FINAL REPORT AUG 0 6 2001

1999 Project Abstract
For the Period Ending June 30, 2001

PROJECT TITLE:	Sustainable Farming Systems - Continuation
PROJECT MANAGER:	Helene Murray
ORGANIZATION:	Minnesota Institute for Sustainable Agriculture (MISA), U of MN
MAILING ADDRESS:	1991 Buford Circle, 411 Borlaug Hall, St. Paul, MN 55108
WEB SITE ADDRESS:	http://www.misa.umn.edu
FUND:	Future Resources Fund
LEGAL CITATION:	ML 1999, Chap. 231, Sec. 16, Subd. 7 (m.)

APPROPRIATION AMOUNT: $350,000

Overall Project Outcomes and Results

Partnerships to Deliver Research and Outreach Programs: Collectively we developed creative solutions to environmental and economic problems associated with many current agricultural practices. The two local teams, in the Chippewa River and Sand Creek Basins, planned and implemented all project activities. Oversight was provided by a statewide Steering Committee. These enduring relationships are a tangible result of the project. The partnership consisted of farmers, researchers, landowners, private sector representatives, agency personnel, community members and non-profit organizations representatives.

Research Projects on Sustainable Farming Systems: Field-based and computer model simulation shows that farm management decisions have a direct impact on water quality. Rainfall events large enough to generate runoff can occur at any time during the growing season. The majority of soil erosion.and water quality degradation is caused by large, infrequent rainstorms. Land management practices need to take this into account. There are many management practices – such as conservation tillage, strip-till, contour strips, terracing, grass strips, etc – that can be used on cropland to reduce soil erosion and protect water quality. However, large soil losses can still occur when rainstorm runoff events coincide with young crops. Grass-based management systems, in comparison, protect against soil erosion and prevent water quality degradation year round. Economic analysis of three farms show that sustainable farms demonstrate that economic performances match and often exceed conventional farms. Additional analysis of economic and field data will be done.

Project Results Use and Dissemination

Outreach Programs: From July 1, 1999 through June 30, 2001, 34 field days and workshops were held throughout the State with attendance at the events estimated to be 2,275 people. Outreach will continue beyond the time frame of this project to share information learned from the economic analysis and water quality research. Scientific journal articles describing the research are being written.

Research Projects on Sustainable Farming Systems: Field-based and computer model simulation show that farm management decisions have a direct impact on water quality. Rainfall events large enough to generate runoff can occur at any time during the growing season. The majority of soil erosion.and water quality degradation is caused by large, infrequent rainstorms. Land management practices need to take this into account. There are many management practices – such as conservation tillage, strip-till, contour strips, terracing, grass strips, etc – that can be used on cropland to reduce soil erosion and protect water quality. However, large soil losses can still occur when rainstorm runoff events coincide with young crops. Grass-based management systems, in comparison, protect against soil erosion and prevent water quality degradation year round. Economic analysis of three farms show that sustainable farms demonstrate that economic performances match and often exceed conventional farms. Additional analysis of economic and field data will be done.

Project Results Use and Dissemination

Outreach Programs: From July 1, 1999 through June 30, 2001, 34 field days and workshops were held throughout the State with attendance at the events estimated to be 2,275 people. Outreach will continue beyond the time frame of this project to share information learned from the economic analysis and water quality research. Scientific journal articles describing the research are being written.

IV. OUTLINE OF PROJECT RESULTS:

1. PARTNERSHIPS TO DELIVER RESEARCH AND OUTREACH PROGRAMS: The team process successfully launched in 1997 continued working together in West Central (WC) and Southeast (SE) Minnesota. Collectively we developed creative solutions to environmental and economic problems associated with many current agricultural practices. The two local teams, with oversight from a statewide Steering Committee, planned and implemented all project activities. These enduring relationships are a tangible result of the project. The partnership consisted of farmers, researchers, land owners, private sector representatives, agency personnel, community members and non-profit organizations representatives.

*** Result 1 Budget: $ 82,590 Balance: $ 0**

2. RESEARCH PROJECTS ON SUSTAINABLE FARMING SYSTEMS:

2.A. Field Research

The equipment (ISCO samplers and related equipment), purchased with LCMR-awarded funds in our first grant (1997-99). is currently in storage at the Department of Soil, Water & Climate at the U of MN. It will be used for a similar study beginning next year for a sub-watershed project in the Minnesota River Basin near New Ulm.

The 1999 summer season was dominated by equipment failures and maintenance, which has hampered our ability to get all of the data we had planned on collecting. The devices that monitor water levels and are needed to detect the onset of runoff were very unreliable. At every site the A/V probes failed once, and at two farms the equipment failed twice. Even the bubbler which monitors water in the flume failed at one farm. Runoff events were missed as a result of these equipment failures. However, ISCO (the manufacturer) did replace or repair them without charge. Even with the equipment failures and the resulting missing data all was not lost. Tables 1-3 show the data for rainfall, runoff, and sediment, nitrate and phosphorus loadings from the three farms.

Nitrogen. We found that the low input grass based systems have lower concentrations of nitrate-N in the tile drain water than the other farming systems. For example, tile drainage water from the organic dairy farm contained 1-2 parts per million (ppm) nitrate-N. In contrast, nitrate-N in tile drainage water from the conventional dairy farm and the row crop farms contained 2-9 ppm and 8-20 ppm, respectively.

Phosphorus. We found low concentrations of P, <1-3 ppm, in the tile drainage water from the grass based systems. Concentration of P in the run-off water from row crops depended on whether the site had a surface inlet or a buried inlet. The buried inlet site had much lower concentrations of P than the surface inlet site, <1 ppm *vs.* >9 ppm. Buried inlets act as a filter, preventing soil particles and associated P from entering the tile line during a run-off event. Consequently, they reduce both sedimentation and P loading of surface waters.

Sediment. Sediment is eroded soil that has been deposited into surface waters. The amount of run-off and soil erosion produced by a rainfall event depends on factors such as the duration and intensity of the storm, slope steepness and length, soil type, and vegetative cover. While any rainstorm can cause a run-off event, it is the large, "one-hundred-year" type storms that are responsible for the majority of run-off and soil erosion. In 1998, the Sand Creek sites experienced such a rainstorm, with >4 inches of rain falling in a few hours. This storm accounted for >93% of the run-off water and >75% of the sediment loss for the whole year. Total sediment losses from the grass sites was <3 lb/ac. Contrast these numbers with those of other University researchers working only a few miles away on a conventionally managed row crop site. They recorded sediment losses in the order of 10 ton/ac during the same rainstorm on a site with the same soil type and terrain.

Often during a rainstorm driven run-off event, it is typical for run-off water and sediment to flow into a surface inlet soon after the onset of rain. However, if the inlet is buried there can be a delay of several hours before the storm water reaches the tile drainage system. As already stated, buried inlets also filter out eroded soil, reducing the amount of sediment and P that is delivered to surface waters. These differences between a surface and a buried inlet can been seen in the data. A typical run-off event at one of our monitoring sites with surface inlet showed the rainfall caused run-off and an immediate increase in tile line flow, and sediment load. Compare this to one of our buried inlet sites there was a delay between the rainfall and the increase in tile line flow, followed by a slow reduction in flow. It is important to note that there was no sediment detected in tile line water from the buried inlet site.

Conclusion: The presence of vegetation such as grass pasture and alfalfa significantly reduce the movement of nutrients and sediment off the field. Buried inlets are effective in reducing sediment and associated P from entering the tile line.

Table 1. Rainfall, runoff, and sediment, nitrate and phosphorus loadings from the Beef Cow-Calf Grazer farm for the monitoring seasons of 1998, 1999 and 2000.

					Phosphorus		
	Rainfall	Runoff	Sediment	Nitrate	Soluble	Particulate	Total
	(in)	(in)	(lb/ac)				
			1998				
April	2.3	0.00	0.0	0.00	0.00	0.00	0.00
May	2.3	0.00	0.0	0.00	0.00	0.00	0.00
June	1.3	0.00	0.0	0.00	0.00	0.00	0.00
July	2.2	0.00	0.0	0.00	0.00	0.00	0.00
Aug.	2.7	0.00	0.0	0.00	0.00	0.00	0.00
Sept.	0.7	0.00	0.0	0.00	0.00	0.00	0.00
Oct.	3.9	0.00	0.0	0.00	0.00	0.00	0.00
Totals	19.4	0.00	0.0	0.00	0.00	0.00	0.00
			1999				
April	1.3	0.00	0.0	0.00	0.00	0.00	0.00
May	3.0	0.11	2.9	0.01	0.02	0.01	0.03
June	3.4	0.00	0.0	0.00	0.00	0.00	0.00
July	5.7	0.18	6.0	0.02	0.00	0.04	0.05
Aug.	3.8	0.00	0.0	0.00	0.00	0.00	0.00
Sept.	1.8	0.00	0.0	0.00	0.00	0.00	0.00
Oct.	0.4	0.00	0.0	0.00	0.00	0.00	0.00
Totals	15.4	0.29	8.9	0.02	0.02	0.05	0.08
			2000				
April	1.0	0.00	0.0	0.00	0.00	0.00	0.00
May	3.7	0.00	0.0	0.00	0.00	0.00	0.00
June	2.7	0.03	4.1	0.00	0.01	0.01	0.02
July	5.1	0.00	0.0	0.00	0.00	0.00	0.00
Aug.	1.1	0.00	0.0	0.00	0.00	0.00	0.00
Sept.	0.8	0.00	0.0	0.00	0.00	0.00	0.00
Oct.	1.7	0.00	0.0	0.00	0.00	0.00	0.00
Totals	16.1	0.03	4.1	0.00	0.01	0.01	0.02

Table 2. Rainfall, tile line flow and water quality data from the Dairy Grazing farm for the monitoring seasons of 1998, 1999 and 2000.

	Rainfall	Tile flow	Sediment	Nitrate	Phosphorus		
					Soluble	Particulate	Total
	------ (in) ------		---------- (lb/ac) ----------				
				1998			
April	3.0	0.00	0.0	0.00	0.00	0.00	0.00
May	4.3	0.00	0.0	0.00	0.00	0.00	0.00
June	8.7	0.35	0.8	0.01	0.03	0.02	0.05
July	3.5	0.00	0.0	0.00	0.00	0.00	0.00
Aug.	3.6	0.00	0.0	0.00	0.00	0.00	0.00
Sept.	1.2	0.00	0.0	0.00	0.00	0.00	0.00
Oct.	2.9	0.00	0.0	0.00	0.00	0.00	0.00
Totals	27.2	0.00	0.0	0.00	0.00	0.00	0.00
				1999			
April	4.2	0.00	0.0	0.00	0.00	0.00	0.00
May	5.1	0.00	0.0	0.00	0.00	0.00	0.00
June	3.3	0.00	0.0	0.00	0.00	0.00	0.00
July	4.4	0.00	0.0	0.00	0.00	0.00	0.00
Aug.	4.2	0.00	0.0	0.00	0.00	0.00	0.00
Sept.	1.3	0.00	0.0	0.00	0.00	0.00	0.00
Oct.	1.2	0.00	0.0	0.00	0.00	0.00	0.00
Totals	23.7	0.00	0.0	0.00	0.00	0.00	0.00
				2000			
April	0.8	0.00	0.0	0.00	0.00	0.00	0.00
May	5.3	0.00	0.0	0.00	0.00	0.00	0.00
June	6.1	0.00	0.0	0.00	0.00	0.00	0.00
July	3.4	0.00	0.0	0.00	0.00	0.00	0.00
Aug.	2.4	0.00	0.0	0.00	0.00	0.00	0.00
Sept.	0.9	0.00	0.0	0.00	0.00	0.00	0.00
Oct.	0.9	0.00	0.0	0.00	0.00	0.00	0.00
Totals	19.8	0.00	0.0	0.00	0.00	0.00	0.00

Table 3. Rainfall, tile line flow and water quality from the Organic Dairy Grazing farm for the monitoring seasons of 1998, 1999 and 2000.

	Rainfall	Tile Flow	Sediment	Nitrate	Phosphorus		
					Soluble	Particulate	Total
	------ (in) ------		------------------------ (lb/ac) ------------------------				
			1998				
April	1.8	7.6	0.0	0.00	0.00	0.00	0.00
May	5.1	0.3	1.0	0.03	0.00	0.00	0.01
June	7.8	5.2	52.8	0.58	0.27	0.32	0.59
July	4.0	2.1	0.4	0.24	0.00	0.00	0.00
Aug.	3.7	0.1	0.0	0.01	0.00	0.00	0.00
Sept.	0.9	0.0	0.0	0.00	0.00	0.00	0.00
Oct.	1.4	0.0	0.0	0.00	0.00	0.00	00.0
Totals	26.5	15.3	54.2	0.86	0.27	0.32	0.60
			1999				
April	3.8	2.2	1.9	0.39	0.01	0.02	0.03
May	8.5	5.1	8.6	0.64	0.02	0.03	0.05
June	4.3	0.4	2.5	0.06	0.01	0.00	0.01
July	3.3	0.02	0.1	0.00	0.00	0.00	0.00
Aug.	3.6	0.03	0.2	0.01	0.00	0.00	0.00
Sept.	1.4	0.0	0.0	0.00	0.00	0.00	0.00
Oct.	0.9	0.0	0.0	0.00	0.00	0.00	0.00
Totals	26.4	7.70	13.3	1.10	0.04	0.06	0.09
			2000				
April	0.9	0.0	0.0	0.00	0.00	0.00	0.00
May	3.7	0.0	0.0	0.00	0.00	0.00	0.00
June	4.3	0.0	0.0	0.00	0.00	0.00	0.00
July	3.1	0.001	0.02	0.00	0.00	0.00	0.00
Aug.	4.0	0.002	0.03	0.00	0.00	0.00	0.00
Sept.	1.2	0.0	0.0	0.00	0.00	0.00	0.00
Oct.	0.9	0.0	0.0	0.00	0.00	0.00	0.00
Totals	18.1	0.024	0.05	0.00	0.00	0.00	0.00

2.B. Computer Model Simulation Long-term water quality simulations for this study were conducted with the Agricultural Drainage and Pesticide Transport (ADAPT) computer model. The ADAPT model runs on a daily time step and requires input data for precipitation, temperature, cropping system management, site topography, and soil information. The model was calibrated using the collected water quality and soil data. Long-term (20 year) simulations using different management scenarios were run with the calibrated model.

Modeling for two farms has been completed. Data from these two sites have been used to calibrate the ADAPT model. The model was then employed to predict the long-term impact on water quality from a change in land management practices.

Computer Model Results:
I. For one farm, we simulated three scenarios, (1) no change from the existing permanent grass and forage/corn rotation, (2) a conventional corn/soybean rotation, a cropping system common in the watershed, and (3) permanent pasture over the entire site. The results of the 20 yr simulation predict that losses of sediment, NO_3-N and P would greatly increase should this site be managed in a conventional corn/soybean system. For example, at the 0.5 probability of a loss event, *i.e.* a rain event large enough to cause losses could happen 1 in 2 years, sediment loss from grass, grass and crops, and corn system is 3.5, 670 and 3600 lb/acre, respectively. The model predicts slight increases in sediment, NO_3-N and P as the severity of a rainfall event increases in the grass based systems. Compare this to the huge losses predicted from the corn cropping system. This prediction is corroborated by experience of Dr. Neil Hanson of the University of Minnesota's Department of Soil, Water and Climate.

Conclusion for this farm: Our experience at this farm has reinforced the importance of grass and forages in reducing sediment and nutrient losses from the rolling topography found in the Sand Creek Watershed. This area of Minnesota receives much of its' rain in the spring and early summer when row crops are not well established and therefore offer little protection to the soil from rainfall. On the other hand established grass and forages are able to hold the soil in place. Our model predictions have demonstrated that if this site were managed in a conventional corn/soybean rotation there would be a large increase in sediment and nutrient losses. To reduce soil and nutrients from entering the Sand Creek and to reduce its' contribution to the poor water quality in the Minnesota River it will be necessary to include more grass and forages into the existing cropping systems.

II. For the second farm where we have completed the modeling simulation, we simulated two scenarios, (1) no change from the existing permanent grass/legume pasture, and (2) a conventional corn/soybean rotation, a cropping system common in the watershed. The results of the 20 yr simulation predict that losses of sediment, NO_3-N and P would greatly increase should this site be managed in a conventional corn/soybean system. For example, at the 0.5 probability of a loss event, *i.e.* a rain event large enough to cause losses could happen 1 in 2 years, sediment loss from grass/legume, and corn system is 50, and 450 lb/acre, respectively. The model predicts large increases in sediment and P as the severity of a rainfall event increases in the corn based systems.

Conclusion for this farm: The results of the monitoring and modeling reinforce the importance to water quality of grass based cropping systems even at a site such as this with very flat terrain. When runoff occurs from land under grass the water quality will be better than if the site had a row crop. However, in a grazing situation how the grass cover is managed can impact water quality. When over grazing and over stocking coincide with a runoff generating rainfall event soil erosion and poor water quality will result.

III. At two sites it was impossible to calibrated the ADAPT model because there was insufficient data as limited rainfall was recorded at these sites in 3 years of field studies; therefore long-term simulations were not conducted for these two farms.

IV. Modeling data has been started for the remaining 4 other farm sites in the study, but has been hampered by computer program glitches. Data from these sites will be analyzed as soon as the computer program problems are worked out.

2C. Economic Analysis

Livestock farmers worldwide are looking at management intensive grazing (MIG) as a promising alternative to traditional, capital intensive management systems.

In early November 1999 we had a major accomplishment. SFS team representatives met with a farm business management instructor to discuss the need for a revised FINPACK estimate of pasture forage values. At that time, FINPACK assigned a very low value to pasture grass since the program is geared toward ranching operations that do not practice managed-intensive grazing. Consequently, pasture enterprise returns reported by FINPACK for our dairy grazing operations are unrealistically low or even negative. During the November meeting, a new method for valuating pasture forage was developed and this methodology was submitted to the Farm Business Management Association (FBMA) with a recommendation that all instructors throughout Minnesota begin using the new methodology and pasture unit values when calculating returns to pasture in managed-intensive grazing systems.

Until that time, grazing operations are not distinctly identified by the FBMA. On behalf of the SFS team, a request was submitted to the regional FBMAs that data be sorted for graziers and published in their annual reports. The new sort is important as it is more likely to be recognized by bankers. Lending institutions are often reluctant to finance grazing operations because of a lack of information about financial performance. There are currently a total of 25 graziers in the Farm Business Management Program state-wide, 19 of which are dairy operations. A report will be made available to the SFS Team in January 2000 which will include a summary of financial performance for dairy enterprises and will compare the enterprise data from grazing operations to more traditional dairies statewide. While work has been done on a whole-farm level in Wisconsin and Pennsylvania, the analysis done by SFS team members will provide the first report of enterprise data in the country. We are discussing ways to combine our project data with the FBMA data compiled by the SFS team, and other data collected by the team, to build an even larger database of financial performance on dairy and other livestock grazing operations.

The amount of labor required to operate a grazing dairy system has been studied as part of this project. The researchers found that Minnesota graziers appear to use fewer total labor hours on a whole farm basis when compared with non-grazing dairy operators. Moreover, the graziers rely on family members to supply the majority of farm labor. However, the researchers caution that the differences in total labor requirements are likely the result of differences in farm size between the graziers and the more traditional dairies reported in the MnSCU data set. As a result, gross income and operator returns tend to be lower for Minnesota dairy graziers than their non-grazing counter parts.

Existing economic research (based on surveys, case studies, modeling and anecdotal evidence) attributes MIG with reduced feed costs, increased herd health, and smaller debt loads. Moreover, graziers' exposure to external economic risk (market price fluctuations) is lower than that of conventional system operators as a result of less reliance on external feed and other inputs (Rust, Sheaffer, Eidman, Moon and Mathison). But there are also several economic concerns/risks associated with MIG including reduced productivity (output), lower overall equity and net worth (Watt), and lack of financial efficiency. In general, however, alternative livestock systems can be as profitable, if not more profitable, than their traditional counterparts when savings in feed costs balance productivity losses (Corselius and Wisniewski).

This study uses data from three Minnesota grazing operations to explore the Project's general economic hypothesis that: alternative farming systems are an economically viable alternative to conventional management systems at the individual farm level. Grazing represents one of several generally recognized alternative management systems.

Unlike much of existing research, economic data and analysis for this study are based on: (1) year round monitoring (i.e. not limited to the grazing season); (2) multi-year analysis for each farm; (3) and inclusion of whole farm and enterprise data. Limitations of the study include: (1) a small-sample size; and (2) lack of random selection – profiled farms were not randomly selected; they were identified on the basis of their suitability for water quality monitoring. Moreover, like all economic analysis, the effect of management (a critical input for grazing systems) cannot be accounted for when analyzing the components of each farm's economic profitability.

Based on the above limitations, this study does not attempt to draw general conclusions about the overall competitiveness of grazing systems. Instead, this analysis aims to identify the strengths and weaknesses of these three, individual MIG operations as they compare with traditional Minnesota livestock management systems.

<u>Profiled Farms</u>

Economic monitoring took place on five grazing operations for the study period. Complete data is available for three of the five farms. All three farms practice MIG and supply the majority of livestock feed from pasture.

Farm type, primary operator age, experience, and farm size varies among the three profiled farms, but all three farms are considered diversified and conduct some direct marketing. Two of the five farms (located in South Central Minnesota) generate a majority of farm income (80 percent or more) from the dairy enterprise. One of these dairy operations is certified organic. The remaining profiled farm (located in West Central Minnesota) is classified as a beef cow-calf operation.

Primary operator age ranged from 28 to 59 years at the beginning of the study period while grazing experience varied from two to eight years. Annual gross income (representing farm size) for the profiled farms ranged from $25,500 to $395,460 over the study period. Herd size (also an indicator of farm size) varied from 36 head to 152 for the dairy operations. All of these factors – age, experience, and farm size – have been found to affect the economic performance of farming operations and are considered in the economic profiles. Age, for example, affects debt-to-asset ratios. Debt-to-asset ratios for farm operators are typically highest among young, beginning operators and decline steadily as age increases (Barry, Ellinger, Hopkin and Baker). Moreover, as farmers gain more experience and move forward in the transition from traditional to alternative farming operations, income profitability often increases (Corselius and Wisniewski).

Data Collection and Sources

Data used in the economic analyses are taken from actual farm records for the profiled farms. Economic monitoring and data collection began in the winter of 1997/1998 and ended in January 2001. The economic study period is defined as January 1, 1998 – December 31, 2000.

Two accounting software packages (Quicken and AgBiz) were used by profiled farm operators to track cash inflows and outflows throughout the study period. All accounting was done using the accrual method. Final whole farm data is presented on a market basis unless otherwise noted. All enterprise data is presented on a cost basis.

Whole farm and enterprise data for each of the profiled farms were evaluated using FINPACK® (comprehensive financial analysis software) with assistance from MnSCU Minnesota Farm Business Management Program instructors (all profiled farm operators were enrolled as students in the Minnesota Farm Business Management Program). The final analyses are based on averages of FINAN results for each year in the study period. All prices used in the analyses are actual prices received and reported by the profiled farm operators. Organic feed and commodity prices were estimated using a multiplier of conventional county prices since organic market prices histories do not exist at this time. Pastures were valued using a method developed by West Central Research Center researcher Margot Rudstrom. Data averages reported in the comparative analysis for the Minnesota grazier and traditional groups are drawn from annual MnSCU Farm Business Management Program reports and additional reports prepared by South Central Technical College Dean Dennis Jackson.

Analysis

Economic performance for each profiled farm is analyzed at the whole farm and enterprise levels. At the whole farm level, sixteen traditional economic indicators of liquidity, solvency, profitability, repayment capacity and financial efficiency are evaluated using University of Vermont Financial Guideline Measures and through a comparison of the indicators with other farms of similar size and age classes. The project's economic hypothesis is explored at the enterprise level through a comparative analysis in which the profiled farms are evaluated alongside other Minnesota graziers and similarly sized traditional livestock producers of like farm type.

In addition to traditional economic performance measures, the profiled farms are evaluated for financial longevity by a trend analysis of farm assets, liabilities and net equity. The overall level of farm liabilities and changes in net equity are important indicators of financial flexibility and economic strength. A large net equity position enables the farm business to survive in years of financial loss (Watt).

Economic conclusions are based on data from the three profiled farms as well as the MnSCU Farm Business Management Program grazier and traditional farm data set.

Economic Analysis Conclusions

Farm One is considerably larger than most Minnesota graziers and traditional dairy producers – its herd size is more than double that of the average dairy producer in Minnesota. Moreover, Farm One's primary operator is considered an experienced grazier and the oldest farmer in our study. After accounting for size and operator age, it can be said that Farm One is financially competitive at the whole farm level and more profitable than traditional dairies at the enterprise level. Farm One's mix of alternative replacement heifer and feeder-finish hog enterprises generated supplemental cash farm income that pushed Farm One's total net farm income well above SC Minnesota whole farm averages.

Farm One was financially competitive with traditional dairy operations of a similar size--thanks to lower feed costs, better feed efficiency, and marketing premiums that outweighed its below-average milk production. Farm One netted $3.51/cwt for milk over the study period on average. By comparison, the Traditional Dairy Group (with a similar herd size) netted $2.87/cwt. These results support existing research. At the same time, Farm One steadily paid down liabilities and increased its farm assets--consequently improving its net farm equity base. Based on data from Farm One, large-scale dairy grazing appears financially competitive with traditional dairy management systems of a similar size.

One surprise, however, was that smaller-sized graziers proved more profitable, on average, than their relatively large-scale counterparts at the enterprise level on a per unit basis. Farm One recorded higher overall direct and indirect costs than other Minnesota graziers with the exception of feed costs on average. Consequently, graziers in the MnSCU data set (with an average herd size of 49 cows) netted $ 3.84/cwt on average between 1998-1999 – nine percent more than the average net return recorded for our large-scale grazier, Farm One. While this is promising for smaller-scale producers, it should be noted that the Grazing Group herd average was so small that at the whole farm level, small-scale graziers would not be able to maintain a decent standard of living.

Farm One's use of cropland as pasture appears to be a financially profitable decision. It's pasture enterprise netted up to five times that of other SC feed crop enterprises throughout the study period. This enabled Farm One to cut its feed expenses in the dairy enterprise to eight percent below those of other similarly-sized traditional dairy operations.

Based on the 1998-2000 whole farm and enterprise data for Farm Two, it appears that organic grazing is a financially stable alternative for smaller-scale producers. Farm Two netted farm income returns that were well above those of similarly-sized management intensive grazing and traditional dairy management systems while steadily improving its net equity base.

The advantage of the organic management system lies, not surprisingly, in Farm Two's opportunity to market commodities at price premiums; so long as the premium effect outweighs productivity losses and other input expenses associated with field labor and higher-priced feed, organic grazing appears to be a very competitive management system compared to other grazing and traditional dairy systems. Farm Two averaged net returns for its dairy enterprise that were 62 percent and 95 percent above those returns averaged by the Minnesota Grazing Group and Traditional Dairy Group, respectively. Moreover, it maintained above average feed efficiency. Throughout the study period, Farm Two's relatively high input expenses and below-average milk production were far outweighed by organic milk price premiums.

When organic premiums are removed (but feed still valued organically), Farm Two performs financially much like other graziers and below that of its traditional dairy counterparts due to below-average productivity. However, as long as organic premiums remained 11 percent or more above traditional milk market prices during the 1998-2000 period, Farm Two would have remained financially competitive with its traditional counterparts[1]. In other words, organic premiums could fluctuate downward by more than half of the study period average before Farm Two would begin to lose its competitive edge over traditional dairies of a similar size.

Moreover, the use of prime SC cropland for pasture appears to be a financially profitable alternative to cash crops for Farm Two. Its pasture enterprise netted substantially more income/acre with its land in pasture than other SC Minnesota producers who planted federally-subsidized corn, spring wheat, soybeans, oats, and sweet corn.

Farm Three is a young business in its start-up phase. During the study period, Farm Three expanded its cow-calf herd from 34 pairs to 70 pairs, expanded into background beef finishing, and continued to apply long-term soil building amendments to its pasture land. All of these economic factors, combined with unusual animal losses and lack of winter feed during 2000, hurt Farm Three's short-term financial prospects.

At the whole farm level, Farm Three under-performed other farms in its age and size class. It ended the study period with what the University of Vermont considers "vulnerable" profitability, solvency, debt repayment, and financial efficiency rankings. Although some of these below-average rankings may be expected for a start-up business, they clearly do not appear to be a function of age or size. Other WC operators of similar age class, for example, ranked "stable" to "strong" in these areas of financial performance.

However, Farm Three does appear to have potential for long-term profitability. At the enterprise level, Farm Three's herd management is comparable with other beef cow-calf and background operators in Minnesota. Moreover, with the exception of feed costs, Farm Three managed to keep its other direct and indirect operating expenses down to levels below those reported by other beef cow-calf and background beef producers, respectively. If Farm Three is able to reduce its feed costs (through a combination of increased stocking rates, reduced supplementation, and fewer soil amendments), it may prove competitive with traditional beef cow-calf and background beef operations. Moreover, with the elimination of its Corriente beef cow-calf herd, whole farm profitability would improve dramatically.

*** Result 2 Budget: <u>$ 230,100</u> Balance: <u>$ 0</u>**

---

[1]*Eleven percent minimum premium calculated as follows:* Total costs = $11.50/cwt for Farm Two. Net return for Traditional Dairy Group = $3.22/cwt. Minimum gross return = 11.50 + 3.22 or $14.72/cwt. Gross return for Traditional Dairy Group = $13.18/cwt. Gross difference = (14.72-13.18) = 1.54. Traditional milk price = 13.71. Calculation of minimum organic premium: (traditional milk price)(X percent) = (gross difference) or [(13.71)(X)]= (1.54) where X = 0.112 or 11 percent.

3. OUTREACH PROGRAMS:

3A. ***Field days and workshops***: From July 1, 1999 through June 30, 2001 a total of 34 field days or workshops have been held and have been attended by an estimated 2,724 people. These totals greatly exceeded our expectations in terns of number of events and participants. A list of field days and workshops, and numbers of people attending each event is provided in the Appendix.

3B. ***Written materials:***
A 39-page research report was developed and we had 1,000 copies printed. The June 2001 report is titled: *Sustainable Farming Systems: Demonstrating Environmental and Economic Performance* highlights findings from 3 farms in the study and includes analysis of the field study and economic analysis. A companion piece containing the Executive Summary was also prepared.
The economists working on our project, Gigi Digiacomo and Margot Rudstrom, have developed a poster to be presented at the American Agricultural Economics Association Annual Meeting, August 3-4, 2001, Chicago, Illinois. The title is: "Organic Dairy Grazing: Profitability and Financial Efficiency Under Alternative Market Price Scenarios, 1998-99.

The following research briefs and fact sheets were prepared during the course of this grant and were previously submitted to the LCMR staff:

Labor: How does it stack up on Minnesota dairy grazing operations? The brief explores labor requirements on two dairy grazing operations from the SFS project, and compares them with the labor requirements of 22 other Minnesota grazing operations and 546 non-grazing dairy operations from the 1998 Minnesota State College and University (MnSCU) data set. 4 pages.

More Than Just Numbers: Monitoring whole farm goals with traditional financial data. 2 pages.

Composting: A cost-effective manure management alternative. 4 pages.

Scientific journal article submissions are being prepared. We will send copies to the LCMR office when they are printed.

* **Result 3 Budget: <u>$ 37,310</u> Balance: <u>$ 0</u>**

V. DISSEMINATION: Objective 3 describes how we disseminated information (field days, workshops and written materials). Additionally, team members presented data and information about the team building process at events sponsored by other groups (local, national and regional meetings) as well as via professional, scientific journal publications and popular press articles. MISA's www site posted fact sheets and other written materials prepared by the team.

Numerous articles about the SFS Team work have appeared in the popular press, as well as in partner organization newsletters including: *Community Connections*, the *Land Stewardship Letter, Sustainable Agriculture* newsletter, and the *Corner Post.* Work with the Farm Business Management Association was fruitful and, over time, will help continue dissemination of information generated by this project.

VI. CONTEXT

A. Significance: Farmers are searching for alternatives to current agricultural practices that reduce environmental risk and increase profit margins. In order to promote agricultural change toward more sustainable farming practices, new partnerships have been developed to evaluate alternative farming practices. In 1997 we received a grant from LCMR to begin development of the partnership infrastructure to facilitate cooperative research and education efforts among the various groups concerned with agricultural systems. Our team documented viable economic and environmental returns by coupling on-farm and University research data. We developed management alternatives that integrate recent scientific advances with sustainable farming practices; improve farm efficiencies; enhance environmental quality; and enhance farm profitability.

B. Time: Monitoring and evaluating the impacts of different cropping systems on the environment are long-term commitments. However, we will concluded this particular study at the end of the growing season of 2001. With 1997-99 LCMR funding. this project launched a number of new partnerships, as promised in our proposal. We anticipate that many new partnerships and research projects will continue to develop even though financial support for this project ends with this grant. We will be requesting funds from other granting sources (EPA, USDA, etc) for new ideas that have been generated through the partnerships described in Objective 1 of this project.

VII. COOPERATION: Primary cooperators include the Sustainable Farming Association of Minnesota (SFA); The Minnesota Project (TMP); Land Stewardship Project (LSP); Minnesota Department of Agriculture's Energy and Sustainable Agriculture Program (ESAP - MDA); University of Minnesota (Minnesota Institute for Sustainable Agriculture, University of Minnesota Extension Service, Experiment Station; and numerous departments).

Project Participants as of June 30, 2001 & affiliation

Deborah Allan, Department of Soil, Water and Climate, U of MN
Audrey Arner, Land Stewardship Project and farmer
DeEtta Bilek, Sustainable Farming Association of Minnesota and farmer
George Boody, Land Stewardship Project
Gigi Digiacomo, economics consultant
Mary Hanks, Supervisor, Energy & Sustainable Agriculture Program - MDA
Christopher Iremonger, Department of Soil, Water and Climate, U of MN
Diane Jensen, The Minnesota Project
Dennis Johnson, West Central Research & Outreach Center, U of MN
Loni Kemp, The Minnesota Project
David Mulla, Department of Soil, Water and Climate, U of MN
Helene Murray, Minnesota Institute for Sustainable Agriculture
Bill Wilcke, U of MN Extension Service
Bruce Vondracek, MN Cooperative Fish and Wildlife Research Unit and U of MN
Terry VanDerPol, Land Stewardship Project
Caroline van Schaik, Land Stewardship Project
Eight participating farm families in the WC and SE regions

VIII. LOCATION: West Central Region (Chippewa and Pomme de Terre River watersheds); and Southeast Region (Sand Creek and Whitewater River watersheds).

7 m. Sustainable Farming Systems Team		
1999-2001 Events		
		Number in
Event	*Date*	*Attendance*
Reading Your Stream, various stops along the Chippewa River	July 27, 1999	12
Field Day at Twisted Horn Ranch, Milan	August 10, 1999	40
Planning for Profit, Land and Stewardship (co-sponsored with Sustainable Livestock		
Systems Team and the West Central Research & Outreach Center), Morris	August 12, 1999	40
Sand Creek Team Display, Scott County Fair	Summer 1999	100
Whole Farm Planning meeting, New Prague	November 30, 1999	20
MN Forage and Grassland Council Conference	January 11-12, 2000	200
MN Grazing Conference	February 2-3, 2000	200
MN Fruit& Vegetable Growers Conference	February 3-4, 2000	200
MN Organic Conference	February 15-16, 2000	200
Youth and Agriculture	February 22, 2000	60
SFA of MN Annual Conference, Morris	February 26, 2000	120
Chippewa River Watershed Project Annual Meeting	March 9, 2000	90
The Watershed Approach to Improving Water Quality: Fact or Fantasy	March 28-30, 2000	250
Land Stewarship: How do you measure success?	April 14, 2000	15
Building a Network of Producers: Feed-Grain and Livestock-Dairy	May 17, 2000	30
Sand Creek Watershed Display, city hall*	June 6-July 26, 2000	
Songbird Walk Along Sand Creek	June 26, 2000	25
CWCROC Station Day	July 13, 2000	75
Scott County Fair-booth display*	July 26-30, 2000	
Discover Chippewa	August 5, 2000	65
Stream walk, Minar Farm, New Prague	August 29, 2000	40
Upper MS Watershed Roundtable	September 16, 2000	36
MN Farmers Union Annual Mtg.	Nov. 17-19, 2000	200
OGBA Annual Meeting/Seminar	December 2, 2000	100
Minnesota Forage & Grassland Council Conference	January 8-9, 2001	200
Is Grazing or Organic Right for Your Dairy Farm?	January 24, 2001	100
Minnesota Organic Conference	February 8-9, 2001	100
Legislative Hearing, Ag Finance Committee	February 20, 2001	50
SFA of Central MN Annual Meeting:	March 3, 2001	60
Dairy Farmers Planning for Profit	March 21, 2001	50
Stearns County Commissioners meeting	March 20, 2001	12
River Friendly Farmer Committee	April 3, 2001	10
Read the Water - training on stream monitoring	June 9, 2001	25
Total Attendance:		**2725**
* = numbers unknown		