

# INFORMATION TECHNOLOGIES – STRATEGIC RESEARCH INITIATIVE

## Final Report Submitted in October 2003

### Executive Summary

The Information Technologies – Strategic Research Initiative (IT-SRI) began its work with a focus in three areas:

1. Development of decision and analysis support systems,
2. Development of activity, output and outcome reporting systems for Council on Food and Agricultural Research (C-FAR) funded research, and
3. Development of outreach information systems.

Many outcomes contribute towards meeting objectives within each of these three areas. Major outcomes of the IT-SRI are summarized in four areas.

First, researchers developed comprehensive information systems that aid decision-making in specific settings. Four comprehensive websites are now available on the web:

1. *Farmdoc* is available at [www.farmdoc.uiuc.edu](http://www.farmdoc.uiuc.edu). This website addresses agricultural economics issues and has a goal of developing innovative and comprehensive programs to improve decision-making under risk through research and education. The *farmdoc* project provides seamless and integrated expertise in farm management, agricultural finance, commodity policy, and agricultural law. Usage of *farmdoc* has increased over the life of the IT-SRI. *Farmdoc*'s requests increased from about 10,000 per month in 1999 to an average of 150,000 in 2003.
2. *Illinois Integrated Pest Management (IPM) On-line* is available at <http://www.ipm.uiuc.edu/>. *IPM Online* contains information on pest management for Illinois users. Information is available for field crops, fruits, vegetables, landscape and turf, greenhouse, home and gardens, and livestock. *IPM On-line*'s successful requests increased from an average of 4,039 per month in 1998 to an average of 66,612 per month in 2002. Preliminary data indicate a continued increase in 2003.
3. *Illinois Interactive Agronomy Handbook (IAH)* is available at <http://www.ag.uiuc.edu/iah/>. *IAH* builds on the popular printed version of the *Illinois Agronomy Handbook*. Electronic versions of chapters in the *Illinois Agronomy Handbook* are available at *IAH* and include chapters on climatology, corn production, soybean production, small grains production, cover crop production, alternative crop production, hay & pasture, seed, water quality, soil fertility, nutrient management, tillage systems, water management, weed control management, insect management, disease management, nematodes, and nutrient management.

4. Illinois *TRAILL* is available at <http://traill.outreach.uiuc.edu/>. *TRAILL* provides integrated research information to the livestock industries. Species sites within *TRAILL* include BeefNet, DairyNet, HorseNet, PorkNet, PoultryNet, and SheepNet. Each species site provides a section for current topics, papers, events, and newsletters.

Development of these websites met objectives related to third area of "outreach information systems" that is listed above.

The second area of outcomes related to decision support systems. Researchers made advances in developing decision and analysis support systems. Many of these decision-support systems are included in the above described comprehensive websites. Additional support systems developed by the IT-SRI include:

1. The *Enhanced Farm Research Analyst (EFRA)* is available at <http://www.farmresearch.com/efra/>. *EFRA* is an extension to ArcView that aids researchers, consultants, and farmers in developing on-farm research by designing research plots and performing statistics on geo-referenced data. This tool aids in conducting research that will tailor recommendations for very specific situations. For example, use of this tool could allow for the development of fertilizer recommendations pinpointed to soil types and locations within fields.
2. The *Online Evaluation Workbook* is available at: <http://www.communitydevelopment.uiuc.edu/evalbook/>. The workbook provides a step-by-step evaluation guide to help individuals design an evaluation strategy for economic development projects. The online version provides an interactive forum for conducting a project evaluation. The online version will be completed by December 2003. The online evaluation tool builds on the other tools available in the CFAR sponsored Community Development Toolbox. In addition to strategic planning, needs assessment and benchmarking the evaluation tool works with the others to build a comprehensive economic development strategy.
3. *On-Machinery Information Manager* project has developed a prototype of an Agricultural Infotronics System for remote monitoring. This prototype was developed for a Case MX-240 tractor with an attached cultivator. Based on results from this research, it was concluded that the AIS technology has the potential to increase the effectiveness of precision agricultural operations.
4. *Prostar* a Web-enabled agribusiness simulation of a retail fertilizer and chemical dealership. This simulator was designed to be used in college classes, in university outreach and in agribusiness training environments to improve the learning, comprehension and retention of knowledge relevant in making better business management decisions.

5. *Resource Management Mapping Service (RMMS)* is available at <http://space1.itcs.uiuc.edu/website/rmms/>. *RMMS* is designed specifically to aid watershed management groups in planning projects by providing geographically information about their watershed. *RMMS* also contains information of interest to other users across Illinois. *RMMS* is a geographical information system that currently has over 50 layers of information Illinois. Layers include soil type information (where electronically available), watershed boundaries, streams, wetland boundaries, congressional districts, counties, Illinois Department of Natural Resource boundaries, towns, townships, highways, land fills, and roads.

These activities contributed towards meeting goals within the first area listed above of developing decision and analysis support systems.

The third area of outcomes relate to advances in information technologies. IT-SRI researchers have developed new and innovative methodologies for presenting information to users. Indicators of this success include national recognition of IT-SRI projects in popular press outlets including *agricultural.com*, *Successful Farmer*, and *Farm Journal*. Moreover, results from these projects also have been presented as invited sessions at the meetings of American Society of Agronomy and the American Agricultural Economics Association meetings. *Farmdoc*, a project within the IT-SRI, also won the national team award for outreach from the American Agricultural Economics Association in 2002.

The fourth area of outcomes relate to the way individuals receive information within Illinois. Many individuals now receive information directly through websites that used to be obtained through written publications or through meetings. This is evidenced by the dramatic increase in use of the websites developed by IT-SRI researchers. Moreover, individuals who do not access information directly from websites are still impacted by the IT-SRI. Many information users, such as the University of Illinois – Extension, use information provided by the IT-SRI in conducting their programs.

These outcomes were obtained over the life of the project which can be divided into three stages. The initiation stage lasted during fiscal years (FY) 1999 and 2000. During this time period, over 30 projects were initiated involving more than 60 researchers at the University of Illinois, Illinois State University, Southern Illinois University-Carbondale, Western Illinois University, Illinois Scientific Surveys and American Farmland Trust. The second stage occurred during FY2001 and FY2002 and represented consolidation. During this period, the above 30 projects were reduced down to 11 projects. This consolidation allowed focus and increased visibility of individual projects within the IT-SRI. The third stage was refinement and occurred during FY2003. During this stage, projects were brought to fruition.

The project leader of the IT-SRI from FY1999 through FY2002 was Sally Thompson. Her leadership enabled much of the success of the project. Gary Schnitkey served as project leader for fiscal year 2003.

Researchers within the IT-SRI generated over \$2 million of funds that levered IT-SRI funds.

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### TABLE OF CONTENTS

SRI Primary Objectives and Goals . . . . .	4
Project Leadership and Principal Investigators. . . . .	5
Summary of Outcomes Over Life of the Project . . . . .	6
Products . . . . .	14
Initial Objectives That Were Not Accomplished . . . . .	20
Outreach Activities . . . . .	21
SRI Components Planned for Continuation . . . . .	21
Leveraged Funds . . . . .	22

### SRI PRIMARY OBJECTIVES AND GOALS

A pre-proposal to the Council on Food and Agricultural Research (C-FAR) concerning the Information Technology Research Initiative (IT-SRI) stated that the IT-SRI's activities were to focus in three areas:

- (1) Decision and analysis support systems.** Decision-support systems became practical during the 1990s because of computational advances and decreases in costs of computer hardware and software. In addition, large data sets, such as geographically referenced yield data, began to be developed in agriculture. These events suggested the need to develop computer-designed tools to aid in decision-making. Hence, this area's overall goal was to develop computer-based tools to aid in decision-making. Suggested focus points included geographical information systems, dynamics of plant and animal pathogens, evaluation of risks associated with pathogens, costs of alternative systems, and biosystems and bioinformatics.
- (2) Activity, output, and outcome reporting systems.** This area focused on developing a tracking and reporting system for funded C-FAR research that could be used by various participants in the evaluation of SRI projects.
- (3) Outreach information systems.** Efforts in this area were to develop electronic means for disseminating results from research programs, develop new methods of organizing information taking into consideration how people access and use information, develop learning modules that cut across traditional teaching, research, and extension lines, and promote the adoption of information technologies.

## **PROJECT LEADERSHIP AND PRINCIPAL INVESTIGATORS**

Sally Thompson was the project leader for the Information Technologies – Strategic Research Initiative (IT-SRI) from 1998 through 2002. Dr. Thompson oversaw the formation of the initiative and provided leadership for the IT-SRI over much of the life of the project. Her leadership enabled much of the success of the project. Gary Schnitkey served as project leader for fiscal year 2003.

The following were principal investigators of projects within the Information Technologies – Strategic Research Initiative (IT-SRI):

Donald Bullock, Professor, Department of Crop Sciences, University of Illinois at Urbana-Champaign, Principal Investigator (PI) of In-field Management Prescriptions project.

Paul Ellinger, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, PI of Farm Financial Performance Assessment project. This project was merged into *farmdoc*.

Rick Farnsworth, Formerly an Associate Professor, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, PI of Illinois Watershed Management Clearinghouse project.

Julie Fesenmaier, Senior Research Specialist, Department of Human and Community Development, University of Illinois at Urbana-Champaign, PI of Community Development Toolbox project.

Jim Legacy, Professor Emeritus, Department of Plant, Soil, & General Agriculture, Southern Illinois University at Carbondale, PI of the Farmer Use of WWW Protocols project.

Robert Hoeft, Professor, Department of Crop Sciences, University of Illinois at Urbana-Champaign, PI of the Interactive Online Agronomy Handbook project.

Scott Irwin, Professor, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, PI of *farmdoc* project.

Doug Johnston, Assistant Professor, Department of Landscape Architecture, University of Illinois at Urbana-Champaign, PI of Biological Workbench project.

David Onstad, Associate Professor, Department of Natural Resources and Environmental Science, University of Illinois at Urbana-Champaign, PI of Sustainable Agriculture Information project.

Patrick O'Rourke, Professor, Department of Agriculture, Illinois State University, PI of the Farm Based DASS project.

Gary Schnitkey, Associate Professor, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, PI of the A System to Aggregate Data project. This project was merged into *farmdoc*.

Kevin Steffey, Professor, Department of Crop Sciences, University of Illinois at Urbana-Champaign, PI for the IPM Online Handbook project.

Richard Wallace, Associate Professor, Department of Veterinary Clinical Medicine, University of Illinois at Urbana-Champaign, PI for the Illinois TRAILL project.

Jill Webster, Assistant Professor, Department of Plant, Soil, & General Agriculture, Southern Illinois University at Carbondale, PI of the Farmers Use of the Internet project.

Qin Zhang, Associate Professor, Department of Agricultural and Biological Engineering, University of Illinois at Urbana-Champaign, PI of the “On-Machinery Information System” project.

## **SUMMARY OF OUTCOMES OVER THE LIFE OF PROJECT**

The major outcomes of the Information Technologies – Strategic Research Initiative (IT-SRI) can be summarized within four areas:

1. Researchers have developed comprehensive information systems that aid decision-makers in specific settings. Four comprehensive websites address issues in:
  - a. Agricultural economics (*farmdoc* available at [www.farmdoc.uiuc.edu](http://www.farmdoc.uiuc.edu)),
  - b. Agronomy (*Interactive Agronomy Handbook* available at [www.ag.uiuc.edu/iah/](http://www.ag.uiuc.edu/iah/)),
  - c. Livestock (*Illinois TRAILL* available at <http://traill.outreach.uiuc.edu/>), and
  - d. Pest management (*Integrated Pest Management (IPM) On-line* available at [www.ipm.uiuc.edu](http://www.ipm.uiuc.edu)).

As more fully described in the “Products” section of this report, these sites aid in decision-making by providing information through publications and other media and by providing computerized decision tools. Use of these sites has increased dramatically over the life of the project. For example, *IPM On-line*’s successful request increased from an average of 4,039 per month in 1998 to an average of 66,612 per month in 2002. Preliminary data indicate a continued increase in 2003. Similarly, *farmdoc*’s requests increased from about 10,000 per month in 1999 to an average of 150,000 in 2003. This usage confirms the utility of these sites. This project accomplishes the IT-SRI’s objectives within the “outreach information systems” area.

2. Researchers have made advances in developing decision and analysis support systems. Many of these decision-support systems are included in the above described comprehensive websites. Additional decision-making tools include:
  - a. *Enhanced Farm Research Analyst*
  - b. *Online Evaluation Handbook*
  - c. *On-Tractor Management System*

*d. Resource Management Mapping Service*

Each of these tools is more fully described in the “Products” section of this report. These tools have increased in sophistication prior over those available prior to the IT-SRI, thereby allowing decision-makers to more accurately tailor information to their own situations. These tools accomplish the IT-SRI’s objectives within the “decision and analysis support systems.”

3. Researchers have contributed to the advance in information technologies. IT-SRI researchers have developed new and innovative methodologies for presenting information to users. Indicators of this success include the national recognition of IT-SRI projects in popular press outlets including *agricultural.com*, *Successful Farmer*, and *Farm Journal*. Moreover, results from these projects also have been presented as invited sessions at American Society of Agronomy and the American Agricultural Economics Association meetings. *Farmdoc*, a project within the IT-SRI, also won the national team award for outreach from the American Agricultural Economics Association in 2002.
4. Researchers had altered the way in which individuals receive information within Illinois. Many individuals now receive information directly through websites that used to be obtained through written publications or through meetings. This is evidenced by the dramatic increase in use of the websites cited in item (1) above. Moreover, individuals who do not access information directly from websites are still impacted by the IT-SRI. Many information users, such as the University of Illinois – Extension, use information provided by the IT-SRI in conducting their programs.

These outcomes resulted from the progress made over the life of the IT-SRI. This progress can be divided into three stages: 1) Initiation during Fiscal Years (FY) 1999 and 2000, 2) Consolidation of activities in FY2001 and FY2002, and 3) Refinement in FY2003. Each of these stages is described in the following sub-sections.

**Initiation (FY1999 and FY2000).** The IT-SRI began project activities in FY1999. During FY1999, the IT-SRI funded over 30 projects involving more than 60 researchers at the University of Illinois, Illinois State University, Southern Illinois University-Carbondale, Western Illinois University, Illinois Scientific Surveys and American Farmland Trust. These projects were selected from proposals solicited from researchers at the above institutions. These initial IT-SRI projects were divided into three groups dealing with Farm and Agribusiness Tools, Water Quality and Natural Resources, Community and Consumer Interests, and Research Tools. A brief description of each of the projects within these groups is provided below.

**Farmer and Agribusiness Tools.** Projects in this area helped farmers and agribusinesses make better management decisions as well as promoted the use of information technology to farmers. Applications included precision agriculture, pest management, and marketing and financial management tools.

**Illinois IPM Online:** This project was designed to increase the reach and impact of timely, educational articles published weekly throughout the growing season. Researchers launched a user-friendly Integrated Pest Management (IPM) website to

provide greater access to IPM information related to field crops, urban areas, medical entomology, livestock entomology and fruit and vegetable production.

**Interactive Online Illinois Agronomy Handbook:** This project was designed as a companion site to the print version of the *Illinois Agronomy Handbook*. Value was added to the print version by providing interactive calculators, databases, multimedia components, related online resources and updates.

**Management of Insect Pests Attacking Corn and Soybeans in Illinois:** At the request of the USEPA, USDA-ARS, the scientific community and industry, researchers created a simulation model to determine the risks of resistance development by western corn rootworm to transgenic corn.

**Weed Identification and Herbicide Decision Tools:** Two new computer-aided decision tools helped growers identify weeds and select the most appropriate herbicides. These programs were made available and updated over the Internet to provide growers with access to the most current information possible.

**World Wide Web Sites for Outreach Programs in Plant Sciences:** This project developed an operational website for the U of I Plant Clinic. The website included information about services and fees, links to sample submission forms, and links to newsletters and fact sheets.

**Cyberfarm:** The Cyberfarm website existed before the IT-SRI and was designed to show the many ways agriculture is using the Internet. The Cyberfarm team also works to initiate discussion and show how agriculture can use information technology, such as video conferencing. This project extended the Cyberfarm website.

**Farmer Use of WWW Protocols:** This research provided a baseline study of farmers' use of the Internet and other electronic media to solve farm problems. This project also evaluated the content requirements of some of the IT-SRI projects.

**Illinois Technology and Research: Allied and Integrated for Livestock Linkages (TRAILL):** This project was designed to provide integrated information for pork, dairy, beef, sheep, and poultry industries. It provided the latest University of Illinois research-based information to consumers, livestock producers, educators, consultants, veterinarians and agribusiness personnel.

**Corn End-Use Value Calculator:** This project developed a web-based application that placed a value on corn based on alternative end uses for wet millers, dry millers, snack food producers and livestock feeders. This tool was designed to aid farmers in identifying optimal varieties based on system value.

**Farm Financial Performance Assessment: An Interactive Database Approach:**

This project's objective was to create spreadsheets, a simulation model, and a calculator for evaluating farm financial performance. The tools were to be part of tools of the Farm Financial Analysis Web site, an interactive information and financial system that will assist users in evaluating the financial performance of farming operations.

**farm.doc (Decision Outreach Central):** This project's objective was to provide new and innovative risk management tools, timely information and analysis, decision-aid tools and resources.

**A System for Aggregate Analysis of Spatially Distributed Crop Production Data:**

This project addressed the feasibility of a firm offering a service that aggregates site-specific data, such as yield and soil information, across farms. The Farm Business Farm Management (FBFM) cooperative efforts in the financial record-keeping area will serve as a model for this firm.

**Data Mining for Site-specific Agriculture:** This project's objective was to determine if spatial information could be used to identify significant relationships through use of computer-based data-mining applications. Collaborators on this project include IMC International, the U of I Department of Statistics and the National Center for Supercomputing Applications.

**Development of an On-Tractor Information Manager:** An infrastructure for an "on-machinery" information management system was developed. This infrastructure was to allow users to collect operational information from on-board and off-machinery sources, process the information in real-time, make an optimal operation decision on the job site, and implement the optimal operations.

**Farm-based DASS and Improved Simulation Training for Farm Supplier**

**Management:** Researchers identified standard components on which management decision-making simulations could be designed and constructed. This identification led to the development of a computer simulation model for aiding farmers in strategic management teaching.

**In-field Management Prescriptions :** This project was to design an extension to the ArcView – a commercial, geographical information system developed by ESRI, Inc – that would aid farmers and others in conducting on-farm field experiments. The extension product, Enhanced Farm Research Analyst, will help producers and farm managers keep their production records in a way that will allow for easy and efficient query and data management.

**Water Quality and Natural Resources.** These projects help Illinois citizens improve the management of their natural resources by providing spatial databases, Geographic Information Systems (GIS) compatible software, simulation models and decision-support systems.

**A Practitioners Introduction to Dynamic Land/Water Simulation Modeling:** This project produced two books: Westervelt, James D. and Reetz, Harold F. (2000) *GIS in Site-Specific Agriculture*, Interstate Publishers, Inc., Danville, Ill.; and Westervelt, James D (2000) *Simulation Modeling for Watershed Management*, Springer-Verlag, N.Y. The precision agriculture GIS book was coordinated with ESRI, Inc. the Potash and Phosphate Institute-Foundation and the U of I, with draft reviewers tapped from ESRI, Inc., GROWMARK, Inc., GIS Solutions, U of I and CCNet Agribusiness Task Force. Reviewers for the watershed simulation modeling component of the project represented various Illinois agencies and Illinois watershed management groups across Illinois.

**DASS Web-based Database Module:** Researchers designed a multilevel approach to watershed modeling to support decision making by watershed associations, land owners, conservationists and state agencies. Models applied to a pilot watershed revealed areas vulnerable to erosion and assessed wetlands as a management practice to reduce erosion. The time savings is significant; researchers estimate work done in days using the Web-based database would have taken weeks (months without GIS and Internet). The Illinois Department of Natural Resources, Watershed Management was a partner in this project.

**Development of DASS Toolbox Guidelines/Protocols/Standards:** Researchers helped seed projects for developing an on-tractor information management system, an inexpensive GIS-based module to allow farmers to analyze their site-specific data, and the modeling of business processes of crop consultant operations. Researchers also reviewed technical environments, made recommendations on development standards for farmland and watershed management and published a report on DASS development standards for C-FAR's IT and Water Quality SRIs.

**Illinois Land-Use Clearinghouse: An Outreach Information System:** The Illinois Land-Use Clearinghouse debuted midsummer 1999 with population and demographic statistics, state land-use statutes, land-use legislation, state-related literature, links to resources from other states, maps and a unique database of contact information for people and organizations working in land-use issues in Illinois. Partners included the American Farmland Trust's Farmland Information Library, Illinois Department of Agriculture and the Illinois Farm Bureau.

**Illinois Watershed Management Clearinghouse:** Two grassroots movements changed the approach to managing Illinois water and other natural resources. The first movement shifted natural resource decision making to local communities and resource owners; the second overlaid local control with a more holistic management approach called sustainable development (improving the well-being of human and natural communities). This clearinghouse will provide resource managers, policy makers and other practitioners who want to develop and implement equitable, economically viable resource-conserving strategies with easy and timely access to the best available science and information. Principal stakeholder groups involved in initial phases of the project included the Court Creek Watershed Protection Committee, Natural Resources Conservation Service and the Illinois Department of Natural Resources. Partnerships also included IT-SRI investigators working on other mapping and modeling projects.

**Map Illinois: Interactive, Web-based Access to Natural Resource Geospatial Data:**

Researchers developed the means by which the public can use Web browsers to access geospatial databases using standard Web browsers. A prototype environment allows visitors to zoom closer by degrees. Partners in this research included the Illinois Scientific Surveys and the Pilot Watershed Program and Ecosystem Partnership Program, both Illinois Department of Natural Resources programs.

**Map Illinois: The Illinois Natural Resources Geospatial Data Clearinghouse:** The Illinois Natural Resources Geospatial Data Clearinghouse was an Internet catalog of free, downloadable, geographically referenced digital data. The data are applicable to a wide range of natural resource issues, including water quality, soil conservation, mineral resource availability and land cover. Researchers augmented the clearinghouse with more than one thousand Digital Raster Graphic (DRG) images of topographic quadrangles in Illinois.

**The Dynamic Integrated Urban Expansion Model: An Ecological Approach:**

Researchers developed a simulation model that represents the state of an ecological system and understandings about how the human and landscape/watershed processes interact. Mill Creek, one of 12 primary watersheds in Kane County, serves as the study area. The model can be used to test the impact of alternative land management practices, policies and legal regulations on water quality, storm water hydrographs, flooding, traffic densities, available groundwater and open space. Even as an enhanced model is being developed, the initial model is being run by various groups in Kane County. This project is part of a larger scope of work that involves the National Science Foundation. Informal leveraging is ongoing with the Army Corps of Engineers, U of I Imaging Systems Laboratory and the Building Research Council.

**Validating Spatial Econometric Modeling of Land Use in Illinois:** Researchers evaluated data on location characteristics, tax valuation and sales transactions for urban and rural real estate in Kane County.

**Community and Consumer Interests.** Projects in this area supported the use of information technology to access food and agricultural information by consumers and the general public. Projects ranged from providing nutrition information to consumers to developing tools for the creation of an agricultural digital library.

**Web Development for Functional Foods and Nutrition Analysis Tool**

**(Electronic Nutrition Information Grows Up):** Researchers enhanced the Nutrition Analysis Tool for delivery of nutrition information to consumers in a more user-friendly, comprehensive and sophisticated fashion. In addition, researchers created education modules that guide the user to personal messages based on his or her NAT results, stage of change classification, or interest in a particular dietary change. More than one million users tapped into this site some months.

**Microbial Control Decision Making:** The Viral Diseases of Insects in the Literature (VIDIL) database was expanded to assist users in finding background information critical to understanding the value and potential of insect viruses. In addition, new records were added to the Ecological Database of the World's Insect Pathogens. Scientists and integrated pest management practitioners use these databases.

**Morrill I: An Outreach Information System Prototype:** Morrill I was a prototype of a digital library – a next-generation online system that supports knowledge-on-demand from a single interface system. This system was envisioned to be integrated across disparate content resources, full text, richly formatted and highly searchable. Applications of this project are being used in the Interactive Online Agronomy Handbook. This project included a collaborative relationship with the National Center for Supercomputing Applications and partnerships with various U of I libraries.

**The Internet: A New Tool in Your Development Toolbox:** Expert and community networking databases, assessment and evaluation tools, retail sales data and a telecommunications infrastructure index were items in the Economic Development Toolbox. Researchers were creating a first-stop, interactive environment where users can find and share information and knowledge related to technology adoption and community development.

**World Food and Sustainable Agriculture Information on the Web:** Web resources developed on world food issues included an extensive report on the controversies surrounding genetically modified organisms and world trade negotiations. In the area of sustainable agriculture, a survey identified five pressing information needs of Illinois farmers and consumers: niche or alternative markets, genetically engineered crops, production information for alternative farming, water quality, and information for small and family farms.

**Research Tools.** These projects used information technology to support research in agricultural biology and natural systems.

**Biology WorkBench:** Researchers finalized a design and implemented the framework of an information management and analysis system for genome projects. The Genome Project Management System is designed to help researchers in agricultural genomics manage, retrieve and analyze their DNA sequence data easily from the Web and make their data available to the agriculture community and general public. The system has been used in three genome projects: the Soybean EST (expression sequence tag) project, the Cattle EST project and the Honey Bee EST project.

**Revitalization of the Soybean Insect Research Information Center:** The Soybean Insect Research Information Center (SIRIC) created a new infrastructure for an electronic database representing the world's scientific and research literature on soybean-related arthropods. The SIRIC database is a valuable resource for researchers, extension agents, growers and others in the soybean community.

**Consolidation (FY2001 and FY2002).** The above projects were successful in developing products during the initial stages of the IT-SRI. There was, however, a goal of increasing the cooperation and synergies between the projects. By focusing efforts in fewer areas, more visible products addressing the needs of a broader set of users could be developed. To aid in this cooperation, the above list of projects was consolidated into eleven projects. Through this consolidation, the scopes of the individual projects were expanded, thereby providing users with more information at one place. The eleven projects were:

**Farmers Use of Internet:** This project provided evaluations of IT-SRI projects that were designed to aid in improving the website.

*farm.doc:* *Farmdoc* expanded its mission to providing economic and law information.

**Community Development Toolbox:** This project developed tools for development assessment. Work continues on this project using SRI funds.

**Illinois IPM Online:** This project was designed to become the major site for pest information. Work continues on this project using SRI funds.

**Illinois Interactive Agronomy Handbook:** This project was designed to be the major source of agronomy information.

**Illinois TRAILL:** *TRAILL* was designed to become the project that provided livestock information.

**Illinois Watershed Management Clearinghouse:** This project's objective was to provide geographical information primarily for groups interested in watershed planning. Work continues on this project using SRI funds.

**In-field Management Prescriptions:** This project focused on precision agriculture. This project's major objective was to develop the *Enhanced Farm Research Analyst (EFRA)*.

**On-Machinery Information System:** This project was designed to develop an on-machinery information system. Work continues on this project using SRI funds.

**ProStar:** This project's objective was to develop *Prostar*, a simulation model for use by agribusiness.

**Sustainable Agriculture:** This project developed information technologies useful for sustainable agriculture.

**Refinement (FY2003).** Efforts in FY2003 focused on refining already existing products by increasing the user-friendliness of existing tools, publicizing the existence of products, and insuring that the products remained functional after the life of the product.

## PRODUCTS

Products produced by Information Technologies – Strategic Research Initiative (IT-SRI) are divided into three areas:

1. Full Service Subject Matter Websites. These websites provide printed material, decision tools, and other media to address decision-making within a topical area.
2. Information Technology Based Tool. These are tools that are designed support decision-making within one particular area.
3. Publications.

Products within each of these areas are described in the following subsections.

### Full Service Subject Matter Websites:

**Illinois TRAILL** is available at <http://traill.outreach.uiuc.edu/>. *TRAILL* provides integrated research information to the livestock industries. Species sites within *TRAILL* include BeefNet, DairyNet, HorseNet, PorkNet, PoultryNet, and SheepNet. Each species site provides a section for current topics, papers, events, and newsletters.

*TRAILL* also contains specialized sites. The Illini Predictive Equations for Alfalfa Quality (PEAQ) site provides a tool for calculating the nutrient value of alfalfa. This tool is useful in determining when to harvest alfalfa. A biosecurity and livestock diseases site provides information on diseases of current concern include Bovine Spongiform Encephalopathy (Mad Cow disease), Foot and Mouth, and Johne's diseases. The site also provides information and links on Anthrax and West Nile Virus.

**Illinois Interactive Agronomy Handbook (IAH)** is available at <http://www.ag.uiuc.edu/iah/>. *IAH* builds on the popular printed version of the *Illinois Agronomy Handbook*. Electronic versions of chapters in the *Illinois Agronomy Handbook* are available at the site and include chapters on climatology, corn production, soybean production, small grains production, cover crop production, alternative crop production, hay & pasture, seed, water quality, soil fertility, nutrient management, tillage systems, water management, weed control management, insect management, disease management, nematodes, and nutrient management.

In addition, there are innumerable on-line tools available on *IAH*. These tools allow a user to tailor recommendations to their own individual settings. Two examples of the tools include *Soil Plan* and *Nutrient Management* worksheets. *Soil Plan* allows entry of soil test data across multiple years. These data; along with soil type, location, and anticipated yield data; are used in developing fertilizer recommendations. This tool allows farmers and consultants to tailor fertilizer recommendations based on soil type, nutrient test levels, location, previous crops, and previous fertilizer recommendations. In so doing, commercial fertilizer is used

more efficiently resulting in reductions in one of the largest direct costs of commercial crop production.

The *Nutrient Management Worksheet* allows farmers and consultants to efficiently plan livestock manure applications to farmland. A database of nutrients contained in livestock manures is consulted when developing livestock manure application recommendations. When fully functional, this worksheet will allow any Illinois farmer to create nutrient management plans that satisfy new Federal requirements. Following the worksheet's recommendations will result in more efficient manure applications, thereby lowering fertilizer costs and reducing the chances of nutrient runoff.

**Integrated Pest Management (IPM) On-line** available at <http://www.ipm.uiuc.edu/>. *IPM On-line* contains information on pest management for Illinois users. Information is available on field crops, fruits, vegetables, landscape and turf, greenhouse, home and gardens, and livestock. Within each of these areas, fact sheets are available on insects, diseases, and weeds which can be quite detailed. The insects in the corn area, for example, includes fact sheets on armyworm, billbug, black cutworm, corn blotch leaf miner, corn earworm, corn flea beetle, corn leaf aphid, corn rootworm, European corn borer, grasshoppers, picnic beetles, sap beetles, stem borer, two spotted spider mite, wireworms, and western corn rootworm.

The site also includes decision aids that help an individual user make decisions for their own situations. For example, *IPM On-line* project has European corn borer calculators. These calculators estimate likely damage from first-generation corn borers and compares damage estimates to costs of treatment.

The site also has served as a means to provide up-to-date information on pests of current concern. In 2002, for example, *IPM On-line* contained a soybean aphid watch. Aphids pose an economic hazard to Illinois farmers and have been entering Illinois and surrounding states. Aphid watch information allows farmers and consultants to track known aphid location by Illinois counties, thereby identifying the most threatened areas

A list of tools available on IPM On-line is

- Interactive Western Corn Rootworm Scouting Report Form: ([http://www.ipm.uiuc.edu/fieldcrops/insects/western\\_corn\\_rootworm/scouting.html](http://www.ipm.uiuc.edu/fieldcrops/insects/western_corn_rootworm/scouting.html)). This form enables corn growers and agri-business personnel to help us build a database to improve decision making.
- European corn borer, 1943–2002, database on Farm.edu: <http://web2.its.uiuc.edu/website/farmedu/>. This database will be updated annually and will be used by growers to make decisions about managing European corn borers with transgenic Bt corn.
- The Hines Report: [http://www.ipm.uiuc.edu/pubs/hines\\_report/index.html](http://www.ipm.uiuc.edu/pubs/hines_report/index.html). This weekly report throughout the growing season provides insect trap-capture information from four locations in southern Illinois. Information about the following insects are included in the report: armyworm, corn earworm, European corn borer, fall armyworm, Japanese beetle, and southwestern corn borer.

- Soybean Aphid Suction Trap Network:  
[http://www.ipm.uiuc.edu/fieldcrops/insects/soybean\\_aphids/suction\\_trap\\_network/](http://www.ipm.uiuc.edu/fieldcrops/insects/soybean_aphids/suction_trap_network/). This network provides weekly information about the captures of winged soybean aphids at nine locations in Illinois.
- Soybean Aphid Watch:  
<http://www.pmcenters.org/Northcentral/Saphid/Aphidindex.htm>. This mapping system, based upon interactive reporting, reveals the annual distribution of the soybean aphid in North America.
- Illinois Insect Monitoring Network:  
<http://www.ipm.uiuc.edu/fieldcrops/imm/index.html>. This network enables individuals to submit trap-capture data for black cutworm, corn earworm, and European corn borer. Other insects will be added. Results are presented in state maps and county reports.
- *Illinois Agricultural Pest Management Handbook*, current year, available in both print and electronic format (CD [see following] and on the Web at <http://www.ipm.uiuc.edu/pubs/iapmh/index.html>).
- A CD entitled *Illini Crop Pro: A Professional's Guide to Crop Production and Protection* was created and provided to everyone who attended the 2002 and 2003 Illinois Crop Protection Technology Conference. The contents of the CDs were: the current year's *Illinois Agricultural Pest Management Handbook*, *Illinois Agronomy Handbook*, and the current year's *Proceedings of the Illinois Crop Protection Technology Conference*, as well as some IPM video clips.
- Streaming video clips: <http://www.ipm.uiuc.edu/ipm/videos/index.html>.
  - A Day in the Life of Field Entomologists
  - Western Corn Rootworm Damage Ratings
  - Wireworm Bait Stations
  - Japanese Beetles
  - Scouting for Western Corn Rootworms
  - Nitrogen Leakage and the Hypoxia Zone
  - Soybean Aphids Found in Midwest
- Calculators for European Corn Borer, first and second generations:  
<http://www.ipm.uiuc.edu/decision/index.html>.
- Variant Western Corn Rootworm On-Farm Survey:  
<http://www.ipm.uiuc.edu/wcrsurvey/index.html>. This section of the IPM Web site reports the results from annual on-farm surveys to determine the distribution of the variant western corn rootworm. The results are county- and site-specific.
- *The Bulletin*, currently the *Pest Management & Crop Development Bulletin* at <http://www.ag.uiuc.edu/cespubs/pest/>. This weekly newsletter is being redesigned to improve navigability, searchability, and archiving. The project will be completed before the 2004 growing season.
- Insect development calculator (currently under development). This section of the IPM Web site will allow people to select the insect of interest and weather station in the Illinois Climate Network (Illinois State Water Survey) to calculate the current heat-unit accumulations.

*Farmdoc* is available at [www.farmdoc.uiuc.edu](http://www.farmdoc.uiuc.edu). *Farmdoc*'s goal is to develop innovative and comprehensive programs to improve decision-making under risk through research and education. The *farmdoc* project provides seamless and integrated expertise in farm management, agricultural marketing, agricultural finance, commodity policy, and agricultural law to decision-makers in agriculture. This integration is most visibly reflected in the *farmdoc* website, a core element of the project. The website is organized around the general topics of management, marketing, finance, policy, law and taxation, as well as around specific issues such as crop insurance and the performance of market advisory services.

*Farmdoc* has developed a series of publications and factsheets. These publication series provide information about various topics. Publications include Illinois and Purdue Weekly Outlook Newsletter (issued weekly), Illinois and Purdue Grain Price Outlook Newsletter (issued 8 times per year), Illinois and Purdue Livestock Price Outlook Newsletter (issued 6 times per year), Illinois Farm Economics: Facts and Opinions (issued bi-weekly), Agricultural Law and Taxation Briefs, AgMAS Research Reports, 19 reports issued, and Illinois Rural Policy Digest, issued quarterly, Fall 2002 to the present.

The following tools were developed and included in *farmdoc*:

a. *FAST Spreadsheet Tools*

*Financial Analysis:*

Appraisal of Current Financial Position, December 1999

Simple Balance Sheet, December 1999

Ratio Analysis, July 2003

Cash Flow Planning, July 2003

Cash to Accrual Income Approximation, February 2001

Estimation of Deferred Taxes, February 2001

Net Worth Allocation, February 2001

*Investment Analysis:*

Capital Budgeting, October 2000

Grain Bin Analysis, October 2000

Land Purchase Analysis, November 2002

Lease vs. Purchase, November 2002

Machinery Financing, November 2001

MACRS Calculator, July 2003

Time Value Tools, February 2003

*Loan Analysis:*

Loan Amortization, July 2003

Loan Comparison, January 2002

Revolving Loan Calculator, January 2002

*Farm Management:*

Breakeven Analysis, June 2001

Crop Budgeting Tool, February 2003  
Crop Insurance Calculator, July 1999  
Crop Insurance Historical Evaluator, June 2003  
Crop Storage Analysis, January 2002  
Enterprise Allocation and Analysis, January 2002  
Farmland Lease Analysis, June 2001  
Farm Rent Evaluator, July 2003  
Machinery Economics, July 2003  
Grain Inventory Management, August 2002  
Farm Database Tools  
Illinois Crop Yield Database, July 2003  
Illinois Farmland Sales Database, June 2001

*b. Other Spreadsheet Tools*

Illinois Farm Bill Decision Tool, August 2002  
Starlink Settlement Corn Loss Tool, June 2003

*c. Online Tools*

*Marketing and Outlook:*

Agricultural Supply and Demand Database, August 2001  
Counter Cyclical Payment Tool, March 2003  
Illinois Average Price Received Database, March 2003  
Illinois Regional Cash Price Database, May 2001  
Illinois Regional Basis Decision Tool, May 2001

*Management:*

Historic Crop Costs from Illinois FBFM Database, February 2003  
Illinois Crop Budgets, February 2003  
Illinois Crop Budgets Tool, February 2003  
Field Operations Calculation Tool, May 2003  
Illinois Combine Cost Calculation Tool, May 2003  
Tractor Cost Calculation Tool, May 2003  
Illinois Historic Crop Yields, September 2003

*Crop Insurance:*

2003 iFARM Crop Insurance Premium Calculator: North Central Region, January 2003  
2003 iFARM Crop Insurance Evaluator: Illinois, February 2003  
2003iFARM Crop Insurance Evaluator: Indiana, February 2003  
2003iFARM Crop Insurance Evaluator: Iowa, February 2003  
2002 iFARM Crop Insurance Evaluator: Illinois, March 2002  
2002 iFARM Crop Insurance Premium Calculator: North Central Region, February 2002  
Crop Insurance Premium Calculator for 2001 Illinois Crops, March 2001

### **Information Technology Based Tools:**

**Enhanced Farm Research Analyst (EFRA)** is available at <http://www.farmresearch.com/efra/>. *EFRA* is an extension to ArcView that aids researchers, consultants, and farmers in developing on-farm research by designing research plots and performing statistics on geo-referenced data. This tool aids in conducting research that will tailor recommendations for very specific situations. For example, use of this tool could allow for the development of fertilizer recommendations pinpointed to soil types and locations within fields.

**Online Evaluation Workbook** is available at: <http://www.communitydevelopment.uiuc.edu/evalbook/>. The workbook provides a step-by-step evaluation guide to help individuals design an evaluation strategy for economic development projects. The online version provides an interactive forum for conducting a project evaluation. The online version will be completed by December 2003. The online evaluation tool builds on the other tools available in the CFAR sponsored Community Development Toolbox. In addition to strategic planning, needs assessment and benchmarking the evaluation tool works with the others to build a comprehensive economic development strategy.

**On-Machinery Information Manager** project has developed a prototype of an Agricultural Infotronics System for remote monitoring. This prototype was developed for a Case MX-240 tractor with an attached cultivator. Based on results from this research, it was concluded that the AIS technology has the potential to increase the effectiveness of precision agricultural operations.

**Prostar:** *Prostar* a Web-enabled agribusiness simulation of a retail fertilizer and chemical dealership. This simulator was designed to be used in college classes, in university outreach and in agribusiness training environments to improve the learning, comprehension and retention of knowledge relevant in making better business management decisions.

**Resource Management Mapping Service (RMMS)** is available at <http://space1.itcs.uiuc.edu/website/rmms/>. *RMMS* is designed specifically to aid watershed management groups in planning projects by providing geographically information about their watershed. *RMMS* also contains information of interest to other users across Illinois. *RMMS* is a geographical information system that currently has over 50 layers of information Illinois. Layers include soil type information (where electronically available), watershed boundaries, streams, wetland boundaries, congressional districts, counties, Illinois Department of Natural Resource boundaries, towns, townships, highways, land fills, and roads.

Besides geographical information, *RMMS* has many tools that can aid decision-makers. One of the tools allows an individual to outline a farm boundary and then provides an assessment

of whether that farm is eligible for the Conservation Reserve Enhancement Program (CREP). Other tools include area calculation tools and map email utilities.

*RMMS* also serves as the primary base of tools developed for other uses. For example, data with *RMMS* has been used to develop a tool to aid the Corp of Engineers in their permitting process. The Illinois Department of Natural Resources uses *RMMS* to aid in developing watershed planning.

### **Journal Articles:**

Onstad, D. W., C. A. Guse, J. L. Spencer, E. Levine, and M. Gray. 2001. Modeling the adaptation to transgenic corn by western corn rootworm (Coleoptera: Chrysomelidae). *J. Econ. Entomol.* 94:529-540.

Onstad, D. W., J. L. Spencer, C. A. Guse, S. A. Isard, and E. Levine. 2001. Modeling evolution of behavioral resistance by an insect to crop rotation. *Ent. Expt. Appl.* 100:195-201.

Guse, C. A., D. W. Onstad, L. L. Buschman, P. Porter, R. A. Higgins, P. E. Sloderbeck, G. B. Cronholm, and F. B. Peairs. 2002. Modeling the development of resistance by stalk-boring Lepidoptera (Crambidae) in areas with irrigated, transgenic corn. *Environ. Entomol.* 31:676-685

Onstad, D. W., C. A. Guse, P. Porter, L. L. Buschman, R. A. Higgins, P. E. Sloderbeck, F. B. Peairs, and G. B. Cronholm. 2002. Modeling the development of resistance by stalk-boring Lepidoptera (Crambidae) in areas with transgenic corn and frequent insecticide use. *J. Econ. Entomol.* 95:1033-1043.

Braxton, S. M., D. W. Onstad, D. E. Dockter, R. Giordano, R. Larsson, and R. A. Humber. 2003. Description and analysis of two Internet based pathogen databases: EDWIP and VIDIL. *J. Invert. Pathology* 83:185-195.

### **INITIAL OBJECTIVES THAT WERE NOT ACCOMPLISHED**

As state in the primary objectives section, the Information Technologies – Strategic Research Initiative (IT-SRI) were in three areas: (1) decision and analysis support systems, (2) activity, output, and outcome reporting systems, and (3) outreach information systems. The IT-SRI accomplished objectives within the decision and analysis support systems and outreach information systems area.

Some of the objectives within the “activities, output and outcome reporting systems” area were not accomplished. One of the objectives in this area was to develop a comprehensive tracking and reporting system for funded C-FAR research. A comprehensive tracking system was not

developed for all of C-FAR research. However, much of the C-FAR research covered by the topical areas of the four full subject matter websites are reported in on those websites.

One project that was planned for funding in FY2002 and FY2003 by the IT-SRI was FARM.EDU. FARM.EDU was designed to provide one portal for all IT-SRI projects. FARM.EDU also would have provided the comprehensive tracking system for IT-SRI research. Due to budget shortfalls, this project was not funded. It was decided to fund the individual projects within the project. Many of the individual projects within the IT-SRI will continue to grow after the end of the IT-SRI. FARM.EDU would have required continued C-FAR funding to continue. Since funding was not scheduled to continue, FARM.EDU was not funded

## **OUTREACH ACTIVITIES**

Most of the Information Technology – Strategic Research Initiative (IT-SRI) projects had outreach components. By there very nature, the full service subject matter web sites had important outreach components. Some of the IT-SRI also conducted meetings that publicized material on the websites. The *farmdoc* project, for example, conducted “Farm Income” meetings in December in 2000, 2001, and 2002. Over 900 individuals attended these sections.

The IT-SRI also conducted training sessions for personnel within the University of Illinois – Extension in 2001. These training sessions showed Extension personnel the how to use material produced by the IT-SRI. As a result of these sessions, and continuing follow-up after the sessions, Extension personnel rely heavily on IT-SRI developed websites for information.

IT-SRI projects caused a fundamental shift in the way outreach is conducted in some subject matter areas. Websites now contain most of the information and decision tools that are made available to the public. Individuals can access this information any time often at no out-of-pocket costs. This greatly enhances the access to information and decision aids. This shift also enhances the abilities to conduct face-to-face meetings. More material can be made available as reference material that individuals can access after the meetings.

## **SRI COMPONENTS PLANNED FOR CONTINUATION**

Most of the products have received funding from some source after the end of the IT-SRI. Sources of this funding are reported in the “Leverage Funds” section that follows this section.

The four full service subject matter sites will continue to exist and expand after the end of the Information Technologies – Strategic Research Initiative (IT-SRI). Farmdoc and IPM Online have secured adequate funding to continue efforts from other sources over the next several years. The Illinois Interactive Agronomy Handbook also has obtained funding.

The Resource Management Mapping Service (RMMS) also has received funding from several sources to continue development after the end of the IT-SRI. Development with continue on the Enhanced Farm Research Analysis and Online Evaluation Workbook projects.

## LEVERAGED FUNDS

Leveraged funds from the Information Technologies – Strategic Research Initiatives are reported by project in the following subsections. Only funds reported by PIs are included in this section. Funds totaled over \$2 million.

### Community Development Toolbox Projects

Evaluation of Community Technology Centers Fund Project, Illinois Commerce Commission, \$1,250,000 (University of Illinois \$85,000). 2002-2005, Principal Evaluator.

Youth-at-Risk Community Assessment Program Development, University of Illinois Extension, \$5,000, 2001-2002, Principal Investigator.

### *farmdoc*

*Development and Integration of a Suite of Computerized Decision Tools for Farm Financial Decision Making.* Crop Insurance Research Program, US Department of Agriculture, \$371,000, October 2003-September 2006.

*Controlling Risks on Illinois Farms.* Commodity Partnership Programs for Risk Management Education, Risk Management Agency, US Department of Agriculture, \$74,200, October 2003-September 2004.

*For Farmland Owners.* Gift from Moore-Warner Farm Management, \$75,000, September 2002-August 2006.

*Making Sound Crop Insurance Decisions: A Risk Management Education Program Based on the Payout Estimator.* Targeted Commodity Partnerships for Risk Management Education, Risk Management Agency, US Department of Agriculture, \$92,980, August 2002- August 2003.

*Satellite Center for the Development of a Risk Management Internet Portal.* Agricultural Risk Management Education Competitive Grants Program, Cooperative State Research, Education, and Extension Service, US Department of Agriculture, \$180,000, August 2001- August 2004.

*Educational Tools to Evaluate Innovations in Marketing and Crop Insurance.* Agricultural Risk Management Education Competitive Grants Program, Cooperative State Research, Education, and Extension Service, US Department of Agriculture, \$75,000, August 2001-August 2004.

*Farm Income Seminars.* University of Illinois Extension, \$15,000, 2000-2002.

*A Comprehensive Risk Management Education Program for Corn Belt Agriculture.*  
Cooperative State Research, Education, and Extension Service, US Department of  
Agriculture, \$300,000, March 1998-September 2000.

### **Illinois IPM Online project**

*Predicting western corn rootworm injury in rotated cornfields: An integrated pest  
management approach.* Illinois Department of Agriculture, Sustainable Agriculture Grant  
Program, 1999, \$42,130.

*Interactive IPM on the Internet.* North Central Region IPM Competitive Grants Program,  
2000, \$41,206.

*North Central IPM Center.* USDA-IPM Program. \$155,494 in 2003, \$161,417 for 2004,  
\$167,638 for 2005, \$174,170 for 2006.

### **Illinois Watershed Clearinghouse Projects**

*Development of WIRT.* U.S. Corp of Engineers, 2000-2003, \$150,000.

*Conservation Mapping Tracking Program.* U.S. Department of Agriculture, 2003-2004,  
\$82,000.

*Development of Comprehensive Tracking System.* Illinois Environmental Protection Agency,  
2003-2004, \$102,000.

### **Sustainable Agriculture projects**

*Corn Rootworm Modeling for Areawide Management,* \$34,000 from USDA-ARS  
cooperative agreement for project, \$34,000, 2000-2002

*Assessing the Risk of Resistance to Bt corn by Rotation-Resistant Rootworms,* USDA  
Biotechnology Risk Assessment Research Grants Program for project, \$180,000 (with  
Mitchell, Spencer and Gray) 2003-2005

*Modeling Western Corn Rootworm and Transgenic Corn,* Monsanto Corporation, \$40,000,  
2000-2001

### **Prostar Projects**

*Illinois Centaur Network Grant,* Illinois Board of Higher Education, \$40,000

*Higher Education Challenge Grant,* United States Department of Agriculture, \$88,000

Growmark in-kind professional time, \$15,000.