1997 Project Abstract
For the Period Ending June 30, 1999
This project was supported by the Environment and Natural Resources Trust Fund (MS 216.15)

Project Title: Sustainable Farming Systems
Project Manager: Helene Murray
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Legal Citation: ML 1997, Chap. 216, Sec. 15, Subd. Agriculture, 7(c)
Appropriation Amount: $560,000

OBJECTIVES: Our objectives were to enhance the development of partnerships among farmers, researchers, land owners, private sector representatives, agency personnel, community members, and non-profit organizations to: research viable economic and environmental returns by coupling on-farm and University research; develop management alternatives that integrate recent scientific advances with sustainable farming practices; improve farm efficiencies; enhance environmental quality; and enhance farm profitability.

OVERALL PROJECT RESULTS: A comprehensive program of complementary on-farm and experiment station research, demonstration, and educational activities at a over 40 sites (20 research sites and a 20+ demonstration and educational sites) examined economic and environmental effects of sustainable farming systems to Minnesota farmers.

The project delivered three major results:

1. **Functional partnerships to deliver research and outreach programs:** A partnership of farmers, researchers, land owners, private sector representatives, agency personnel, community members and non-profit organizations now exists that planned, implemented, and delivered cooperative research and demonstration projects on sustainable farming systems in the southeast, southwest, and west central regions of Minnesota.

2. **Research projects on sustainable farming systems:** Research on the economic and environmental impacts of sustainable farming systems was initiated at 20 sites in southeast, southwest, and west central regions of Minnesota. Intensive field monitoring of soil and water quality impacts of agriculture was done at 8 on-farm sites. Data will continue to be collected through 2001.

3. **Outreach programs:** We exceeded our goal of reaching a minimum of 800 farmers, and reached 2,452 farmers and agricultural professionals through 47 field days, workshops in southeast, west central and southwest regions of Minnesota, and developed related written materials to strengthen information exchange and ownership by the end of the two year period. A packet of information describing the overall team, the research and economic analysis is available.

Date of Report: July 1, 1999
Status Report: LCMR Final Work Program Update Report
Date of Workplan Approval: June 1997
Project Completion Date: June 30, 1999
LCMR Work Program 1997

I. Project Title: Subd. 7(c) Sustainable Farming Systems

Project Manager: Helene Murray
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Total Biennial Project Budget:

$ LCMR:	$560,000.00
- $ LCMR Amount Spent:	$560,000.00
$ LCMR Balance:	$ 2,257.94

A. Legal Citation: ML 1997, Chap. 216, Sec. 15, Subd. Agriculture, 7(c).
Appropriation Language: Sustainable Farming Systems. This appropriation is from the trust fund to the University of Minnesota for a comprehensive program of complementary on-farm and experiment station research, demonstration and educational activities about the economic and environmental effects of sustainable farming systems.

B. Status of Match Requirement None required

II. PROJECT SUMMARY AND RESULTS: A comprehensive program of complementary on-farm and experiment station research, demonstration, and educational activities at a minimum of 40 sites (20 research sites and a minimum of 20 demonstration and educational sites) examined economic and environmental effects of sustainable farming systems to Minnesota farmers. Our objectives were to enhance the development of partnerships among farmers, researchers, land owners, private sector representatives, agency personnel, community members, and non-profit organizations to: research viable economic and environmental returns by coupling on-farm and University research; develop management alternatives that integrate recent scientific advances with sustainable farming practices; improve farm efficiencies; enhance environmental quality; and enhance farm profitability.

The project delivered three major results:

Result 1. **FUNCTIONAL PARTNERSHIPS TO DELIVER RESEARCH AND OUTREACH PROGRAMS:** A partnership of farmers, researchers, land owners, private sector representatives, agency personnel, community members and non-profit organizations now exists that planned, implemented, and delivered cooperative research and demonstration projects on sustainable farming systems in the southeast, southwest, and west central regions of Minnesota.

Result 2. **RESEARCH PROJECTS ON SUSTAINABLE FARMING SYSTEMS:** Research on the economic and environmental impacts of sustainable farming systems was initiated at 20 sites in southeast, southwest, and west central regions of Minnesota.

Result 3. **OUTREACH PROGRAMS:** We exceeded our goal of reaching a minimum of 800 farmers, and reached 1700+ farmers through 40+ field days, workshops in southeast, west central and southwest regions of Minnesota, and developed related written materials to strengthen information exchange and ownership by the end of the two year period.

III. PROGRESS SUMMARY:

Result 1. Functional Partnerships to Deliver Research and Outreach Programs A great deal of emphasis has been put on developing our team approach throughout the life of the two year project. Our teams in the three regions have successfully developed research and education programs beyond the scope of this project and have been successful in garnering additional funds to support their work. The strong local partnerships developed through team led to increased opportunities for additional projects.

*** Result 1 Budget: $111,000 Balance: $ 0**

Result 2. Research Projects on Sustainable Farming Systems Research on the economic and environmental impacts of sustainable farming systems was initiated at 20 sites in southeast, southwest, and west central regions of Minnesota. Storm events are being monitored using ISCO samplers at eight project locations in the Chippewa River area and in the Sand Creek area near Jordan, MN. Samples of runoff and erosion are collected from tile drains at regular intervals and analyzed for sediment, nitrate-nitrogen (NO3-N), ammonium-nitrogen (NH4-N), dissolved phosphorus (DP), particulate phosphorus (PP), total phosphorus (TP), bioavailable phosphorus (BAP), and chemical oxygen demand (COD). By the end of June 1999, 425 samples from run-off events and 175 samples from the base line flow have been collected. Samples have been analyzed for the above mentioned parameters, with the exception of TP and BAP. Soils are analyzed for nutrients, organic carbon, pH, aggregate stability, bulk density, grain size distribution, infiltration rate, and earth worms. Data will continue to be collected during the continuation phase.

*** Result 2 Budget: $ 256,500 Balance: $ 2,257.94**

Result 3. Outreach Program The outreach component of this project has exceeded our original goals. At the end of the first phase of the project (July 1, 1997- June 30, 1999) we have held a total of 47 events with at least 2,452 people in attendance. A complete list of all events is included with this final report. The events have been done in a variety of venues and formats including: on-farm field days highlighting monitoring and research of the project; programs at the West Central, Waseca, and Southwest Experiment Stations; financial analysis workshops; workshops on organic farming systems, rotational grazing and soil quality. We developed an information packet on the total project that was used at field days, workshops and other events.

*** Result 3 Budget: $ 192,500 Balance: $ 0**

IV. OUTLINE OF PROJECT RESULTS:

Result 1. FUNCTIONAL PARTNERSHIPS TO DELIVER RESEARCH AND OUTREACH PROGRAMS: ***A partnership of farmers, researchers, land owners, private sector representatives, agency personnel, community members and non-profit organizations will exist to plan, implement, and deliver cooperative research and demonstration projects.*** The team process utilized in the Monitoring Project (supported by MISA, LCMR and USDA that examines the biological, economic and community impacts of rotational grazing systems in Southeast Minnesota) will be expanded to additional sites and farming systems in West Central Region (Chippewa and Pomme de Terre River watersheds); the Southwest Region (Redwood/Cottonwood River watersheds) and in the Southeast Region (Whitewater River watershed).

For each of the three farming regions, functional partnerships will be created among agencies, farmers, land owners, researchers, private sector groups, and non-profit organizations to develop creative solutions to environmental and economic problems associated with agricultural practices. A total of three teams will address local research and education needs in 40 sites in SE, WC and SW Minnesota.

To help facilitate discussion and communication within each region, a locally-based person will be hired on a part-time basis in each of the three areas to work with the local teams. One person will also work part-time to provide overall coordination and facilitate communication among project participants in all three regions.

Appendix 1 shows a map of the project areas. See Results 2 & 3 for more information regarding the documentation and evaluation of research and educational activities. We intend to exchange information and possibly collaborate on research with other LCMR grantees as appropriate. For example, this project's work is complementary with the Alfalfa Biomass Production project (#H10/27) and we intend to exchange information between the projects.

*** Result 1 Budget: $ 111,000 Balance: $ 0**

* **Completion Dates:** see each step for completion dates

Result 1A. ***Research Plans:*** The groundwork for identifying farming systems and specific research sites will take place with matching funds spent prior to the beginning of the LCMR funding cycle so that we will be able to install monitoring equipment beginning July 1, 1997. Intensive research (quantitative research plots) will be undertaken in the Southeast and West Central regions to evaluate the impacts of alternative cropping systems on soil and water quality. In the Southeast and West Central regions the teams will compare perennial systems (grazing) and mixed systems (perennial crops grown in rotation with annual crops) to conventional annual cropping systems. Plans for less intensive monitoring of economic, quality of life, and broad-scale biological parameters will be made in all three regions (Southeast, West Central and Southwest). Research plans will be periodically reviewed and adjusted by the teams in order to provide useful, relevant information needed by farmers and to better direct the research effort for their use. See Result #2 for information about research documentation and evaluation.

Completion Dates:

Non-LCMR funds will be used to begin planning research from January - July 1, 1997

LCMR funds:

1997 research plans will be completed by July 31, 1997
1998 research plans will be completed by March 30, 1998

Result 1B. ***Education and Demonstration Plans:*** Once research sites are agreed upon, the interdisciplinary teams will design the details of the education and demonstration activities to highlight research findings and to demonstrate feasible alternative management practices. A minimum of 20 events will take place in the Southeast, West Central and Southwest regions (see Result #3 for more detail).

Completion Dates:

Non-LCMR funds will be used to begin planning education and demonstration work from January to July 1, 1997

LCMR funds:

1997 education and demonstration plans will be completed by July 31, 1997
1998 education and demonstration plans will be completed by March 30, 1998

Result 1C. ***Evaluation:*** Several approaches to evaluation methods will be used to help the team: guide the planning process; assess specific tasks; examine outcomes during the project; and assess impacts of the project in the long-term. To accomplish this, teams in the three regions will meet on an on-going basis to refine research and educational plans, and to reflect on the team process. All three teams will meet mid-way through the project to share information learned. Near the end of the project participants will meet to identify future research and education needs and to assess the project as a whole.

* Evaluation Completion Dates: Evaluation will be done on an on-going basis.

Specific dates to evaluate research:

1. December 1997
2. December 1998
3. June 1999

Specific dates to evaluate education: after each event an evaluation will be made;

1. January 1998
2. January 1999
3. June 1999

7/1/99

A great deal of emphasis has been put on developing our team approach throughout the life of the two year project. Our belief in building a strong foundation of trust and communication payed off: our teams in the three regions have successfully developed research and education programs beyond the scope of this project and have been successful in garnering additional funds to support their work. The local team leaders tell us that the strong partnerships developed through involvement in the Sustainable Farming Systems team led to increased opportunities for additional projects and that the partnerships were a major key in securing additional funding..

The **Project Coordinator** (The Minnesota Project) to date has coordinated six in-person meetings of the entire **Steering Committee** in June 1997, October 1997, February 1998, June 1998 and December 1998, and May 1999. The purpose of the Steering Committee was to provide oversight for all three teams and to ensure a coordinated effort. The Steering Committee consisted of representatives from the three local teams, researchers, non-profit organization representatives, and project staff. Because it was successful we will again use the Steering Committee and working committee models in the continuation phase.

Three committees formed to work between Steering Committee meetings: (1) the Staff Committee, consisting of the eight primary staff who are overseeing the project. This committee meets via biweekly conference calls to share information among all three local teams and make plans. A brief internal update memo was sent to the entire Steering Committee after each conference call; over the two year period a series of 36 updates were sent out to the committee. (2) the **Monitoring Task Force** designed and develop research and demonstration plans on the eight intensive research sites, and at the extensive research sites in the three regions. (3) the **Outreach Task Force** developed and oversaw implementation of outreach efforts.

Additionally, each of the three local teams developed plans for implementing their work in each region. A part time coordinator worked with each team throughout the two years.

The **West Central Team** continues their work in the Chippewa River Watershed, with a focus implementation of this research project within the larger context of work in their region. Attention has focused on collecting research from the four farm sites, and on use of monitoring tools on farms. The Team has so far focused on: monitoring forage quality and quantity; birds

and wildlife; soil, stream bank erosion and land use issues; and streams. The four farmers with extensive monitoring sites on their farms are participating in the economic analysis component as well. Additionally, this local team will work with the West Central Experiment Station at Morris on the *Sustainable Livestock Systems* project recommended by the LCMR for funding in 1999-2001.

The **Southwest Team** is taking a dual track approach. The newly energized Coteau Sustainable Farming Association chapter has implemented a series of research projects the farmers undertook in 1998. At the same time, Lamberton and Southwest State University researchers have pulled together a group of more conventional corn/soybean farmers to design on-farm research for 1998. Farmers in the region have expressed a strong interest in learning more about organic farming and much of the efforts have been focused on learning about organic systems. This group will be working with the project recommended by LCMR for funding in 1999-2000 that focuses on organic production systems. As designed and approved in the original work plan, the Southwest Team's involvement in the Sustainable Farming Systems Team will not be part of the continuation project, but has been an excellent partner during the first two years. We will continue to interact with them on an in-formal basis.

The **Southeast Team** identified farms that fit the intensive research design needs, and the four sites needed were identified and established. On farm monitoring consists of: soil samples and monitoring; compost quality testing; bird monitoring. The four farmers with extensive monitoring sites on their farms are participating in the economic analysis component as well.

Result 2. RESEARCH ON SUSTAINABLE FARMING SYSTEMS: Research on the economic and environmental impacts of sustainable farming systems will be initiated.
Comprehensive data from 20 complementary on-farm and experiment station research sites (8 intensively-monitored sites, either on-farm or at an experiment station, and 12 farms that will be less intensively monitored) will document the impacts of current and alternative farming systems on the environment and on-farm profitability in SE, WC and SW Minnesota. Specific research parameters and designs will be determined by the scientists and local members of the teams identified in Objective 1. In the SE and WC regions, equipment will be installed in paired watersheds (8 sites) to allow intensive monitoring of soil and water quality impacts of agricultural practices over time. In each region, the conventional cropping system will be contrasted with a perennial system (such as rotational livestock grazing) and a mixed system (such as annual and perennial crops grown in rotation to support more typical animal-based farms).

Less intensive monitoring, conducted on 12 farms in the three regions, will use on-farm measures and soil and water analyses to complement the information gleaned from more intensive monitoring of the paired watersheds. These farms may include some cropping system alternatives not included in the paired watershed studies. Some of the parameters that local teams may choose to monitor include wildlife (birds, frogs, toads, etc.), soil quality, stream quality, economics, and quality of life.

* **Result 2 Budget: $ 256,500 Balance: $ 2,257.94**

* **Completion Dates:** see each step for completion dates

Result 2A. ***Monitoring Equipment Installation:*** Once the local teams and researchers identify the sites and parameters to monitor, equipment will be installed at 8 sites in (4 sites x two watersheds) the Southeast and West Central regions. The four sites in each region will constitute two matched pairs, with similar soils and landscape positions. The installed equipment will permit frequent and complete monitoring of amounts of precipitation, infiltration, runoff, sediment load, phosphorus loading of streams, and other parameters which will enable determination of cropping system impacts on soil and water quality at these sites.

Equipment Installation Completion Dates:

Equipment will be installed by: September 30, 1997

Result 2B. ***Data Collection and Monitoring:*** Baseline data will be collected for conventional and alternative cropping systems to examine the cause and effect relationship of economic and environmental parameters.

At the intensively monitored sites, frequent monitoring of nutrient cycling and losses, erosion and sediment loads, and indicators of soil and water quality will be conducted from spring thaw until freezing. In addition, such information as crop yields, farm and stream habitat quality, and production costs will be collected for the conventional and alternative cropping systems. The less intensive on-farm monitoring will include both year-round monitoring of indicators to assess environmental quality, economics and quality of life, as well as annual sampling of some soil and water quality measures. Both intensive research monitoring sites and farms less intensively monitored will serve as demonstration and educational sites (see result #3).

Data Collection and Monitoring Completion Dates:

Field Data Collection Completion Dates: Field data will be collected from

1. August 1997 through November 1997;
2. May 1998 through September 1998, and
3. March 1999 through June 1999.

Economic Data Collection Completion Dates: Economic data will be collected

1. September 1997 through November 1997;
2. February through March 1998;
3. September 1998 through January 1999; and
4. June 30, 1999.

Result 2C. ***Analysis:*** Data collected will be analyzed and synthesized, resulting in identification of the impacts of each system from an economic, environmental and policy perspective. Key longer-term research and data needs will be identified.

* ***Analysis Completion Dates:*** Data Analysis will be done in stages from
1. November 1997 - March 1998;
2. November 1998 - March 1999; and
3. June 30, 1999.

7/1/99

On-farm research and monitoring:

Storm events are being monitored using ISCO samplers at eight project locations in the Chippewa River area and in the Sand Creek area near Jordan, MN. Samples of runoff and erosion are collected from tile drains at regular intervals and analyzed for sediment, nitrate-nitrogen (NO3-N), ammonium-nitrogen (NH4-N), dissolved phosphorus (DP), particulate phosphorus (PP), total phosphorus (TP), bioavailable phosphorus (BAP), and chemical oxygen demand (COD). By the end of June 1999, 425 samples from run-off events and 175 samples from the base line flow have been collected. Samples have been analyzed for the above mentioned parameters, with the exception of TP and BAP. Soils are analyzed for nutrients, organic carbon, pH, aggregate stability, bulk density, grain size distribution, infiltration rate, and earth worms.

The runoff and erosion samples will be used to estimate the environmental impacts of each farm, including:

- rate of erosion
- nitrogen losses
- phosphorus losses
- chemical oxygen demand

Erosion causes loss of productivity on the farm as topsoil is removed, and once in streams, sediment causes turbidity. Turbidity and sedimentation reduce the quality of habitat for spawning of fish. Losses of nutrients (nitrogen and phosphorus) to streams causes eutrophication, which is growth of algae followed by depletion of oxygen levels in the water. Phosphorus is usually the limiting factor for algal growth in streams, as concentrations of nitrogen and phosphorus must be greater than 1.5 and 0.1 mg/L, respectively, to cause eutrophication.

Phosphorus occurs in many forms, not all of which are equally available for uptake by algae. The three main forms are dissolved phosphorus, particulate phosphorus, and bioavailable phosphorus. Algae grow only when bioavailable phosphorus is present. Bioavailable phosphorus consists of all dissolved phosphorus present, as well as a fraction of the particulate phosphorus. Published research indicates that the fraction of particulate phosphorus which is bioavailable ranges from 10-90%, depending on soil properties. Research is underway to determine what fraction of

particulate phosphorus is bioavailable for Minnesota soil conditions. Chemical oxygen demand is the oxygen consumed when organic matter in the water is decomposed. High chemical oxygen demand can produce eutrophication, just as excess nutrients do.

Monitoring will continue in the next biennium with the extension of the SFS project by LCMR for 1999-2001.

Economic Analysis:

As stated in the broader project mission, the goal of economic monitoring is to assess the impacts of different farming systems on profitability, solvency, liquidity and efficiency on a case-by-case basis. Monitoring stretched across disciplines to take advantage of traditional formal and non-traditional informal tools. Namely, the project aimed to answer the following general questions in addition to those identified by each farm participant:

1. Can alternative crop and livestock systems improve environmental quality while maintaining or improving farm income? and

2. What are the risk management advantages of low-input and diversified farming systems?

Economic monitoring goals were four-fold:

1. Outline and record present and future economic goals for each participating farm;

2. Identify formal and informal tools that can be used to assess farm progress in reaching or moving toward economic goals;

3. Evaluate and report on economic performance at the field, whole-farm and watershed level using available tools; and

4. Review applicability and appropriateness of tools used in economic monitoring and make suggestions for future monitoring work and tool design.

An Economic Task Force was created within the project team to work toward the monitoring goals outlined above. The Task Force meets by phone and in person as needed.

Monitoring Participants: Seven farm families volunteered to participate in economic monitoring for the project period 1997 - 2000. Six of the seven volunteers also participate in water quality monitoring.

Monitoring/Analysis Tools: In addition to farmers' own goals, mix of traditional and alternative financial analysis tools are being used by farm participants to monitor economic performance. FINPACK software developed by the University of Minnesota's Center for Farm Financial

Management is used to track profitability, solvency, liquidity and financial efficiency at the whole farm and enterprise levels. Moreover, a series of alternative financial indicators developed by agricultural economist Dick Levins, is used to evaluate a farm's reliance on government payments, purchased feed and other inputs. Alternative indicators also track energy use and community job creation.

Workshops: Watershed team leaders have been working with farm participants to conduct the economic work through a series of group workshops and one-on-one meetings to outline personal and financial farm goals. A farm accounting workshop was sponsored by the Sustainable Farming Systems Project in March 1998 to assist farm participants with computer record keeping. Oklahoma State University Extension Economist Damona Doye conducted two half-day beginners and intermediate workshops on the University of Minnesota's Saint Paul Campus for project participants.

Data Collection/Analysis: Detailed record-keeping and financial analysis began in 1998 in collaboration with the Minnesota Colleges and University Farm Business Management Program. Each farm participant meets regularly with Economic Monitoring Coordinator, Gigi DiGiacomo, and Farm Business Management instructors to record and evaluate financial performance at the whole-farm and enterprise levels. Work will continue in the next biennium.

Result 3. OUTREACH PROGRAMS: 800 farmers will be reached through a minimum of 20 field days and workshops, and written materials to strengthen information exchange and ownership by the end of the two year period.

* **Result 3 Budget: $ 192,500 Balance: $ 192,500**

* **Completion Dates:** see each step for completion dates

Result 3A. ***Field Days and Workshops:*** At least 20 field days and workshops, both on farms and at U of MN experiment stations, will highlight research and demonstration sites. Topics and timing of programs will be jointly identified by team members. Field days and workshops will be widely publicized through newsletters, the extension service, direct mailings, and MISA's world wide web site.

* ***Field days or workshops completion dates:***
    1. August - September 1997
    2. January 1998
    3. March 1998
    4. July 1998
    5. September 1998
    6. January 1999
    7. May 1999
    8. June 30, 1999

Result 3B. ***Written Materials:*** Information sheets and monitoring guides will be developed and disseminated via interactive, participatory field days and workshops on farms and at U of MN experiment stations. We will also put research results on MISA's World Wide Web site.

* ***Written materials completion dates:***
    1. February 1998
    2. May 1998
    3. November 1998
    4. March 1999

* ***Disseminate written materials:***
    1. March 1998
    2. May 1998
    3. December 1998
    4. April - June 30, 1999

7/1/99

The outreach component of this project has exceeded our original goals. At the end of the first phase of the project (July 1, 1997- June 30, 1999) we have held a total of 47 events with at least 2,452 people in attendance. A complete list of all events is included with this final report. The events have been done in a variety of venues and formats including: on-farm field days highlighting monitoring and research of the project; programs at the West Central, Waseca, and Southwest Experiment Stations; financial analysis workshops; workshops on organic farming systems, rotational grazing and soil quality. We developed an information packet on the total project that was used at field days, workshops and other events.

V. DISSEMINATION: Objective 3 outlines our primary plans for dissemination (field days, workshops and written materials). Additionally, team members will present data and information about the team building process at events sponsored by other groups (local, national and regional meetings) as well as via scientific journal publications and popular press articles. Several partner organizations (MISA, MES, SFA, MN Project, LSP) have newsletters in which articles about findings will be disseminated. MISA's WWW site will be used to share information.

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 are needed to develop and evaluate these alternative practices. Greater adoption of sustainable agriculture will require increased efforts to include a wider audience and greater participation from farmers, researchers, land owners, private sector representatives, agency personnel, community members, and non-profit organizations. Currently, however, there is little infrastructure to facilitate cooperative research

and education efforts among the various groups concerned with agricultural systems. This situation has led to restricted information exchange, limited complementary research, and created barriers to the development and adoption of alternative farming systems. In the past, adverse impacts of agricultural practices on the environment have led to contentious interaction among land managers, the public, and governmental agencies in some areas -- the MN River Basin is an example of this. Experience in SE MN has shown that projects can benefit from diverse interests, knowledge and skills. Bringing all parties on-board at project inception can help diffuse conflict and build lasting partnerships.

B. Time: Monitoring and evaluating the impacts of different cropping systems on the environment are long-term commitments. We will initiate the planning process for this project in January 1997 (with non-LCMR funds), and will monitor the sites for 2 years using LCMR funding. Longer-term support for all objectives of this study will be required and we will seek additional sources of funding to support this project.

C. Budget Context:

LCMR Budget History:	$200,000	(for related activities from 2 LCMR grants totaling $325,000).
Non-LCMR Budget History & Source:		
Related work: for development of the Monitoring Team	$288,000 $100,000	from MISA from USDA.
Total:	$588,000	to date.

We intend to actively pro-actively seek additional sources of funding to support the research related to this proposal.

C. 4 Sustainable Farming Systems - Two Year Budget:

LCMR Funds	
Personnel: A combination of 1 FT research associate and 9 PT positions for local coordination, assistant scientists and secretarial support. Funds will not be used to support on-going university positions)	$ 265,000
Equipment[1]: For two watersheds, 2 cropping systems; 8 ISCO samplers ($5,200 per sampler); data transfer & software ($700); equipment installation and maintenance; sample collection bottles and related sample collection materials.	$ 60,000
Acquisition & Development:	$ 0
Other:	
- local team meetings + support	$ 30,000
- travel expenses + fleet services	$ 32,000
- office (phone, postage, fax, supplies, etc)	$ 42,000
- on-farm research/demos (includes farmer stipends, on-farm monitoring of parameters such as soil quality, birds, frog and toad counts, on-farm economics, related publications and written materials, etc.)	$ 25,000
- field days & workshops (18 - 20 field days and 2-3 workshops, includes speaker expenses, materials, advertising, transportation, related publications & written materials, etc)	$ 28,500
- sample analysis & monitoring (lab work and related supplies)	$ 77,500
TOTAL	**$560,000**

[1] Major equipment purchased for the research described in this proposal (ISCO samplers and related equipment) will be used to collect data for the life of this funding request. At the end of the two year funding period, the equipment will continue to be used to support similar research projects as long as the equipment remains in working order. We will seek funding to continue the goals and objectives of this research and data collection effort after the life of this funding period.

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Dr. Murray is the Coordinator for the Minnesota Institute for Sustainable Agriculture (MISA). The purpose of MISA is to bring together the interests of the agricultural community in a cooperative effort to develop and promote sustainable agriculture. Dr. Murray currently serves as manager for eight interdisciplinary research and education teams funded by MISA to ensure communication among MISA's Board of Directors and the teams. Prior to coming to Minnesota, for five years she worked to implement and manage an interdisciplinary study on the social, economic, and biological aspects of a variety of vegetable and small fruit farming systems in western Oregon and Washington; the project included both on-farm and experiment station research and participatory educational programs. Dr. Murray's research interests are focused on identifying ways of increasing diverse team participation in research, education, and outreach programs. She is also well versed in applied agricultural research methods. Recent awards include: the Oldfield/Jackman Team Award, for individual and cooperative efforts as a member of the Collaborative and Participatory Learning Team in 1995, and the Search for Excellence Award for Outstanding Leadership in Educational Programming, in 1990 and 1993.

Education
Ph.D., Crop Science, Oregon State University, 1993
M.S., Horticulture, Oregon State University, 1988
B.S., Fruit Science, California Polytechnic State University - San Luis Obispo, 1981

Recent Professional Positions
Coordinator, Minnesota Institute for Sustainable Agriculture, University of Minnesota
October 1993 to present

Sustainable Agriculture Project Associate, Oregon State University,
October 1988 - September 1993

Albania Assessment Team Member, Oregon State University, June 1992

Selected Publications
Taack, D., H. Murray, and S.R. Simmons. 1994. Minto-Brown Island Park: Farming the Urban-Agricultural Interface. Journal of Natural Resources and Life Sciences Education, Volume 23:2

Murray, H. and L.M. Butler. 1994. Whole Farm Case Studies and Focus Groups. Journal of Alternative Agriculture, Volume 9:1&2

Lev, L.S., D. McGrath, H. Murray, and R.D. William. 1993. Organizing and Conducting Farmer/Scientist Focus Sessions. Journal of Natural Resources and Life Sciences Education, Volume 22:2

February 22, 1999