain through other means. Secondary data sources were used, including annual plans and progress reports of the Arkansas Land and Farm Development Corporation as well as corporation published results.

4.3 Results of Survey of Participating Farms

Description of Farm Families in the IFS Project

Information was received from twenty-four (24) of the thirty-three (33) farmers surveyed. All of the farmers surveyed in this IFS project are African American males. Their farm operations are located in a total of forty-two (42) counties and network together because of their belief in cooperative education and action.

Fifteen (15) of the farmer-respondents have a high school education. Four farmers are college educated and four farmers indicated that they have graduate school experience. One farmer indicated that his level of education is below high school.

The number of farm family members and number of children are presented in **Table 1.** As shown below in **Table 1**, three of the farm families did not have children.

Table 1. Number of Farm Family Members and Number of Children

Farmer Designation	Number of Family Farm Members	Number of Children
1	2	0
2	3	10**
3	2	10**
4	4	5
5	4	3
6	4	2
7	4	1
8	7	5
9	3	1
10	3	1
11	2	0
12	30*	3
13	4	2
14	4	2
15	3	2
16	4	2
17	5	3
18	3	10**
19	1	1
20	3	7
21	2	0
22	7	5
23	2	1
24	4	2

* An extended family of thirty (30) persons.
**Most/all of the children live off the farm.

Five farmers indicated that their children work four to six hours per week on the farm. Three farmers indicated that their children work part-time on the farm--ten (10) to twenty (20) hours per week. The age of the children may have been a factor in these cases as well since the age range of children in this category began at fourteen (14) years of age. One farmer indicated that he had an adult child that works full-time on the farm--forty (40) hours per week.

Information also was obtained on whether the farmer-respondents' children are interested in farming. Thirteen(13) of the farmers indicated that they have children who are interested in farming. This may suggest that they want to become farmers. The introduction of new and young farmers into agriculture is a useful component that enhances the sustainability of the community of farmers as well as the farm family venture. Six of the farmers suggested that their children are not interested in farming. Again, three of the farmers do not have children. Thus, it appears that over one-half of the respondent farms had family characteristics that would encourage continuation of the farm operation.

While this writer did not conduct a formal non-respondent check at the time of the survey, due to lack of resources, an informal inquiry was made concerning the group of farmers that had not responded to the survey. Contact with IFS administrators indicated that the farmer non-respondents likely were similar in terms of average size of farm operation, as well as number of children, and children working in the farm operation. IFS administrators indicated that they saw no differences between the respondent group and the non respondents.

Agricultural Production Practices

The focus of ALFDC's IFS project is to increase the adoption of more sustainable agricultural production practices such as the use of animal manure, cover cropping, crop rotations, and increased crop diversity instead of relying on intensive chemical use. The adoption of such practices would enhance the sustainability of the community of farmers as well as the individual farm family ventures according to ALFDC.

Farmers were asked about the agricultural production practices they used. And they were asked whether or not their use of certain practices was increasing, decreasing, or remaining about the same after participating in the IFS project.

Participants were asked whether or not they used minimum or no tillage. Three of the farmers did not respond to this question. Eight of the twenty-one (21) farmer-respondents (38%) reported that they used minimum tillage. **(Note: In this instance and subsequent ones percentages are based on the number of units reporting an action divided by the total number of farms reporting on that tillage operation. In this instance eight divided by twenty-one (8/21) farms yields a percentage of thirty-eight (38%)).** Four of the farmers' use of minimum tillage is increasing. Three farmers' use of minimum tillage has remained the same after participating in the IFS project.

Also, farmers were asked whether or not they used green manure crops. Five of the twenty-four (24) farmers did not respond to this question. However, two of the remaining nineteen (19) farmer-respondents (11%) indicated that they use green manure crops and that there use has remained the same after participating in the IFS project.

In addition, farmers were asked whether or not they used chemical fertilizers.

Four of the twenty-four (24) farmers did not respond to this question. Eighteen (18) of the remaining twenty (20) farmers (90%) indicated that they use chemical fertilizers. Four farmers indicated that their use of chemical fertilizers increased after participating in the IFS Project (**See: Table 2A**). Four farmers indicated that their use of chemical fertilizers decreased after participating the IFS project (**See: Table 2B**). Six farmers indicated that their use of chemical fertilizers remained the same after participating in the IFS project. Four farmers who reported chemical use did not indicate whether their chemical use has increased, decreased or remained the same after participating in the IFS project.

Whether or not cultivation or rotations were used for weed or pest control was also a question in this study. Seventeen (17) of twenty-two (22) farmer-respondents (77%) indicated that they used cultivation or rotation for weed or pest control. Seven of these farmers reported that their use of cultivation or rotation for weed or pest control has increased after participating in the IFS project (**See: Table 2A**). Three reported that their use remained the same after participating in the IFS project (**See: Table 2C**). Six farmers did not indicate whether their use of cultivation or rotations had increased, decreased, or remained the same.

Farmers were also asked about their use of composted manure and raw manure. Three of the twenty-four (24) farmers did not respond to either of these questions. Seven of the twenty-one (21) farmer-respondents (33%) indicated that their use of composted manure increased after participating in the IFS project (**See: Table 2A**). Five farmers are using raw manure. Four of these three farmer's use of raw manure increased after participating in the IFS project. One farmers' use of raw manure has remained the same after participating in the IFS project.

Additionally, the question of whether or not the participant used cover crops was addressed. Three of the twenty-four (24) farmers did not respond to this question. Ten(10) (48%)of the remaining twenty-one (21) farmers reported that they used cover crops. Five of these twenty-one (21) farmers indicated that their use of cover crops has increased after participating in the IFS project (**See: Table 2A**). Six of these twenty-one (21) farmers indicated that their use of cover crops had remained the same after participating in the IFS project. Four out of twenty-two (22) farmers indicated that they used plastic and straw mulches. There was no information available on four of the farmers as it related to plastic and straw mulches.

It is easier to assess the agricultural practices performed by farm operators since joining the IFS project by looking at the combined actions of the twenty-four (24) operators contributing to sustainable agriculture. Based on the information provided by IFS Administrators and review of literature, the following practices are used as those contributing to agricultural sustainability:

- Continued use or increased use of green manure;
- Continued use or increased use of minimum tillage or no tillage;
- Decreased use of chemical fertilizer or non-use of chemical fertilizer;
- Continued use or increased use of cultivation and rotations for weed and pest control as opposed to chemical applications;
- Continued use or increased use of composted or raw manure;

- Continued use or increased use of cover crops or mulches.

Table 2D shows the farm operators that reported one or more of these six practices to enhance agricultural sustainability. Most of the farms performed at least two of the 6 practices, with a few performing 4 or 5 of the practices. Thus, for most respondents practices that enhance agricultural sustainability that were used before they joined the project were continued after they became participants in the IFS project. And, in a number of instances farm operators added or increased practices after they joined the IFS project.

Table 2A Increased Use of Production Practices by Respondents

Farmer Designation	Increased Use of Minimum Tillage	Increased Use of Green Manure	Increased Use of Chemical Fertilizer	Increased Rotation for Weed and Pest Control	Increased Use of Composted or Raw Manure	Increased Use of Cover Crops or Mulches	Increase in Number of Practices Used Per Farmer
1	Yes	N.A.	No	No	Yes	No	2
2	No	D.N.A.	No	?	No	No	0
3	No	No	Yes	No	No	No	1
4	No	No	No	Yes	Yes	Yes	3
5	No	No	?	No	No	No	1
6	D.N.A.	D.N.A.	D.N.A.	D.N.A.	No	No	0
7	No	No	Yes	Yes	No	No	2
8	No	No	No	No	No	No	0
9	No	No	Yes	No	No	No	1
10	No	No	No	Yes	Yes	Yes	3
11	No	No	No	Yes	Yes	Yes	3
12	D.N.A.	D.N.A.	No	Yes	Yes	Yes	3
13	Yes	D.N.A.	No	D.N.A.	D.N.A.	D.N.A.	1
14	No	No	No	Yes	No	Yes	2
15	No	No	?	?	No	No	0
16	Yes	D.N.A.	No	?	No	No	1
17	No	No	?	?	No	No	0
18	N.A.	N.A.	N.A.	?	N.A.	N.A.	0
19	D.N.A.	D.N.A.	Yes	Yes	Yes	Yes	4
20	Yes	D.N.A.	No	No	Yes	D.N.A.	2
21	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0
22	D.N.A.	N.A.	?	?	No	No	0
23	?	?	N.A.	No	No	No	0
24	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0
Total	4	0	4	7	7	6	

D.N.A. Indicates Does Not Apply
N.A. Indicates No Response or Not Available
? Implies that the respondent is using a particular practice. However, the respondent did not indicate whether or not his use of a particular practice has increased after participating in the IFS Project.

Table 2B Decreased Use of Production Practices by Respondents

Farmer Designation	Decreased Use of Minimum Tillage	Decreased Use of Green Manure	Decreased Use of Chemical Fertilizer	Decreased Rotation for Weed and Pest Control	Decreased Use of Composted or Raw Manure	Decreased Use of Cover Crops or Mulches	Decrease in Number of Practices Used Per Farmer
1	No	N.A.	No	No	No	No	0
2	No	D.N.A.	No	?	*	No	0
3	*	*	No	No	*	*	0
4	No	*	Yes	No	No	No	1
5	*	*	No	No	*	No	0
6	D.N.A.	D.N.A.	D.N.A.	D.N.A.	No	No	0
7	*	*	?	No	*	*	0
8	*	*	*	*	*	*	0
9	*	*	No	*	*	*	0
10	*	No	Yes	No	No	No	1
11	No	No	Yes	No	No	No	1
12	D.N.A.	D.N.A.	Yes	No	No	No	1
13	No	D.N.A.	No	D.N.A.	D.N.A.	D.N.A.	0
14	*	*	No	No	*	No	0
15	*	*	?	?	*	*	0
16	No	D.N.A.	No	?	*	*	0
17	*	*	?	?	*	*	0
18	N.A.	N.A.	N.A.	?	N.A.	N.A.	0
19	D.N.A.	D.N.A.	No	No	No	No	0
20	No	D.N.A.	No	Yes	No	D.N.A.	1
21	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0
22	D.N.A.	N.A.	?	?	*	*	0
23	?	?	N.A.	*	*	*	0
24	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0
Total	**0**	**0**	**4**	**1**	**0**	**0**	

D.N.A. Indicates Does Not Apply

N.A. Indicates No Response or Not Available

? Implies that the respondent is using a particular practice. However, the respondent did not indicate whether or not his use of a particular practice has decreased after participating in the IFS Project.

* Indicates that the respondent did not use a particular practice.

Table 2C Continued (Same) Use of Production Practices by Respondents

Farmer Designation	Continued (Same) Use of Minimum Tillage	Continued (Same) Use of Green Manure	Continued (Same) Use of Chemical Fertilizer	Continued (Same) Use of Rotation for Weed Control	Continued (Same) Use of Composted or Raw Manure	Continued (Same) Use of Cover Crops or Mulches	Number of Practices Continued Per Farmer
1	No	N.A.	Yes	Yes	No	Yes	3
2	Yes	D.N.A.	Yes	?	*	Yes	3
3	*	*	No	Yes	*	*	1
4	Yes	*	No	No	No	No	1
5	*	*	No	Yes	*	Yes	2
6	D.N.A.	D.N.A.	D.N.A.	D.N.A.	Yes	Yes	2
7	*	*	?	No	*	*	0
8	*	*	*	*	*	*	0
9	*	*	No	*	*	*	0
10	*	Yes	No	No	No	No	1
11	Yes	Yes	No	No	No	Yes	3
12	D.N.A.	D.N.A.	No	No	No	Yes	1
13	No	D.N.A.	Yes	D.N.A.	D.N.A.	D.N.A.	1
14	*	*	Yes	No	*	No	1
15	*	*	?	?	*	*	0
16	No	D.N.A.	Yes	?	*	*	1
17	*	*	?	?	*	*	0
18	N.A.	N.A.	N.A.	?	N.A.	N.A.	0
19	D.N.A.	D.N.A.	No	No	No	No	0
20	No	D.N.A.	Yes	No	No	D.N.A.	1
21	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0
22	D.N.A.	N.A.	?	?	*	*	0
23	?	?	N.A.	*	*	*	0
24	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0
Total	**3**	**2**	**6**	**3**	**1**	**6**	

D.N.A. Indicates Does Not Apply

N.A. Indicates No Response or Not Available

? Implies that the respondent is using a particular practice. However, the respondent did not indicate whether or not his use of a particular practice has continued (remained the same) after participating in the IFS Project.

* Indicates that the respondent did not use a particular practice.

Table 2D Continued (Remained the Same) or Increased Use of Production Practices by Respondents

Farmer Designation	Continued or Increased Use of Minimum Tillage	Continued or Increased Use of Green Manure	Continued or Increased Use of Chemical Fertilizer	Continued or Increased Use of Rotation for Weed and Pest Control	Continued or Increased Use of Composted or Raw Manure	Continued or Increased Use of Cover Crops or Mulches	Number of Practices Increased or Continued Per Farmer
1	Yes	N.A.	Yes	Yes	Yes	Yes	5
2	Yes	D.N.A.	Yes	?	*	Yes	3
3	*	*	Yes	Yes	*	*	2
4	Yes	*	No	Yes	Yes	Yes	4
5	*	*	Yes	Yes	*	Yes	3
6	D.N.A.	D.N.A.	D.N.A.	D.N.A.	Yes	Yes	2
7	*	*	?	Yes	*	*	1
8	*	*	*	*	*	*	0
9	*	*	Yes	*	*	*	0
10	*	Yes	No	Yes	Yes	Yes	4
11	Yes	Yes	No	Yes	Yes	Yes	5
12	D.N.A.	D.N.A.	No	Yes	Yes	Yes	3
13	Yes	D.N.A.	Yes	D.N.A.	D.N.A.	D.N.A.	1
14	*	*	Yes	Yes	*	Yes	3
15	*	*	?	?	*	*	0
16	Yes	D.N.A.	Yes	?	*	*	2
17	*	*	?	?	*	*	0
18	N.A.	N.A.	N.A.	?	N.A.	N.A.	0
19	D.N.A.	D.N.A.	Yes	Yes	Yes	Yes	4
20	Yes	D.N.A.	Yes	No	Yes	Yes	4
21	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0
22	D.N.A.	N.A.	?	?	*	*	0
23	?	?	N.A.	*	*	*	0
24	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0
Total	7	2	10	10	8	11	

D.N.A. Indicates Does Not Apply

N.A. Indicates No Response or Not Available

? Implies that the respondent is using a particular practice. However, the respondent did not indicate whether or not his use of a particular practice has continued (remained the same) or increased after participating in the IFS Project.

* Indicates that the respondent did not use a particular practice.

Type of Agricultural Production

Farm operators were asked about the nature of their agricultural production, and whether their crop and livestock production had changed since joining the IFS project. The responses from the twenty-four (24) farm operators who answered the questionnaire showed that there has not been substantial change in farmer-operators' crop production and little change in livestock production since they have joined the IFS project.

Most of the farmers are growing the same crops and livestock (i.e. soybeans, wheat, corn, watermelons, other vegetables, cows, chickens, ducks, geese and hogs) currently as they were prior to participating in the IFS project. However, more vegetables are being grown on a larger scale (**See: Table 3**). It is more beneficial for smaller farmers to diversify and grow higher-value crops (vegetables) because vegetables provide a higher rate of return. Row crops (i.e. rice, soybeans and corn) are more profitable when there is a sizeable acreage and can be produced on a larger scale. In addition, growing vegetables increases crop diversity--farmers that are diversified do not have to rely on a single crop for their income.

Change in Total Agricultural Production

Farm operators were asked whether their agricultural production had changed since they became a part of the IFS project. In particular they were asked what crops and livestock did they grow and raise before and after participating in the IFS project. Twenty-three (23) of the twenty-four (24) farmers surveyed responded to this question. Eight of the farmers (35%) out of the twenty-three (23) farmer-respondents indicated that their crop production had changed. The data suggests that these eight farmers increased their crop diversity by growing vegetables on a larger scale after participating in the IFS project (See: **Table 3**). However, the cost of agricultural production as well as the income for these particular farmers stayed about the same after participating in the IFS project.

The most significant change in production was attributed to the addition of a wider range of vegetable crops and an increase in the production of vegetables--both previously produced and new vegetables (See: **Table 3**).

Table 3. Agricultural Production Before/After Participating in the IFS Project

Farmer Designation	Production (Before)	(After)
1	Rice, Beans, Wheat Cows	Same
2	N.A.	N.A.
3	Soybeans, Hogs	Same
4	Rice, Soybeans, Wheat	Same + Organic Garden
5	Soybeans, Wheat	Same
6	Watermelons, Sweet Potatoes	Sweet Potatoes, Peas, Tomatoes, Cabbage
7	Soybeans, Corn, Hogs	Same
8	Soybeans	Soybeans, Wheat
9	Rice, Soybeans, Wheat	Same

Table 3 (Continued). Agricultural Production Before/After Participating in the IFS Project.

Farmer Designation	Production (Before)	(After)
10	Hogs, Cows, Chickens, Ducks, Geese, Corn, Butter Beans, Green Beans, Greens, Sweet Potatoes, Irish Potatoes, Bell Peppers, Hot Peppers, Squash, Watermelons, Cantaloupes, Tomatoes, Onions, English Peas, Cabbage	Same + Basil
11	Soybeans, Wheat Tomatoes, Bell Corn, Sweet Potatoes, Okra, Peppers, Onions, Cabbage, Water-melons, Peas	Same + Greens, Squash Cucumbers, Lima Beans
12	Vegetables*	Same
13	N.A.	N.A.
14	Soybeans, Wheat Vegetables*	Same
15	Cows, Vegetables*	Same
16	None	Vegetables*
17	Soybeans, Wheat	Same

Table 3 (Continued). Agricultural Production Before/After Participating in the IFS Project.

Farmer Designation	Production (Before)	(After)
18	Beans	Same
19	Soybeans, Wheat Milo, Vegetables	Soybeans, Wheat , Milo
20	Rice, Soybeans, Wheat, Milo	Spinach, Greens, Okra, Peas
21	Swine, Chickens	N.A.
22	Peas, Okra, Greens, Peppers	N.A.
23	None	Okra, Peas, Squash
24	N.A.	N.A.

N.A. Indicates Not Available

Agricultural Production Cost

A reduction in the cost of agricultural production is another focus of ALFDC's IFS project. A reduction in the cost of agricultural production enhances the sustainability of the community of farmers as well as the individual farm family venture. Farmer-respondents were asked about their costs of agricultural production before and after participating in the IFS Project. To provide an easy response for farmers, the following ranges of agricultural production costs were used:

1 = $ 5,000 - $10,000
2 = $10,000 - $20,000
3 = $20,000 - $30,000
4 = $30,000 - $40,000
5 = $40,000 or Greater

Farmers' agricultural production costs before and after participating in the IFS Project are documented in **Table 4.** Twenty (20) farmers responded to the question related to agricultural production. Sixteen (16) farmers indicated that their agricultural production costs had remained the same after participating in the IFS Project. Three farmers indicated that their agricultural production costs increased after participating in the IFS Project.

Table 4. Costs Before and After Participating in the IFS Project

Farmer Designation	Costs (Before)	Costs (After)	Comparison
1	5	5	S
2	3	3	S
3	5	5	S
4	2	2	S
5	1	1	S
6	2	2	S
7	1	1	S
8	5	5	S
9	2	3	I
10	5	5	S
11	5	5	S
12	5	5	S
13	2	2	S
14	1	1	S
15	1	1	S
16	1	5	I
17	5	5	S
18	N.A.	N.A.	N.A.
19	1	5	I
20	5	5	S
21	1	N.A.	N.A.
22	N.A.	N.A.	N.A.
23	N.A.	N.A.	N.A.
24	N.A.	N.A.	N.A.

(D) Decrease, (S) Same, (I) Increase, (N.A.) Not Available

For the sixteen (16) farmers that reported that their production costs had remained the same, analysis showed that four of these actually reported changes in agricultural (crop and livestock) production--increased vegetable production. Nine farm operators reported no changes in agricultural production. Five farmers did not respond to the question about agricultural (crop and livestock) production.

Of the two farm operators that reported increases in agricultural production costs one reported changes in agricultural production--increased vegetable production. And, one farmer-respondent reported no changes in agricultural production.

While the measures of production costs are broad, not precise, the results obtained indicate that farm operators have experienced no major cost of production increases since joining the IFS project. It is possible that the categories used mask minor changes in agricultural production costs--that is increases within the dollar ranges provided to farm operators in the questionnaire.

Income

An increase in income is also an objective of ALFDC's IFS project. An increase in income enhances the sustainability of the community of farmers as well as the individual farm family venture. Farmer-respondents were asked what was their income before and after participating in the IFS Project. Again, to provide an easy response for farmers, the following convenient ranges for income were used in obtaining farmers' responses:

1 = $ 5,000 - $10,000
2 = $10,000 - $20,000
3 = $20,000 - $30,000
4 = $30,000 - $40,000
5 = $40,000 or Greater

Farmers' income before and after participating in the IFS project is documented in **Table 5.** Twenty farmers (20) responded to the question related to income. Sixteen (16) farmers indicated that their income had remained the same after participating in the IFS project. Three farmers indicated that their incomes increased after participating in the IFS project.

Table 5. Income Before and After Participating in the IFS Project.

Farmer Designation	Income (Before)	Income (After)	Comparison
1	5	5	S
2	3	4	I
3	5	5	S
4	2	3	I
5	1	1	S
6	3	3	S
7	3	3	S
8	5	5	S
9	2	2	S
10	5	5	S
11	5	5	S
12	5	5	S
13	3	3	S
14	3	3	S
15	3	3	S
16	2	3	S
17	2	2	S
18	N.A.	N.A.	N.A.
19	1	3	I
20	5	5	S
21	1	N.A.	S
22	N.A.	N.A.	N.A.
23	N.A.	N.A.	N.A.
24	N.A.	N.A.	N.A.

(D) Decrease, (S) Same, (I) Increase, (N.A) Not Applicable

Leadership and Community Education

Still another focus of ALFDC's IFS project is leadership development and community education and empowerment . This is encouraged by the IFS administration through educational programs with farm operators (and spouses), and through the special training of selected farmers to serve as paraprofessionals for training of others. These efforts enhance the sustainability of the community of farmers as well as the individual farm family venture.

Movement has been toward more integrative and active leadership at the project level. Within the IFS project, Paraprofessional Farmers are selected and trained to form networks of five to seven participating farmers, called Target Farmers. The Target Farmers are selected by the Paraprofessional Farmers--people that they are able to relate to. Also, Target Farmers must be members of the local community.

The criteria for selecting Paraprofessional Farmers include the following:

- Candidates must enter the IFS Project as Target Farmers.
- Candidates must exhibit leadership qualities.
- Candidates must demonstrate that they have a profitable farm operation.
- Candidates' record of achievement must include participation in professional organizations, agriculture seminars, community volunteerism, work with youth, etc.
- Candidates must be committed to environmental and social sustainability.
- Candidates must be accessible.
- Candidates must provide a one-page essay: Would you be willing to become a Paraprofessional Farmer if you were not getting a stipend?
- References must be provided by candidates.

Impressive leadership skills have been demonstrated by the Paraprofessionals in the project. Their past accomplishments include initiative in organizing IFS produce, horticultural crop and expanded market opportunities. Also, they collaborated with the Arkansas Economic Corporation (AEC) and the ALFDC to secure a $100,000 loan to upgrade a coop packing shed for cooling and grading vegetables and to secure pea and bean harvesters.

Target Farmers feel that Paraprofessional Farmers should be examples that other participating farmers will want to follow. They believe that Paraprofessional Farmers, leading by example, should encourage neighbors and family members to use less commercial chemicals and use more cover cropping, organic methods, and natural insect repellents (i.e. garlic and red peppers). And they believe Paraprofessionals should encourage other practices that preserve the land for future generations such as fertilizing crops with chicken pellets, raw chicken litter and gin trash as alternatives to conventional chemical use. Also, Paraprofessional Farmers should provide information related to cost-efficient production practices and work with other farmers in any areas in which they may be experiencing problems.

Target Farmers feel overwhelmingly that they have learned from the IFS Project such skills as alternative methods of production, use of different crop varieties, new marketing and management skills, as well as how to better work with others. Generally, participating farmers feel that Paraprofessional Farmers are very informative and are doing what they are supposed to do. Many of the Target Farmers also feel that they have the leadership qualities needed to become Paraprofessional Farmers. However, not many of the participating farmers (Target Farmers) are optimistic about becoming Paraprofessional Farmers

4.4 Paraprofessional Farmer Profiles

Since the role and performance of the Paraprofessional Farmer is viewed by Target Farmers as being so crucial in the IFS project, profiles are provided here of the five

Paraprofessional Farmers who served the IFS project and its thirty-three (33) farmer participants.

Paraprofessional Farmer #1

Paraprofessional Farmer #1 grew up near Parkin, Arkansas where he now farms 3000 acres of soybeans, wheat and rice, and mills brown rice. He served as ALFDC's President for the first 12 1/2 years of its existence and continues to be active in advocacy work for African-American farmers. He is President of African-American Farmers USA and on the Board of several advocacy and rural development organizations.

He began milling his own rice because the large rice millers dock too much and have too much shrinkage. He also finds his price is approximately $1 more per bushel when he sells his rice himself. A small miller has problems breaking into markets controlled by the large mills. Further, he has benefited from markets with USDA for rice to be shipped overseas. He also markets directly to consumers.

He is the only African - American rice processor in the United States. Active in the Small Farmer's Cooperative of Arkansas, he believes ownership by farmers of value-adding capacity is crucial to sustainability. He is converting his mill to be able to produce both brown and white rice.

This farmers' IFS demonstration is with soybeans. He is trying different varieties to test yield potential and the effect of various chemicals on yield. The chemicals he is testing are "environmentally friendly" Dupont products which can be applied over the top of certain varieties to reduce the need for pre-emergence herbicides.

His IFS target group is comprised of fellow cash grain farmers all soybean producers. He has been conducting his own on-farm experiments and trials for the last fifteen (15) years.

Paraprofessional Farmer #2

Paraprofessional Farmer #2 carries on a three-generation tradition of vegetable production to serve the people of Marianna, Arkansas. Though some produce is now marketed through community markets as far away as Chicago, Illinois, most produce is sold directly from the farm to long-time local customers. Providing home delivery and accepting food stamps, this farm is as much a community service as a business. His farm is truly community supported and community supporting.

This farmer experiments with new varieties, species and environmental practices every year. One hundred thirty acres of extremely diverse vegetable production is further diversified by a similar number of row crop acres along with production of hogs, goats, ducks and chickens. In recognition of this diversity and innovation, this farm was designated by USDA as the first Alternative Crop Technology (ACT) farm.

The focus of this farmer's target group is to help members create their own diversity to build on the demonstrated successful alternatives used on his farm. IFS demonstrations on this farm and others include a comparison of various types of mulch for complete elimination of herbicides.

Paraprofessional Farmer #3

Paraprofessional Farmer #3 is an active farmer and cooperative leader. He is President of the Cooperative Health Clinic Board, former President of the Lee County Vegetable Cooperative Board and President of the Board of the Arkansas Economic

Corporation. He grows cucumbers, squash, watermelon, greens, corn and tomatoes mainly for markets in Lee County, Arkansas and Memphis, Tennessee.

His IFS demonstrations have included a drip-irrigated test involving variations in type and rate of composted chicken litter and various mulches in producing tomato varieties for fall markets. He also is concentrating on helping his IFS target group diversify--especially into Southern peas, greens, beans and organic sweet potatoes. In addition, he has been active in value-added activities including development of an Agricultural Park near Marianna, Arkansas as well as the development of a squash relish.

Paraprofessional Farmer #4

This Paraprofessional Farmer and his farm family of Grady, Arkansas are widely known for their innovation in vegetable production and marketing-- especially greens. This farmer's focus as an IFS Paraprofessional is helping the members of his target group diversify in vegetable production. His mother began their family's activities with produce from three acres peddled out of the back of her car thirty (30) years ago. Together the family has expanded to 1000 acres with over thirty (30) types of vegetables.

IFS demonstrations include organic sweet potatoes (including a test of composted, pelleted chicken litter) and organic turnips. This farmer is helping his IFS Target Farmers to perform demonstrations with chicken litter on squash, cabbage and tomato and with organic sweet potatoes.

This Paraprofessional and his farm family have maintained profitability in the face of rising input costs by developing retail sales outlets in Pine Bluff, Arkansas and Little Rock, Arkansas, and through a restaurant in Pine Bluff, Arkansas. These outlets also provide a market to help his target group members diversify. However, wholesale to major chains, such as Krogers, is still the foundation of the Paraprofessional Farmer's business.

This Paraprofessional Farmer suggests that success in vegetable production comes from maintaining a close relationship between production and marketing. Diversification combined with integration of production and marketing has helped this farmer, his family and his IFS Target Farmer group to continue to expand vegetable production. Other IFS vegetable networks also benefit from marketing through this farm family operation.

The key to sustaining a family or a network, according to this Paraprofessional Farmer, is ensuring the members get along well. One way this farm family achieves harmonious working relations is by sorting out the day's priorities while eating breakfast or dinner together every day.

Paraprofessional Farmer #5

This Paraprofessional Farmer and his IFS target group grow the predominant crops of Arkansas--rice, soybeans and wheat. Beginning with a 1/8 inheritance of a one hundred and twenty (120) acre farm in 1965, he now farms 3500 acres, in addition to serving as Mayor of Allport, Arkansas and pastor of his church. As an IFS Paraprofessional Farmer, his objective is to help mainstream, row-crop farmers become sustainable. He demonstrates minimal chemical usage in soybeans and assists his Target Farmers in Southern pea demonstrations. His IFS demonstrations have included reducing herbicide needs in rice through careful timing of the flood.

Open communication has been this Paraprofessional Farmer's means to creating a family atmosphere in his IFS group. With this firm foundation, he believes the possibilities are practically boundless for farmers who work together. He is active in the Small Farmers Cooperative of Arkansas which recently purchased a grain storage facility in Cotton Plant, Arkansas to give farmers more control over marketing. He envisions the cooperative expanding into supply and increased storage in the Allport, Arkansas area.

The Paraprofessional Farmer truly believes in networking his participating farmers. He invites his target group to Polly's Cafe in England, Arkansas or to his church services every Sunday in Allport, Arkansas.

These profiles of five Paraprofessional Farmers demonstrate the various impacts that an innovative and successful farmer, serving as a paraprofessional, can have on other farmers in his target group. These five Paraprofessional Farmers are helping individual Target Farmers in their group to (a) develop better, more sustainable row crop and vegetable production practices, (b) increase their production, particularly in the case of vegetables, (c) improve the cost of production for row crops and vegetables, and (d) increase income from their farming operations. In addition to on-farm efforts, the Paraprofessional Farmers are helping their Target Farmers with access to markets, group marketing , and new market development. Further, the demonstrated leadership by the Paraprofessional Farmers serve as an example for Target Farmers--an example important for their personal leadership development and self empowerment.

The experiences summarized for these five Paraprofessional Farmers serve as a useful supplement to the data analysis provided earlier in this chapter. They give useful examples of the dynamics between the Paraprofessional Farmer and his Target Farmers, and the manner in which change occurs and is influenced by the IFS Paraprofessional and farmer network arrangement.

4.5 Assistance by IFS Collaborators

IFS Project and Sustainable Agriculture System Support

The University of Arkansas at Pine Bluff helped the IFS Project to identify different problem areas and means by which to solve those problems, in the opinion of farmers. The University has provided technical assistance and the demonstration and use of university equipment as well.

Institutional policy and practice changes also have been made to provide more support for sustainable agricultural systems. An SCS (NRCS) Cost-Share Grant for farmers involved in the IFS Project has provided a $150,000 cost-share grant for two years, 1994-95, at $75,000 per year. Besides cost shares for farmers, the budget line items include travel, video/teleconference training, and production of fact sheets. And, SCS (NRCS) was ready to provide technical assistance on soil and water conservation. Some of the previous rules and regulations related to obtaining an SCS (NRCS) Cost-Share Grant appeared to be limiting to minority farmers. Increased awareness generated by the IFS project, helped resolve the problem.

In addition, the Arkansas Economic Corporation (AEC), a state-wide non-profit marketing organization serving limited-resource farmers, has provided cooperative development support and expanded market opportunities for farmers in the IFS project. As a result of this IFS project, there has been a substantial improvement in the effectiveness of state agencies and universities in delivering outreach and training services about sustainable agriculture (ALFDC, 1995). Arguably, small farmers are more likely to adopt sustainable production practices than very large, highly commercialized units.

Assistance by Cooperative Associations and Others in Marketing

In general, farmer-respondents marketed their products before and after participating in the IFS Project through the following mediums:

- Farmers' market, distribution centers, brokers;
- Restaurants;
- Granaries located in Marianna, AR--sell to the one with the higher prices;
- Arkansas Vegetable Growers' Association and Marketing Cooperative Association;
- Curbside--word of mouth within the community;
- Produce markets in Memphis and Chicago;.
- Krogers;
- Walmart.

Information obtained from participation in the IFS Project played a role in farmers being able to access markets with Krogers, Walmart and restaurants. Results of the farmer-questionnaire suggests that farmers were not taking advantage of these markets prior to participating in the project.

The role of market associations is to provide the services and information needed in the movement of products from the farmer to the consumer. The intent is to provide the most efficient and effective market opportunities for the farmer. Most farmers prefer the market in which their profits will be maximized.

4.6 Assistance by IFS Administrators

IFS administrators provided technical assistance in alternative production practices and training and supervision of the Paraprofessional and Target Farmers. They also conducted research and demonstration trials. In addition, they provided information on new and improved marketing and management strategies. They monitored and evaluated the IFS project with the primary intent of providing efficient and effective delivery support systems. Another significant task of IFS administrators was to seek funding opportunities to maintain continued financial support of the IFS project. This involved coordinating efforts and working closely with IFS collaborators.

4.7 Test of Hypotheses

The Formal Hypotheses presented in Chapter 1 are restated as follows:

1) Farm operators involved in the IFS Project have adopted more environmentally and economically sustainable agricultural production practices than they did before entering the IFS project.

2) Farm operators in the IFS project have undertaken more alternative enterprises, complementing or substituting for traditional enterprises than they did before entering the IFS project.

3) Farm operators in the IFS project have attempted more profitable combinations of current (traditional) enterprises and alternative (new) enterprises with improved practices and value-added activities than they did before entering the IFS project.

The results from the survey tend to support hypothesis number one. The review of literature suggests that more economic and environmental production practices include making the use of cover cropping, crop rotations and the use of animal manure a more integral part of the farming system, decreasing intensive chemical use, and increasing value-added production and crop diversity.

In addition, farmers tended to continue their use of cover cropping or mulches, crop rotations and use of composted and raw (livestock manure) and green (crop) manure, after participating in the IFS project. Also, there has been continued or increased use of minimum tillage. Further there has been some reduction in chemical use. Twelve (12) of eighteen (18) respondents, continued or increased at least two production practices contributing to agricultural sustainability after joining the IFS project. However, only a small percentage of farmers have made major changes in their production. Vegetables are being grown on a larger scale. Only 5 of eighteen (18) respondents increased crop diversity.

Vegetables may be viewed as an alternative enterprise for most of the farmers. Traditional row crops (i.e. corn, soybeans, rice and cotton) are the more frequently grown crops within the geographic area studied. Some farm operators in the IFS project have undertaken vegetable growing on a wider scale complementing or substituting for traditional row crops since entering the IFS project. This tends to support hypothesis number two somewhat. However, information obtained in this study does not overwhelming support hypothesis number two.

Income and operating costs have changed little since entering the IFS project.

Income did not increase and agricultural production costs did not decrease, based on the cost and income data obtained from the eighteen (18) respondent farmers. Thus, the income and cost changes hypothesized for farmers after participating in the IFS project did not seem to occur. The information obtained does not support hypothesis number three.

The review of interview findings and published sources show support for the claim that Paraprofessional Farmers, IFS administrators and collaborators did provide the necessary leadership, education and assistance in sustainable agricultural practices. Demonstrations and trials were conducted in sustainable agricultural practices for the benefit of Target Farmers. Target Farmers participated in these processes. Information and assistance was available to farmers seeking more profitable, improved and value-added agricultural production and marketing practices.

Interview findings with Target Farmers show that awareness of Target Farmers has been heightened by participation in the project. Also, there is a greater understanding of the need to preserve the environment. Farmers involved in the project demonstrated leadership, supported development, and helped advance community empowerment through on-farm demonstration, advocacy, mentoring youth in agricultural work experience programs, and attendance at training or trainer workshops and field trips.

Chapter 5

Conclusions and Recommendations

5.1 Chapter Introduction

Approaches used and conclusions reached in the analysis of one Integrated Farming System (IFS) project in Arkansas are reported in section 5.2. Section 5.3 revisits the framework of analysis presented in Chapter 3 and used in Chapter 4. It provides an assessment of the framework in light of insights obtained in its use. Section 5.4 addresses limitations of this study and makes some specific recommendations for future studies, while Section 5.5 provides some general recommendations for future studies concerning the effectiveness of projects advancing sustainability of agriculture.

5.2 Approaches to the Analysis and Conclusions Reached

The American farmer (specifically, the small farmer) is experiencing many economic and environmental problems. These problems include increased costs, decreased income, increased interest charges, soil erosion and loss, and pollution from intensive chemical use to name but a few. A wealth of research findings indicate that more sustainable agricultural production practices are needed for individual farms and for communities of farmers.

The overall objective of the IFS project involved in this study is to get farmers involved in the project so that they will be encouraged to adopt more sustainable production practices. Among the sustainable practices encouraged are making cover cropping and crop rotations a more integral part of the farming system, increasing use of green manure, minimum tillage, and non-chemical means of controlling weeds and pests, decreasing use of chemical fertilizers and increasing use of composted and raw manure, increasing value-added activities in production and processing, and increasing crop diversity. The IFS project also seeks to increase both individual and community leadership and self-empowerment concerning sustainable agriculture.

A "framework of analysis" was created to help evaluate whether one community-based IFS project in Arkansas creates conditions for sustainability of agriculture. Sought were insights concerning whether the IFS project advanced economic and environmental sustainability of individual farms and sustainability of communities of farmers.

Addressed were project inputs, by participating farmers and farm families, Paraprofessional Farmers, IFS administrators, and IFS collaborators including research and extension professionals, and project outputs resulting from actions by these stakeholders. Also addressed were project measures to judge outcomes that resulted.

Phase I of the "framework for analysis" focused on development and use of sustainable agricultural practices, increasing agricultural production, improving cost of agricultural production, and increasing income of participating farmers. It addressed conditions before farmer participation in the IFS project and conditions after farmers joined the IFS project, participated in its networks, observed its field demonstrations and received technical, management and marketing assistance. The Phase I framework for analysis guided the design of the survey instrument used in obtaining information from farmers participating in the IFS project.

During the course of the study, a second phase was added to the "framework for analysis". Phase II addressed several conditions supplementing those addressed in Phase

I, including on-farm agricultural contributions to achieve sustainability of the farm family venture and community of farmers, off-farm use of farm family labor and creativity, and broader collective actions by stakeholders to strengthen rural communities. While information available about the IFS project allowed some elements of Phase II to be addressed, most went beyond the initial scope of this study.

The survey of participating farmers, the interviews of Paraprofessional Farmers, the interviews and contacts with IFS administrators and collaborators, including research and extension professionals, and the reports, documents and other information obtained collectively provided a wealth of information about the IFS project.

Six farm production practices were identified by IFS administrators and from a review of research findings as key ones advancing agricultural sustainability. Five involved the continued use or increased use of the practices--green manure, minimum tillage or no tillage, cultivation and rotation for weed and pest control instead of chemical applications, composted or raw manure fertilizers, and cover crops and mulches. The sixth was a decrease in the use of chemical fertilizers.

Of the thirty-three (33) farmers participating in the IFS project, twenty-four (24) completed the survey instrument. Of these twenty-four (24) respondent farmers, fifteen (15) or 63 percent performed 2 or more of the practices, and 30 percent performed at least three of the six practices after joining the IFS project. And, several of the farmers performed 4 or 5 of the sustainability enhancing practices.

For most respondents, practices that enhanced sustainability that were used before they joined the IFS project were continued by them after participating in the IFS project.

And, in several instances, farm operators added or increased sustainability enhancing practices after they joined the IFS project.

All of the farmers involved in the IFS project, with one exception, decreased chemical use or increased or continued at least one of the sustainable agriculture practices. Thus, the project is maintaining and creating conditions for sustainability, and heightening awareness of actions advancing sustainability. Consider, for example, a farmer who is participating in the IFS project who never before viewed chemicals as a health hazard or being harmful to the soil. He stated that his opinion changed as a direct result of participation in the IFS project. He is now using reduced amounts of chemicals and his goal is to become an organic farmer.

The survey results obtained from participating farmers disclosed that they had not made substantial change in the types of crop or livestock production since joining the IFS project. Neither had their total agricultural production increased substantially since they became part of the IFS project. Probably the most significant modification in production was the addition of a wider range of vegetable crops and an increase in the production of vegetables.

An attempt was made to determine if participation in the IFS project was accompanied by a reduction in the cost of production or by an increase in farm family income. Results of the survey showed no major changes in either cost of production or farm family income. However, it should be noted that the cost and income categories used in the survey may have been so large as to mask changes in costs and income that were not major, but never-the-less were significant to the farm family.

One measure of external contributions to sustainability of the farm was off-farm use of farm family labor. The survey results showed that over half of the respondent-farmers indicated their spouses worked off the farm. Information was not obtained on the extent to which children of farm families worked off the farm to supplement farm family income.

It is likely there are other direct and indirect income generating activities in which farm family members engage to supplement farm income. It is not known whether these various efforts were encouraged or facilitated by participation in the IFS project.

People-centered participatory development is explicit in Integrated Farming Systems projects. Operators of small farms are included in the process of development. Researchers acquire, through farmers participation, valid and reliable information that can be used to enhance the farmers' capabilities.

Paraprofessional Farmers involved in this IFS project provided community service in the areas of on-farm demonstrations, advocacy, mentoring youth in agricultural work experience programs and attendance at training workshops and field trips. The skills, knowledge and attitudes they developed have been disseminated and demonstrated among the farmer-to-farmer networks by the Paraprofessional Farmers serving as trainers.

Findings from interview with IFS administrators indicated that the paraprofessional demonstrations caused farmers to take a more systematic approach to agricultural production--taking a closer look at the product, the production and everything that affects both. Also, demonstrations were successful in proposing alternative methods of production. Additional information also was obtained on packing, grading, plastic mulching, marketing, and mechanical harvesting. There was also a greater understanding of the need to preserve the soil and provide safe food.

Given the wealth of evidence from the farmer survey, the interviews with Paraprofessional Farmers, IFS administrators, IFS collaborators and others, and the secondary sources, it can be concluded that farm operators involved in the IFS Project have maintained and adopted more environmentally and economically sustainable agricultural production practices than they would have before entering the IFS project. Further, it can be concluded that these actions are enhancing the individual farm family venture as well as the sustainability of the community of farmers.

Information obtained in this study does not support the hypothesis that the farm operators in the IFS project have undertaken more alternative enterprises, complementing or substituting for traditional enterprises, than they did before entering the IFS project. In addition, information gathered does not support conclusively the hypothesis that farm operators in the IFS project have attempted more profitable combinations of current (traditional) enterprises and alternative (new) enterprises with improved practices and value-added activities than they did before entering the IFS project.

The survey was not designed to collect detailed information on new enterprises or on value-added activities in production, processing or marketing. However, vegetables are being grown on a larger scale versus traditional row crops. Row crops are more profitable when a large acreage and economies of size are possible. However, it is more beneficial for smaller farmers to diversify and grow higher-value crops (vegetables) with a higher rate of return per acre.

5.3 Revisiting the Framework for Analysis

The "Framework for Analysis--Phase I" focuses most directly on actions that the farm operator and family can undertake in their farm operation that will enhance the agricultural sustainability of that farm. As such, it addresses changes in agricultural production practices that enhance sustainability as well as those that detract from it, changes in production--both type and amount--to increase sustainability, and changes in cost of operation and in income that affect economic sustainability of the farm operating unit.

The Phase I framework also addresses actions taken by those assisting the farm family in its farm operation. In this instance the stakeholder group included Paraprofessional Farmers, IFS administrators, and IFS collaborators, including research and extension professionals. Both their inputs to the IFS project and the resulting outcomes from their contributions are considered.

The focus and elements of the Phase I framework, including the related questions and measures used, each proved to be helpful to the author. Through their use, the author was assisted in the design of the survey instrument for participating farmers, and in the conduct of interviews with Practitioner Farmers, IFS administrators and IFS collaborators, including research and extension professionals. The Phase I components also assisted the author in her approach to data assembly and analysis and in categorizing the findings in a useful manner.

Thus, the author recommends that each of the components set forth in the "Framework for Analysis--Phase I" (in chapter 3) be considered by those analyzing farmer projects that seek to enhance sustainability of farms or communities or farmers. For such analyses, the Phase I framework is appropriate and necessary. However, because of its narrow focus on the farm operation and because of the limited number of elements involved, the Phase I framework is not sufficient to encompass all possible major actions to enhance farm and farmer community sustainability.

The "Framework for Analysis--Phase II", developed well into the conduct of this study, focuses on additional actions that the farm family and others can take (actions supplementing those specified in Phase I) to enhance the sustainability of the farm, the farm family operation, and the farmer community. Some of these additions are elaboration's of the earlier framework, as in the case of "changes in income from value-added activities for current/traditional agricultural enterprises", "improved practices in new enterprises", "value-added activities in the new enterprises", and "more profitable combinations of current traditional and alternative new enterprises, including the value-added dimensions of both".

Other major additions pertain to "new uses of family labor and creativity for purposes other than the farm operation". These include "new on-farm enterprises undertaken on the farm that are not related to operating the farm" as well as "new uses of family labor and creativity off the farm". These encompass alternative uses of the "farm operator's labor", the "spouse's labor", and "labor of the children and other household members". Further, the framework includes the "income contributions" from these three sources--both direct contributions, as in the case of salary income, and indirect, as in the case of health care insurance and benefits.

Finally, Phase II includes the "broader collective actions to strengthen the rural community", such as through market creation and improvement, business and industry retention and strengthening, or improvement of hospitals and health care services, nursing homes, schools and other community services and products. These are collective actions that may involve the farm families, the Farmer Practitioners, the IFS administrators, the IFS collaborators, and possibly a range of other leaders, citizens and professionals with whom the above stakeholders cooperate. The collective actions may involve forms of "planning and visioning" and "implementation". They may serve to advance one or several "sectors of the local community or economy". Or, they may "advance other farm sustainability or quality of living conditions". And, they may serve to enhance the community and institutional context within which the various improvements may be facilitated or supported.

The combination of Phases I and II provides a more complete framework appropriate for addressing and assessing the effectiveness of projects intended to advance sustainability of farms and farmer communities. Some re-ordering and combination from the two parts would be appropriate to arrive at a single well-integrated framework.

5.4 Limitations of the Study and Some Specific Recommendations for Future Study

There are some limitations to this study related to survey design--depth of questions and non-respondent checks. The survey design allowed for limited information to be gathered on the use of farm operator and spouse labor for purposes other than the farm family operation. Half of the farm operators' spouses worked full-time off the farm, and these jobs were a source of medical insurance--one of the dominant ways of adjusting in the time of crisis. However, off-farm use of farm family labor and creativity was not explored thoroughly in this study. The depth of the questions in the survey did not reveal whether off-farm use of operator and spouse labor increased, stayed the same, or decreased after the family participated in the IFS project. Information was not obtained on the extent to which children of farm families worked off the farm to supplement farm family income.

The survey design focused on current and new agricultural enterprises, on improved agricultural practices, and to a lesser extent on value-added agricultural activities. The emphasis was not on enterprises that were non-agriculturally related (e.g. making of quilts, handbags, wood crafts, resale of wholesaled items, machinery repair for others, welding, small engine repair etc.). Broader collective actions to strengthen the rural communities (i.e. markets, hospitals, schools, nursing homes, doctors, pharmacies, etc.) also may have provided useful information. All of the aforementioned information should be considered in future studies that use a systems approach to the evaluation of projects to enhance sustainability of farms and farmer communities.

In addition, a thorough non-respondent check should be conducted to ensure the characteristics of respondents are sufficiently similar to those of non-respondents to permit generalization of findings to the total population of farm operators and farms within the project. Such a non-respondent check also may increase both the identification of and availability of information that is more representative of the entire participant farmer group involved in the project being studied.

5.5 Some General Recommendations Concerning Future Studies

It is likely that there will be other studies of the effectiveness of multi-farmer projects for enhancing agricultural/farm sustainability and farmer community sustainability. Whether these future studies center on an IFS project or on some other organized community project, several additional general recommendations appear appropriate based on experiences in this study.

First, special care should be given to the full range of elements to be considered-- the framework for analysis. The on-farm elements alone are numerous and complex in their relationships. However, the off-farm elements are equally numerous and equally complex. And, the interrelationships between and among on-farm and off-farm elements appear to be fundamental to both an individual farm's survival and to survival of the community of farmers. Each of these sets of elements should be carefully and thoroughly considered at the earliest stages of the study.

Second, the formal survey design, including non-respondent analysis, and the interview design for personal interviews with project administrators, collaborators, community leaders and others should follow the full development of the framework of analysis to be used. Both survey instrument questions and interview questions can be more targeted to ensure that each element and each set of relationships among elements is covered.

Third, assessing change caused by the existence and operation of the multi-farmer project and its administration is a special challenge. Both the design of the survey instruments used and the design of the personal interviews conducted should give special attention to determining the respondent's views on causation.

Fourth, the broader community context within which the multi-farmer project occurs and functions likely is of major importance to the success or failure of the multi-farmer project. Surely, it is important whether or not the broader community is comprised of leaders and other citizens concerned with and dedicated to preserving a quality rural community for all its members, including farmers and their farm and family needs and opportunities.

Hopefully, the above general recommendations, the prior treatment of limitations and specific recommendations, the critique of the framework for analysis, and the other findings of this study will benefit those who seek to analyze and advance projects for agricultural/farm sustainability and the sustainability of farmer communities.

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APPENDIX

Appendix

Survey Instrument Used to Obtain Data From Farmer Participants in the IFS Project

As part of the study a questionnaire was developed and sent to farmer-participants. Each farmer receiving the questionnaire was provided with a consent form that indicated the farmer participant need not answer the questionnaire if he chose to do so. Farmer participants also were informed that the questionnaire and all related materials would be treated as strictly confidential.

Questionnaire

The following questions are to be answered by each farmer participating in The Arkansas Land and Farm Development Corporation's Integrated Farming Systems Project. Circle the number next to the appropriate answer and fill in the blanks.

1. What is your gender?
   1 = Male
   2 = Female

2. What is your marital status?
   1 = Married
   2 = Single
   3 = Divorced
   4 = Separated
   5 = Widowed
   6 = Other

3. How old are you?
   _____ years old

Page Two

4. What is your race?
   1 = African American
   2 = Caucasian
   3 = Hispanic
   4 = Other

5. What is your level of education?
   1= Below High School
   2 = High School
   3 = College
   4 = Graduate
   5 = Other (Please Specify)__________________

6. How many members are in your farm family?
   _____ members

7. How many children do you have?
   _____ children (put 0 if you do not have any children)

8. How old are your children?
   __________ years old (put 1 if less than 1 years old and 0 if you do not have any children)

9. Do your children work on the farm (circle 2 if you do not have any children)?
   1 = Yes
   2 = No

10. Are your children interested in farming (circle 2 if you do not have any children)?
   1 = Yes
   2 = No

11. How many hours do your children work on the farm (put 0 if you do not have any children)?
   _____ hours

12. How many **full-time** farm laborers including farm family members did you hire **before** participating in the Integrated Farming Systems (IFS) Network?
   _____ farm laborer(s)

13. How many **part-time** farm laborers including farm family members did you hire **before** participating in the IFS Network?
   _____ farm laborer(s)

Page Three

14. How many **full-time** farm laborers including farm family members did you hire **after** participating in the IFS Network?

_____ farm laborer(s)

15. How many **part-time** farm laborers including farm family members did you hire **after** participating in the IFS Network?

_____ farm laborer

16. If married, does your spouse work off the farm **full-time** (Circle 2 if you are not married)?

1 = Yes
2 = No

17. If married, does your spouse work off the farm **part-time** (Circle 2 if you are not married)?

1 = Yes
2 = No

18. Does your spouse's job provide medical insurance (Circle 2 if you are not married)?

1 = Yes
2 = No

19. What was your income **before** participating in the IFS Network?

1 = $ 5,000 - $10,000
2 = $10,000 - $20,000
3 = $20,000 - $30,000
4 = $30,000 - $40,000
5 = $40,000 or greater

20. What was your income **after** participating in the IFS Network?

1 = $ 5,000 - $10,000
2 = $10,000 - $20,000
3 = $20,000 - $30,000
4 = $30,000 - $40,000
5 = $40,000 or greater

Page Four

21. What were your operating costs **before** participating in the IFS Network?
    1 = $ 5,000 - $10,000
    2 = $10,000 - $20,000
    3 = $20,000 - $30,000
    4 = $30,000 - $40,000
    5 = $40,000 or greater

22. What are your operating costs **after** participating in the IFS Network?
    1 = $ 5,000 - $10,000
    2 = $10,000 - $20,000
    3 = $20,000 - $30,000
    4 = $30,000 - $40,000
    5 = $40,000 or greater

23. Do you belong to a cooperative association?
    1 = Yes (If Yes, please specify the name of the cooperative that you belong to)

    ____

    2 = No (If No, please specify why you do not belong to a cooperative)

____
____
____
____
____
____

Page Five

24. Please indicate which of the following farming practices you use and if your use of these practices is increasing , decreasing, or remaining about the same after participating in the IFS Network.

DOES NOT APPLY = DNA
INCREASED = I
DECREASED = D
SAME = S

Practice

No Till Or Limited Tillage..............................	Yes	No	DNA	I	D	S
Green Manure Crops..................................	Yes	No	DNA	I	D	S
Chemical Fertilizers......................................	Yes	No	DNA	I	D	S
Cultivation Or Rotation For Weed Or Pest Control..............................	Yes	No	DNA	I	D	S
Organic Farming..	Yes	No	DNA	I	D	S
Scouting For Insects....................................	Yes	No	DNA	I	D	S
Calendar Use Of Insecticides........................	Yes	No	DNA	I	D	S
Composted Manure......................................	Yes	No	DNA	I	D	S
Intensive Rotational Grazing...........................	Yes	No	DNA	I	D	S
Cover Cropping..	Yes	No	DNA	I	D	S
Farm Enterprise Diversity..............................	Yes	No	DNA	I	D	S
Post Emergence Herbicides...........................	Yes	No	DNA	I	D	S
Raw Manure...	Yes	No	DNA	I	D	S
Mulching(With______________________)	Yes	No	DNA	I	D	S
Irrigation(Type______________________)	Yes	No	DNA	I	D	S
Biological Pest Control.................................	Yes	No	DNA	I	D	S

25. How would you describe your current farming practices?(Circle all numbers that apply to you)

1=Conventional
2=No-till
3=Sustainable
4=Organic

26. Before your participation in the IFS Network, how did you describe your farming practices? (Circle all numbers that apply to you)

1=Conventional
2=No-till
3=Sustainable
4=Organic

Page Six

If you checked sustainable or organic in question 24:

26.1. Why do you farm sustainably or use organic methods?

____
____
____
____
____
____

If you did not check sustainable or organic in question 24:

26.2. Why you do not farm sustainably or use organic methods:

____
____
____
____
____
____

27. How did you market your farm products **before** participating in the IFS Network?

____
____
____
____
____
____

Page Seven

28. How do you market your farm products **after** participating in the IFS Network?

29. What crops and livestock did you grow and raise **before** participating in the IFS Network?

30. What crops and livestock do you grow **after** participating in the IFS Network?

31. How has the paraprofessional demonstrations helped you to adopt and understand new production practices?

Page Eight

32. What do you feel a paraprofessional farmer is supposed to do?

If you are a Paraprofessional Farmer go on to question 36.

33. Is your paraprofessional farmer doing what he is supposed to do?

34. Would you like to become a paraprofessional farmer? Why?

35. Do you feel you have the leadership qualities to become a paraprofessional farmer?

36. What have you learned from the IFS Network?

Page Nine

37. How has the university helped your IFS Network?