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University of Illinois Extension
-and-
Illinois Agricultural Experiment Station
-to-
Cooperative State Research, Education and Extension Service CSREES-USDA

University of Illinois Extension - Office of Extension and Outreach
-and-
Illinois Agricultural Experiment Station - Office of Research

College of Agricultural, Consumer and Environmental Sciences
University of Illinois at Urbana-Champaign

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Acknowledgments and Preface

This report has been developed to fulfill the requirements of the Agricultural Research, Extension and Education Reform Act of 1998 (AREERA) which amended the Smith-Lever Act, the Hatch Act and the National Agricultural Research, Extension and Teaching Act of 1997, and animal health and disease funds. AREERA focuses on funding through Smith-Lever 3(b) & 3(c), Hatch, McIntire-Stennis, and Evans-Allen. This report is the fifth annual report under Illinois current plan of work with CSREES-USDA. This plan of work was amended in 2004 at CSREES' request to extend it through 2005 and 2006.

Consistent with the CSREES Annual Report Guidelines this annual report addresses some but not necessarily all of the issues in the plan of work.

Interpretations of AREERA have strictly limited those activities which can be claimed as jointly-funded Extension and Research activities as well as what can be claimed as multi-state Extension activities. As a result of these interpretations, this report fails to disclose the extent to which integrated and multi-state activities now represent the way the College does business. The College has decades-old ties with sister institutions and personnel based in other states. Over the past decade, which has witnessed a reorganization of the College and U of I Extension, a guiding principle has been to integrate Research and Extension so that the citizens of Illinois can be better served.

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A. Programs

Overview

The mission of the college of Agricultural, Consumer and Environmental Sciences (ACES) is discovering, advancing and integrating new knowledge to ensure nutritious and safe food, sustainable and innovative agriculture, strong families and communities, and environmentally sound natural resource management to benefit the people of Illinois and the world. To fulfill the University's land-grant mission, the college of ACES is responsible for the Illinois Agricultural Experiment Station and University of Illinois Extension, subsidiary units authorized by federal and state statutes that complement the academic departments in the college.

Academic Departments and Quality: The College of ACES has seven academic departments: Agricultural and Biological Engineering, Agriculture and Consumer Economics, Animal Sciences, Crop Sciences, Food Science and Human Nutrition, Human and Community Development, and Natural Resources and Environmental Sciences. The College of ACES also provides intellectual and administrative leadership to the Division of Nutritional Sciences, an acclaimed interdisciplinary graduate program. In addition the College of ACES maintains strong links with the College of Veterinary Medicine. The University of Illinois is among the elite group of institutions noted for the impact of research in food and agricultural sciences.

University of Illinois Extension reaches more than 2.8 million people face-to-face in Illinois with educational outreach programs in agriculture and natural resources; nutrition, family, and consumer sciences; 4-H youth development; and community and economic development. The statewide Extension system employs approximately 390 professional field staff, assisted by over 30,000 volunteers in all 102 counties in the state. Extension web sites receive well in excess of five million page views each month, accessed by users from nearly every country in the world.

Faculty Profile: ACES has 222 FTE of tenure system faculty, with appointments divided among teaching (34%), research (52%) and Extension (14%). State budget reductions and reallocations in the past five years were partially met through attrition and vacant faculty lines (55.74 FTE). These losses in state base-funded positions were partly offset by aggressive use of various new faculty programs. Illinois has fewer Extension faculty, less than 31 FTE, than any other land-grant university. In 2006, eleven new faculty members joined the College. Four professors were awarded tenure and five were promoted to associate or full professors.

Financial Management: Despite successive base budget reductions, ACES has been consistently solvent through application of conservative management principles. Reductions and reallocations were met with personnel lines and other expense categories on campus and in Extension centers. ACES implemented a FY 2007 budget reduction of approximately 2.7% to cover the state budget reduction and reallocation, fund the salary program for continuing faculty and staff, and contribute to university and campus unavoidable costs. Reductions were allocated proportionally across units. In addition, a 0.3% campus tax was levied against all units, including Extension, to support the spousal hiring programs and Targets of Opportunity Program (TOP). TOP is designed to support the special recruitment of outstanding faculty members among groups that are underrepresented in specific units on campus. An important goal is to utilize these programs for Extension professionals, and the first TOP hire was made for an Extension professional this year.

University of Illinois Extension was affected in several areas of the FY 2007 state appropriations process. From the University's base budget reduction, Extension lost $287,324. Contained in the Illinois Department of Agriculture budget, the general support line for Extension youth educators was maintained at $1.693 million, while the county board match was increased to $12.8 million. County board match is the state's obligation to match locally committed funds to Extension. The line item for Cook County Extension, first obligated in FY 2006, increased 1.1% from $5 million to $5.055 million in FY 2007. The state appropriated $200,000 for the first time to the AgrAbility (farm safety) program. The state also made a new commitment of $300,000 in recurring funds to the University designated to recover partial loss of Extension specialist capacity.

The research component of the College of ACES comprised $59.3 million of the total ACES expenditures ($158.1 million) in FY 2006. Sources for Illinois Agricultural Experiment Station research expenditures were distributed as: 27.3% state appropriations, 5.7% state grants and contracts, 29.7% federal grants and contracts, 18.2% private gifts and contracts, 8.9% federal appropriations (Hatch Act), 7.9% revolving funds, and 2.3% institutional funds. The Illinois Agricultural Experiment Station's overall portfolio declined by 1% in FY 2006. The appropriation for the Illinois Council on Food and Agricultural Research (C-FAR), funded through the Illinois Department of Agriculture, increased from $3.5 million to $4.5 million in FY 2007, after having dropped from a high point of $15 million in FY 2002. The increase will allow additional flexibility to the four participating universities in Illinois to fund a more robust managed research portfolio of specific interest to Illinois' stakeholders. The state also earmarked $350,000 in the FY 2007 budget to support the Dixon Springs Agricultural Research Center.

Vision and Direction: Throughout the past year, the College of ACES engaged in a process to develop a statement of strategic intent. This process built upon planning processes in previous years that examined the College's identity, culture, mission, and vision. Critical strategic goals for the College of ACES include:

- Developing a sound program base for preeminence in a global context
- Educating and preparing students and stakeholders to be leaders, innovators, and entrepreneurs
- Aligning incentives and building capacity to undertake larger, more innovative collaborative initiatives both internally and externally
- Raising Illinois' position in competitive first-class science that creates knowledge, informs sound decisions, and transforms people and society
- Making Illinois the leader in interdisciplinary initiatives with emphasis on building strength in
  -Bioscience innovation, bioenergy and bioprocessing
  -Healthy and nutritious food systems
  -Sustainable rural and urban landscapes
  -Resilient families and communities

The College has made notable progress toward those goals. To attain preeminence in a global context, the College's main coordinating unit was assigned to the Dean's office, a budget for operations was established, and staff personnel were reassigned to the unit. The College successfully launched the first class for the *Academy for Global Engagement* introducing seven faculty members to a variety of opportunities to enhance the global aspects of their scholarship. Academy members successfully formed partnerships in the College, across campus, and at the international level. The College also solidified a number of institutional relationships, notably including progress with National Taiwan University, Kon Kuk University in Korea, several institutions in China, Wageningen in the Netherlands, Zamorano in Honduras, and others for innovative student programs. In addition, the College continued to encourage many formal and informal collaborative relationships with researchers and institutions around the world. For example, the agreements with CONACYT in Mexico and INRA in France have yielded benefits in terms of excellent graduate students and strong collaborative research projects. Among the international projects managed in ACES, significant projects in Egypt and Afghanistan continued and programs managed by the National Soybean Research Laboratory have flourished in several target countries.

The College of ACES has experienced significant development of several domestic collaborative and interdisciplinary initiatives. ACES partnered with the Illinois Natural History Survey and Lewis and Clark Community College in attracting a $6 million capitol development grant from the state to establish the National Great Rivers Research and Education Center. The College is the main home of the Family Resilience Program which now has the finest family studies facilities in the nation with the opening of Doris Kelley Christopher Hall. College faculty members are also involved in the following University of Illinois cross-campus initiatives:

- *Illinois Informatics Initiative:* The I^3 Initiative currently includes faculty from the College whose expertise is in bioinformatics and automation of machine systems and bioprocesses.

- *Integrated Sciences for Health Initiative:* The College has faculty participation in two campus committees that are related to the initiative, one focused on translational research in the biomedical field and the other focused on health and wellness more broadly. Potential College contributions are most obvious relative to genomic biology, use of animal models, nutrition, bioactivity of food components, and delivery of nutrition and health knowledge and information to local and international communities.

- *Illinois Sustainable Energy and the Environment Initiative:* In the past year, ACES made substantial commitments related to this initiative, and ACES faculty members are deeply engaged on multiple fronts. The Renewable Energy Initiative includes faculty from crop sciences and agricultural and consumer economics in its leadership group. Leadership for the push in bioenergy and bioprocessing has arisen largely in ACES, including establishment of the Center for Advanced Bioenergy Research (CABER) and the recently formed Energy Biosciences Institute with UC Berkeley. A major requirement of the Energy Biosciences Institute is dedicated use of land on the South Farms, lending additional support to the College's objectives for integrated landscapes research and education on the South Farms. Related initiatives include the Integrated Bioprocessing Research Laboratory, in the planning stage, and the wind energy project, initiated by the Students for Environmental Concerns, for constructing three energy-generating wind turbines on the South Farms.

Key strategic priorities for Extension include: entrepreneurship—within Extension and among clientele; community and economic development—emphasizing community leadership; and urban Extension—reaching audiences in metropolitan communities and among changing populations. During the past year, Extension significantly ramped up programs and

staffing in Cook County as a result of new state funding, first earmarked for Cook County Extension programs in FY 2006. Extension also acquired management responsibility for several new programs in the past year. Governed by an external board of electric cooperatives and utilities, the Illinois Electric Council was administratively moved to Extension. Water quality programs totaling over $1.4 million were transferred to Extension from the Vice Chancellor for Research, including the Illinois-Indiana Sea Grant program and USEPA and USGS programs. Business and Industry Services (BIS) was acquired from Northern Illinois University, complementing Extension's community and economic development programs. With 23 professional staff and about 35 contractors, BIS offers educational programs to firms in the range of $100-200 million of gross sales. BIS is expected to generate in excess of $5 million in grant and fee revenue.

Extension strategic priorities also focused on creating expectations and aligning management practices to encourage significantly more grant activity internally. Fourteen professional positions have been reoriented to grant and contract funding. Ten off-campus specialists now have ten-month appointments, paid over twelve months. Extension grant funding continues to grow steadily. Since 2003, Extension grants have increased by 45% to more than $7.3 million, and ICR has increased 63% to more than $674,000.

Extension has recently completed a process for identifying three new program initiatives that will elevate the impact and visibility of University of Illinois Extension both on campus and in communities in an innovative way. Through innovative and entrepreneurial approaches these programs will feature inclusiveness of different disciplines and cross-campus engagement that focus on health and well-being and sustainability of the environment and communities. A description of these programs and their impact will be included in future annual reports of the University of Illinois College of Agricultural, Consumer, and Environmental Sciences. Descriptions of current research and Extension program impacts related to specific CSREES goals and key themes are included in the following sections of the Illinois's annual report.*

***Note on Key Themes Reported by Goal: Illinois has chosen to report on some key themes that were not specifically named in the state's original Plan of Work. Inclusion of additional key themes was precipitated from the federal partner's list of themes in the plans of other states and territories.**

CSREES GOAL I – An Agricultural System that is Highly Competitive in the Global Economy

Indications of the Scope of Research and Extension Programs under Goal I –See Appendix A.

Nearly three-fifths of the University of Illinois College of ACES research portfolio is invested in Goal I—To Advance Knowledge of an Agricultural System That is Highly Competitive in a Global Market. Areas of study at the Illinois Agricultural Experiment Station under Goal I include the planning and operation of agricultural facilities, the breeding of animals for the production of pork with higher consumer acceptance, the development of methods to improve the rate and efficiency of muscle growth in livestock species, improvements to increase ethanol production, using biotechnology to improve the nutritional value of soybeans, and targeting specific control measures to limit the spread of West Nile Virus.

In order to extend knowledge under Goal I, campus faculty and University of Illinois Extension staff offered educational programs that involved 330,967 direct face-to-face teaching contacts. Outreach efforts included expansion of a searchable data base to link value-added food marketing ventures with the food industry and programs on equine reproduction, companion animal care, monitoring livestock movement, organic crop production, and crop production management.

Key Theme – Agricultural Competitiveness

Target-Site Mutations Conferring Resistance to ALS-Inhibiting Herbicides

a. Progress – Herbicides continue to be the primary means of managing weeds in the United States. Among the most widely used herbicides are those that target acetolactate synthase (ALS). Due to their very low use rates and low mammalian toxicities, these herbicides also are among our most environmentally benign. Unfortunately, numerous weed populations have evolved resistance to these herbicides. Although resistance usually is a result of a point mutation in the ALS gene, the exact mutation has been identified for relatively few resistant biotypes. The goal of this project is to add to our catalog of ALS mutations in weed biotypes. During the past year, we have characterized a mutation in the ALS gene from smooth pigweed (Amaranthus hybridus). The same mutation was previously identified in other weed species, but not previously identified in smooth pigweed. As reported for other weed species, the particular mutation conferred resistance to one of the major classes of ALS-inhibiting herbicides, the imidazolinones,

but not to another major class, the sulfonylureas. We also have continued to characterize ALS genes in weedy foxtail (Setaria) species. We determined that weedy foxtail species differ in their numbers of copies of the ALS gene (e.g., giant foxtail [S. faberi] has two copies whereas green foxtail [S. viridis] has only one). The number of copies of ALS for a weed species will influence both the likelihood that resistance to ALS-inhibiting herbicides will evolve and, if it does evolve, the magnitude of the resistance level. There currently is limited information on mutations conferring resistance to ALS-inhibiting herbicides in grass species such as foxtails. However, our results to date indicate that the same ALS mutations previously identified in broadleaf weed species are also present in foxtail species.

b. Impact – The development of herbicide resistance in weed populations threatens the continued effectiveness of herbicides, and thus threatens the ability of U.S. crop producers to remain competitive in the global market. Cataloging of resistance-conferring mutations in the ALS gene aids crop production professionals in rapid confirmation of new resistant populations. In turn, this enables farmers to make informed decisions on the most appropriate herbicides to manage their weed populations.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Optimization of Production for Entrepreneurial Agricultural Businesses

a. Progress – The proposed project is extending the use of simple optimization methods by utilizing existing software packages to seek optimum levels of productivity and to effectively cope with the scheduling and safety concerns that accompany transient phenomena in production systems. Economic growth in the small- to mid-range production of agriculturally-based goods and services such as food and food ingredients, naturally derived chemicals, production machinery and farming production processes themselves are an important part of the overall agricultural economy. Most production facilities for these goods are designed in one of two ways: The first is a facility that has either grown from a much smaller operation, expanding the operation by adding equipment and capability, and perhaps expanding space by expanding an existing structure. The other is an operation that is planned 'from the ground up' and that has its operation designed with a particular set of process parameters in mind. In both cases,

increased demands for production, and increased demand for flexibility of production can cause problems with the utilization of existing equipment and the allocation of resources and space within an established production facility. The limiting factor is often not the apparent lack of equipment or facilities, but a poor understanding of the best uses of existing resources, and a lack of planning tools for their use. In all of these cases, the production facility will often be operating with a lack of experienced engineering staff that are trained in methods of production optimization. This can be an important consideration. The research group is seeking additional funding to develop web-distributed applications packages and tutorials for use by industry so that facility modifications may be modeled and analyzed before significant production-loss costs are accrued by stopping production in 'trial and error' problem-solving attempts.

b. Impact – We are currently in the process of developing several distributable modules for use with planning and operation of agricultural facilities as well as studies on the use and utility of these types of tools. In one of our initial studies, a simple optimization of a cereal bar packaging line yielded a 6% increase in productivity, worth $1,600,000 per year, with no capital expenditure. The stakeholders, small and medium scale agricultural and food producers and processors of the state of Illinois will receive tools and techniques that will allow them to make the best use of limited capitalization and technical infrastructure to build and operate their facilities. Small agricultural processing operations, both on-farm and at the community level, will be able to operate at their optimal level of productivity, increasing profitability and yielding the best value to both the users of the process and the consumers of the final products.

c. Source of Funding – Hatch, State

d. Scope of Impact – State

The Effects and Causes of Agricultural Policy in its Domestic and International Contexts

a. Progress – Agricultural policy encompasses many issues. Among the issues examined are the essentials for the 2007 U.S. farm bill and the World Trade Organization trade negotiations. The drivers of ecosystem change were analyzed. This research represents the first global effort to assess the status of the world's ecosystems. Policies related to reducing the incidence of foot and mouth

disease abroad were assessed. While elimination of foot and mouth disease in other regions would provide the United States the benefit of reduced risk of an outbreak, it would also imply great competition in the global meat market from countries that become free from the virus. A model of foot and mouth disease control was developed that is spatial and dynamic and captures both economic and epidemiological factors for national or regional analysis. This multi-market model measures the direct impacts of an animal disease, the indirect impacts on related sectors of the economy, and the spread of these impacts over time and space and under different disease control scenarios. The research has extended the literature on spatial coordination by recognizing the importance of heterogeneous incentives, differential sensitivities to neighbors, and hard boundaries on interactions. It highlights specific factors that work against international cooperation to address foot and mouth disease control in Latin America. It suggests issues that could be addressed to improve the probability of successful interventions to control the disease. Procedures available to measure the producer welfare effects of changes in an output price distribution under uncertainty were reviewed. Economic theory and numerical integration methods were combined to show how for any form of Marshallian risk-responsive supply, compensating variation of a change in higher moments of an output price distribution can be numerically derived. This numerical procedure better enables measurement of producer welfare effects in the many real-world circumstances in which risk and uncertainty are important elements. The welfare effects of the Common Agricultural Policy corn, cotton, and sugar beet regime practiced in Greece after its 1981 entry into the European Union were examined. The analysis indicates that the income transfers to Greek farmers rose between 1981 and 1992. The 1992 Common Agricultural Policy reform led to stabilization of income transfers to crop farmers and lessened the negative impact to livestock producers.

b. Impact – The research yields valuable information that will aid policy makers in reaching decisions and aids economists in refining economic models. It is expected to result in improved management of animal disease control efforts in the United States and globally. Research on drivers of ecosystem change is expected to lead to the development of alternative policies to preserve the ecosystem. The findings on the effects of the Common Agricultural Policy are important, especially during the heated debate over the policy that will continue during the Doha Round of the World Trade Organization trade negotiations. The research on combining economic theory with numerical integration methods is

expected to have important impacts on the agricultural economics literature in the longer run. It will aid economists desiring to account for risk and uncertainty when they attempt to measure the welfare consequences of policy changes.

c. Source of Funding – Hatch, State

d. Scope of Impact – Global

Evaluation of Risk Management Alternatives for Illinois Farmers

a. Progress - Successful risk management strategies depend on accurate characterization of the uncertainties being faced. Of primary importance for crop farmers is revenue variability arising from uncertain crop yields and prices. In response to the difficulty in managing this risk, the Federal government has developed numerous crop yield and revenue insurance products, and has provided incentives to purchase crop insurance by subsidizing insurance premiums. However, attempts to better understand participation, loss rating, and improve product design and participation have been hampered by uncertainty about the most appropriate characterization of farm-level yield and revenue distributions. This project seeks to fill that gap by developing a robust means to condition yield and price distributions that can be accurately and readily estimated using NASS and FBFM data, on variables that are readily available to the farmer reflecting their management and cropping practices and structural characteristics. The results can be implemented in a very useable model by both farmers and crop insurance agents to further customize their risk assessments and improve crop insurance decisions. Crop insurance decisions were the major focus of activities for the last year. The highly popular premium calculator that estimates the premiums of crop insurance products for corn, soybeans, wheat and grain sorghum in the North Central Region was revised and made available for 2006 crop insurance decisions. The calculator included premiums for basic, optional and enterprise units. In addition, a decision-tool that computes payoffs and risk statistics for representative farms in each of the counties in Illinois, Indiana and Iowa was updated for 2006 crop insurance decisions. A total of 194,090 page and file requests were made to these tools during 2006, a 35 percent improvement over 2005. Clearly, by any standard, large numbers of producers, educators and agribusinesses found these tools of considerable value. Crop insurance decisions will continue to be the major focus of activities for 2007. First, the premium calculator will be updated for 2007 crop insurance

decisions and revised based on user feedback. Second, the co-operative effort will be continued with extension specialists in Iowa and Indiana to extend the crop insurance evaluation tool to Iowa and Indiana.

b. Impact - This project is substantially improving scientific knowledge about risk modeling and evaluation for crop farms in Illinois and throughout the cornbelt. The incorporation of this information into enhanced models provides farmers with an important tool to use in evaluating specific farm risk management strategies. The demand for this type of tool is well established, and is being met through delivery channels that are well-suited for the proposed research information and tools. In total, this project provides highly valuable information and modeling tools to evaluate available risk management alternatives for crop farmers in an effective, useable, and timely form. As evidence of this impact, a total of 194,090 page and file requests were made to the online crop insurance tools at the farmdoc website during 2006, a 35 percent improvement over 2005.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – State

Key Theme – Agricultural Profitability

To Develop Effective Strategies for Management of Phytophthora Blight of Pumpkins

a. Progress – Illinois, with approximately 22,000 acres of pumpkins, ranks first in pumpkin production among the states. About 90% of the commercial processing pumpkins in the United States are produced in about 10,000 acres in Illinois. Phytophthora blight, caused by Phytophthora capsici, has become one of the most serious threats to production of pumpkins and other cucurbit crops (cucumbers, gourds, melons, squash) in Illinois. Yield losses of up to 100% in pumpkin fields have been recorded. This pathogen survives as oospores (thick-walled spores) in soil for several years and attack host plants at any time during the growing season. At present, there is no single method to provide adequate control of P. capsici on pumpkins and other crops. There is no measurable resistance in pumpkin cultivars against P. capsici. A recommended practice for reducing the incidence of this disease in pumpkin fields would be an integrated approach combining crop rotation, seed treatment, induction of plant resistance, sanitation, and management of field moisture. This research was initiated to

develop effective strategies for management of Phytophthora blight in pumpkin fields. The first step in developing effective integrated approach for management of Phytophthora blight in pumpkin fields is developing effective cropping rotations and evaluating efficacy of fungicides for control of the disease. For developing effective cropping rotations, survival of the pathogen (P. capsici) in the soil must be determined. To determine survival of P. capsici in soil, we initiated studies to develop a reliable method for extraction and enumeration of oospores of the pathogen in soil. Five soil types were infested with oospores of P. capsici to produce 102, 103, 104, or 105 spores per 10-g of air-dried soil. Each 10-g of infested soil was processed using our sieving-sucrose-centrifugation method to extract and enumerate oospores in the soil samples. The relationship between oospores recovered and oospores incorporated into soil was $\hat{Y}$= -1.311+1.472X-0.047X2. Also, soil samples were collected from eight commercial fields in three counties with a history of Phytophthora blight, and oospores of P. capsici were successfully extracted from soil using the above-mentioned sieving-sucrose-centrifugation method. A trial was conducted in an irrigated field near Pekin, IL. The field was naturally infested with P. capsici. Processing pumpkin cultivar Dickinson was planted in May. Seeds were slurry-treated with Apron XL LS (0.64 fl oz/100 lb seed) two days prior to sowing. Seeds were sown 18-inches apart in single-row plots, 20-feet long. Seventeen fungicides in 23 different combinations (23 treatments) were applied to soil and foliage. Also, an untreated check was considered. Due to the drier weather and soil conditions than normal, there was not a considerable incidence of seedling death in the plots. Some of the treatments provided satisfactory control of Phytophthora vine blight and fruit rot. Vine infection and fruit rot were significantly higher in untreated plots than some of the fungicide-treated plots. Marketable fruit number and yield were the lowest in untreated check plots.

b. Impact – The pumpkin industry is the most valuable vegetable industry in Illinois. Results of this research will help to assure that the pumpkin industry will continue to be a significant component of Illinois agricultural economy.

c. Source of Funding – Hatch, State, Other Non-Federal Funds

d. Scope of Impact – State

MarketMaker: An Electronic Network that Connects Farmers, Processors, Food Retailers, and Consumers

a. MarketMaker was developed as an online marketing resource to give Illinois farmers greater access to regional markets by linking them with processors, retailers, consumers, and other food supply chain participants. It is currently one of the most extensive collections of searchable food industry-related data in the country and contains over 65,000 profiles of farmers and other food-related enterprises in Illinois, Iowa and Nebraska. All the information can be mapped and queried by the user. The site was created by a team of University of Illinois Extension researchers with the intention of building an electronic infrastructure that would more easily connect food-producing farmers with economically viable new markets and aid in the development of quality-driven food supply chains. The project was funded by the Illinois Department of Agriculture, University of Illinois Extension and the Illinois Council on Food and Agricultural Research (C-FAR).

Previous studies have confirmed that non-commodity value-added products have willing and economically significant markets among key consumer groups such as high-income or ethnic populations. Additionally, these products are more in sync with the demographic shifts among food consumers in the U.S. Unfortunately, in most cases, the additional costs to produce and distribute these food products cannot be passed on directly to the consumer without dramatically impacting the size and subsequent feasibility of these markets. These surcharges on value-added food products confound any opportunities for real growth in these emerging markets. As a result, they remain high-margin, small-scale ventures with limited growth potential and limited capacity as engines for rural economic development.

The objective of MarketMaker is to provide a forum for connecting food supply chain partners for value-added food marketing ventures. MarketMaker gives Illinois farmers greater access to regional markets by linking them with processors, retailers, consumers, and other food supply chain participants.

b. Impact –

- ♦ MarketMaker is currently one of the most extensive collections of searchable food industry-related data in the country and contains over 48,000 profiles of farmers and other food-related enterprises in Illinois.

- ♦ Over 200 producers have listed their products on the site and MarketMaker has had over 900,000 hits in the first two years.

- ♦ In 2005, a multi-state partnership of land-grant institutions and agriculturally-focused organizations formed to build a national network of interconnected MarketMaker sites. To date, eighteen states have formally expressed their support and willingness to commit local resources for the project, and the list is growing.

- ♦ The MarketMaker partnership encompasses New York City and Chicago, two of the largest food consumer markets in the country.

- ♦ The Nebraska and Iowa MarketMaker sites are already online while New York and Kentucky MarketMaker sites are currently under development. To date, these states have contributed over $270,000 to franchise the Illinois MarketMaker model.

c. Source of Funding – State, Federal, Grants

d. Scope of Impact - National

Key Theme – Animal Genomics

Proteomic Analysis of Ruminococcus Flavefaciens FD-1

a. Progress – The primary step in proteomic analysis is the most important: protein solubilization. For R. flavefaciens we have found that cell-surface proteins are effectively extracted and solubilized using procedures that employ a Sarcosyl buffer system. These preparations can be stored for more than 6 months at -80 degrees without affecting the proteomic profile. After Sarcosyl extraction, the cells can be further processed to produce integral membrane and cytoplasmic contents. We expect that this research approach will allow us to resolve the nature of the structure of the cellulase complex from R. flavefaciens FD-1, and identify differentially expressed proteins and regulons that are up-regulated in the presence of cellulose and other plant cell wall components. We are also comparing orthologous proteins that have been sequenced from R. flavefaciens strain 17 with those of strain FD-1, and to elucidate the nature of the relatedness between cellulose-binding, cell-surface attachment, and cellulosomal dockerin-containing proteins of R. flavefaciens.

b. Impact – The impact of the work is the linking between functional data and genomic data for this specific organism. Providing the genetic 'blueprint' for an organism (elucidating its genome sequence) is not the complete picture; it is simply a flat map versus a globe. The inclusion of proteomic data will provide the topography. With respect to preliminary data from our genome sequencing project (identification of presumptive scaffoldin sequences) and 2-D runs of extracts of cell-surface associated proteins we have an excellent opportunity to identify cellulolytic enzymes that work synergistically in R. flavefaciens FD-1.

c. Source of Funding – Hatch, State

d. Scope of Impact – National

Genetic and Functional Approaches to Improve Production and Quality of Pork

a. Progress – Linkage analysis of SSC2 has revealed the presence of a Quantitative Trait Locus with an effect on meat tenderness within the Illinois Meat Quality Pedigree (IMQP). QTL exceeding the genome-wise significance threshold of $p < 0.0001$ were detected at the same position for both Instron force and taste panel tenderness, the instrumental and sensory measurements for tenderness, respectively. Due to the small number of markers used in this analysis this QTL has been positioned within a large marker interval of ~60 cM, or nearly 60 Mb. Therefore, the QTL interval must be refined to a size more suitable for positional cloning experiments (i.e. < 5 cM). Based on the initial QTL scan of SSC2, the most likely map position of the shear force and tenderness QTL coincides with that of microsatellite marker SW1517. Subsequent RH mapping and integration of this marker into the comparative map indicated that it is centrally located within a large segment of conserved gene order with orthology to HSA5. Within this segment is a single candidate gene, CAST. Calpastatin is a specific inhibitor of some calcium-dependent proteases which are believed to play an important role in the breakdown of muscle structural proteins, and thus, postmortem tenderization of meat. Mutations in CAST resulting in unregulated calpain activity could therefore enhance meat tenderness. This notion has led to a number of studies relating CAST activity to meat tenderness. Recently, sequencing of CAST coding regions, as well as parts of the 5' and 3' untranslated regions, of individuals exhibiting divergent meat quality values resulted in the identification of a number of single nucleotide polymorphisms. Haplotypes including these SNPs were

then constructed and used to test for association with a number of meat quality traits. One CAST haplotype was found to be associated with higher juiciness scores as well as lower firmess, Instron force and cooking loss scores. However, as each haplotype contained more than one SNP variant, no one mutation could be suggested as causative. Additionally, the possibility remains that the effects on meat quality are caused by an unidentified mutation in linkage disequilibrium with the observed substitutions. Based on its known function and location, CAST could be considered a good candidate for the effects on Instron shear force and sensory tenderness detected within the IMQP. However, the observed effects on these traits are not nearly as extreme as those in the IMQP (>5% chromosome-wise significance vs. <1% genome-wise significance, respectively). Thus, it is not likely that any of the previously reported CAST polymorphisms are responsible for the tenderness effects observed in the IMQP. For this reason, fine-mapping of this QTL is justified and anticipated to suggest other interesting positional candidate genes and/or polymorphisms. Currently, fine-mapping implicates two tenderness QTL in this region, one with a most likely QTL position coinciding with that of CAST, and a second located nearly 10 cM downstream.

b. Impact – Identification of the gene(s) and underlying molecular variation responsible for the described pork tenderness QTL will allow for the direct selection of breeding animals for the production of pork with higher consumer acceptance.

c. Source of Funding – State, Multi-State

d. Scope of Impact – AL, IL, IN, IA, MD, MI, MN, NE, NC, OH, OK

Livestock Genome Sequencing Initiative

a. Progress – More than 3,000 cattle BAC-end sequences (BESs) were selected for creation of high resolution whole-genome cattle RH and cattle-human comparative maps as well as for a major comparative and evolutionary study of mammalian genomes. The BAC fingerprint map has recently been integrated with the third generation IL-TX RH map. The resulting integrated map of cattle chromosomes was used for proofing the assignment of sequence contigs to chromosomes, and the order of contigs within chromosomes. The IL-TX RH map is publicly available from the NCBI Map Viewer Website (http://www.ncbi.nlm.nih.gov/mapview/) and the cattle-human comparative map is available at the UCSC Human Genome Browser. BTA6 Milk Composition. We identified a SNP in

ABCG2 on BTA6 that is responsible for fat and protein concentration in milk . This SNP was identified in part by targeted sequencing at the IL of clone 5K14 (GenBank AJ871176) from the RPCI-42 cattle Holstein BAC library (http://bacpac.chori.org/mbovine42.htm). SSC8p ETL for Ovulation Rate. Fine mapping of a known ETL for ovulation rate on SSC8 was initiated. We isolated 340 SNP markers and 27 insertions/deletions using a panel of DNA from eight diverse pig breeds (Yorkshire, Meishan, Berkshire, Duroc, Hampshire, Landrace, Large White and Pietrain). SNPs heterozygous for the UIUC Resource Family F1 individuals are being used to genotype a commercial population using a high-throughput SNP genotyping platform for use in linkage/linkage disequilibrium (LD) analyses. In addition to the fine mapping of ETL on SSC8, progress on several others has been achieved. These are the SSC1q ETL for growth rate, the SSC2q ETL for shear force and tenderness, the SSC6q ETL for lean muscle yield, and the SSC5q locus for arthrogryposis multiplex congentia (AMC). BTA15 Locus for Tibial Hemimelia. Tibial hemimelia (TH) is a genetic defect that has been reported in the Galloway and Shorthorn breeds of cattle. The causative locus was mapped to cattle chromosome 15 (BTA15) between the microsatellite markers BL1095 and BMS820. This interval contained a single candidate gene, aristaless-like homeobox 4 (ALX4). A single BAC clone, CH240-78D8, was selected for sequencing the bovine ALX4 gene. The mutation causing TH has been identified as a deletion of 45.7 Kb. This mutation results in a complete loss-of-function of ALX4, thus producing the disease phenotype when an animal is homozygous for the deletion-containing chromosome. Currently, a second deletion mutation of approximately 560 Kb has been identified. Additional BAC clones on either side of CH240-78D8 (CH240-69K13 and CH240-82M15) are being sequenced and assembled with currently available bovine (WGS) sequences to assist in the identification of deletion breakpoints for this second mutation.

b. Impact – The ABCG2 gene was identified as responsible for major differences among dairy cattle in their ability to produce milk with specific levels of fat and protein. Testing for this gene will allow breeders to select bulls with superior breeding potential for milk production traits. The gene for tibial hemimelia in Shorthorn cattle was mapped, resulting in a genetic test used by the industry to eliminate this economically important congenital abnormality. Testing for the mutant allele will assist breeding strategies to reduce the frequency of the unwanted mutation. A candidate gene for the hypotrichosis in Hereford cattle was identified. Developing a method to identify carriers in cattle will assist producers in

making informed breeding decisions to decrease the occurrence of hypotrichosis in Hereford cattle.

c. Source of Funding – USDA Special Grant Funds

d. Scope of Impact – National

Developmental Dynamics of Pig Intestinal Responses to Bacterial Colonization

a. Progress - This project tests the general hypothesis that normal gut bacteria stimulate epithelial cell growth and developmental processes that represent nutritive costs in the small intestine, which impact the efficiency of whole animal growth. Cesarean-derived germ-free (GF) newborn piglets were colonized with adult swine feces, and villus and crypt epithelial cell transcriptomes from colonized and control GF neonatal piglets were compared using laser-capture microdissection and oligonucleotide microarray technology. All of the microarray studies have been completed. The data demonstrate that the RNA expression of a total of 223 genes was differentially expressed in the intestinal epithelium (crypts and villi) of CONV (conventional) relative to GF animals. Among them, 170 genes were significantly unregulated (log 2 of fold change is positive), whereas 53 genes were significantly downregulated (log 2 of fold change is negative) in CONV crypt and villi compared to GF crypt and villi ($P < 0.05$). The differentially expressed genes were categorized according to Gene Ontology biological processes; 6% are involved in transcription, 6% in signal transduction, 6% are involved in cell proliferation, differentiation and regulation of cell growth, 6% in nutrient transport, 9% in nutrient metabolism, 4% in electron transport mechanisms, 5% in immune responsiveness, 29% were involved in other processes and 28% encode genes of unknown function. Efforts during 2006 included: 1) analysis of the microarray data with various bioinformatic programs to identify candidate molecular pathways activated by the normal microbiota; 2) verification of the candidate pathways with quantiative PCR; and 3) manuscript preparation. Pathway analyses of the microarray data indicate that microbial colonization upregulates signaling cascades and transcription factors responsive to type I and to a lesser extent type II interferons while downregulating nuclear factor kB (NFkB)-mediated inflammatory responses. This observation has been confirmed by initial quantitative reverse transcriptase PCR analysis targeting eighteen genes encoding products contributing to interferon- and NFkB-mediated inflammatory responses. Together these data reveal a novel

mechanism, which appears to underlie the state of physiological inflammation that maintains mucosal homeostasis in the small intestine of the pig. A subsequent objective is to identify molecular interactions between microbially-activated inflammatory pathways and cell growth and developmental pathways relating to epithelial renewal and epithelial secretory processes. Such data are crucial for the development of growth models and efficient feeding standards for the pig, as recent work has demonstrated that intestinal protein synthesis, especially secretory protein synthesis, constitutes a substantial fraction of whole body amino acid needs.

b. Impact -The proposal brings together a multidisciplinary team featuring expertise in microbiology, immunology, molecular and cellular biology, and intestinal and growth biology. Through collective efforts to date, the work has provided an expansive and novel database on the impact of normal gut bacteria on regulated gene expression during intestinal development in the pig. Specifically, quantitative data have been generated, which indicated that a large proportion of the nutritive costs incurred in the GI tract support the innate defense functions of epithelial cell renewal and mucus production. As such, the proposal develops the theory and lays the groundwork for unique biotechnological strategies to improve animal growth efficiency through the manipulation of the host and its resident microbiota.

c. Source of Funding – NRI Competitive Grant Funds

d. Scope of Impact – National

Key Theme – Animal Health

Animal Identification Demonstration Project

a. There are national, state, and local concerns that major naturally occurring animal diseases or introduced disease threats could have a catastrophic impact on animal production and the U.S. economy. In the event that a major disease outbreak would happen, it is imperative that a well-managed animal identification system program be in place which could identify and isolate the affected livestock and area. This system includes premise identification as well as individual animal ID and the recording of the movement of livestock to and from farms, fairs, sale barns, etc. Some major concerns of many animal owners is what type of animal ID will be required, how are the tags properly applied, will the tags be readable, and how is the information recorded. In addition, there is a lack of understanding, by youth and adult livestock owners, of

why it is important to have a traceable animal identification program.

One of the important factors in a successful animal identification program is the monitoring of animal movement, such as from farm to fairs/exhibition. To demonstrate this use of individual animal identification and allow youth to become better informed on the importance of animal ID, a pilot project was developed in Illinois to tag and monitor 4-H livestock with the use of radiofrequency identification devices (RFID). Furthermore, the project also allowed for observations to evaluate the tagging, retention, performance, and processing of animals that have been identified with an RFID device. Allflex full-duplex tags specific to each species and an Allflex RS320 Series Stick Reader (cordless) were used in this project.

Another purpose of this project was to educate the youth to better understand how farm premises and animal ID will help animal health officials pinpoint disease outbreaks and how to contain them. Educational CD's and printed information on how diseases can spread were made available to youth and parents involved with this project.

The pilot project included 4-Hers and adults from three Illinois counties and five University of Illinois Extension staff. A total of 294 animals (152 beef, 22 dairy, 35 sheep/goats, and 85 swine) were tagged with RFID devices prior to livestock exhibitions at three 2006 Illinois county 4-H shows. During the arrival of the livestock to the shows, the RFID tags were read and recorded to determine if the numbers were correct and matched with the system from several months prior.

b. Impact –

- ♦ Evaluators reported very little difference to even faster processing times associated with RFID-tagged livestock, as compared to previous technique of ink tattoos and/or ear tagging.
- ♦ Retention of the RFID tags was very high with 96.9% (9 lost of 294 tags) tag remaining intake. Four of the tags were lost on one farm and has been associated with being caught or rubbed to the point of failure.
- ♦ Virtually all RFID tags were reported as readable, except for three swine tags. It was theorized that interference from

the loading unit on a portable scale may have caused them to malfunction while on the scale.

- The 4-H members, their parents and the show personnel involved in the project were very accepting of the RFID tags.
- Youth received the educational materials prior to implementation of the program and were allowed to practice reading the sample RFID tags with the electronic wand.
- The evaluators rated the overall effectiveness of RFID in uniquely identifying the animals as good-to-excellent.
- The use of RFID devices are an effective means of uniquely identifying livestock at county 4-H shows/fairs, speeding up processing time and having high acceptance from persons involved in the project. Incorporation of the animal ID program with 4-H shows allows the youth to become more knowledgeable about the importance of controlling disease transmission from animal to animal.

c. Source of Funding – State, Federal

d. Scope of Impact – Illinois

Control of Emerging and Re-Emerging Poultry Respiratory Diseases in the United States

a. Progress – In order to diagnose and differentiate avian poxviruses, seven sets of primers from fowlpox virus genome (39K, EGF, REV envelope, REV LTR, homolog of HA, A-type inclusion and TK) were selected for amplification of genomic fragments of various avian poxviruses. Genes encoding for A-type inclusion protein and epidermal growth factor (EGF)-like protein were amplified in most of the viruses. While long terminal repeat (LTR) of reticuloendotheliosis virus (REV) specific sequences were amplified in the vaccine strains of fowlpox virus, REV provirus sequences were identified only in the field strains of fowlpox virus. These sequences are absent in the genomes of avianpox viruses isolated from ostrich, canary, and murre. Further, size differences in the 39K amplicon were observed in the fowlpox virus strains.

b. Impact – A diagnosis and differentiation of Avianpox viruses can be done by using combination of primers, which determine presence or absence of specific regions in the virus genome.

c. Source of Funding – Multi-State

d. Scope of Impact – AL, DE, IL, IN, IA, MD, MN, NYC, OH, TX

Enteric Diseases of Swine and Cattle Prevention, Control and Food Safety

a. Progress – Based on our studies showing gangliosides, particularly N-glycolylGM3, are required by sialic acid-dependent strains of porcine rotavirus for enterocyte infectivity, we have synthesized a multivalent, neoglycoconjugate carbomimetic using the native sialyllactose oligosaccharide moieties of porcine intestinal GM3. This neoglycolipid displays a potent ability to inhibit both virus binding and infectivity in vitro. In field trials this inhibitor blocked infection, virus shedding and diarrhea using a twice a day dosage administered to newborn pigs at the time of virus inoculation. We are currently investigating the synergistic effect of SLPE and specific porcine milk oligosaccharides as well as soybean derived flavonoids, which we have found to exhibit anti-rotavirus activity that is acting distinct from virus attachment and entry. Previously we described an in vitro cell suspension assay that measures adhesion of Cryptosporidium parvum sporozoites to host cells (MDBK and Caco-2 cells). This assay involves the incubation of individualized sporozoites and host cells in suspension with end-over-end rotation at 37 degrees. Binding of the sporozoites to host cells is readily observed and quantified by phase contrast microscopy. This assay was used to screen a variety of glycoconjugates for their ability to inhibit parasite binding to host cells. Of the glycoconjugates tested, mucins markedly inhibited binding of sporozoites to host cells. Plasma membrane vesicles (PMV) and fractioned cell membranes, generated from MDBK cells, significantly inhibited binding as well. We have purified and partially characterized this membrane inhibitory activity isolated from MDBK cells, plasma membrane vesicles and bovine intestinal mucosa. The results of these experiments demonstrate that a lipid fraction is responsible for the inhibitory activity seen in all of these fractions. Additionally, we have finishing experiments aimed at identifying specific sporozoite genes expressed as a consequence of the early stages of host cell invasion or exposure to the host cell membrane component mentioned above. These results indicate no differential gene expression occurs within the first 20 minutes of sporozoite invasion of host cells. Finally, we have determined the cryptosporidium oocysts are effectively retarded from overland transport by vegetative filter strips (VFS) and that the mechanism of this retardation is specific adhesion to the clay

particles of the soil that occurs as a consequence of reduced flow over a vegetated surface as compared to bare soil.

b. Impact – Group A rotaviruses are among the most important agents associated with severe diarrhea in the young of both animals and people. They are of prime agricultural importance since they cause serious neonatal diarrhea of many animal species, most importantly neonatal and post-weaning pigs and calves. Receptor therapeutic and/or nutriceutical approaches aimed at blocking virus attachment or replication are likely to be a more field applicable, producer acceptable and deliverable strategically to combat rotavirus in both the majority of people and agricultural animals affected by the disease than traditional vaccine approaches. Due to the zoonotic nature of Cryptosporidium parvum, the economic loss to the cattle and dairy industries caused by this parasite is compounded by the risk of environmental contamination and human infection. This is especially serious in light of the potentially fatal consequences of cryptosporidiosis in AIDS patients, many of whom are already harboring the pathogen. The oocysts are environmentally hearty and exceptionally resistant to chemical eradication. The finding that a relatively simple natural lipid is capable of blocking sporozoite invasion suggests the possibility for a dietary intervention strategy that may be plausible for the treatment of cryptosporidiosis in both animals and people.

c. Source of Funding – State, Multi-State

d. Scope of Impact – AZ, IL, IA, KS, MI, MN, NE, OH, SD, WA

Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation

a. Progress – Cull cows are typically in poor condition at slaughter. Previous work indicates feeding cull cows high concentrate diets improves growth and carcass yields. Non-dairy cull cows were assigned to one of three dietary treatments: forage fed (control), concentrate fed (fed) and concentrate fed with ractopamine supplementation (opta) for the final 35 days prior to slaughter and may serve as a model of muscle growth and atrophy in aging animals. Ractopamine, a beta-1 adrenergic agonist, is thought to increase protein synthesis while leaving protein degradation unchanged resulting in muscle growth. Overall, fed and opta cows gained more weight, had improved fat color (whiter fat) and larger rib eye areas than control cows. With two days of postmortem aging, steaks from control animals were less tender than those from fed and opta cows. These differences, however, were

ameliorated by 14 days of aging. Further research is investigating the cellular components of protein synthesis and degradation. In rainbow trout, the catalytic subunits of u and m calpain were identified. Both rainbow trout calpains showed high degrees of homology with calpains from other species. Feed restriction of fingerlings led to increased expression of both calpain 1 and 2 indicating these isozymes may be involved in protein mobilization for energy during fasting. Furthermore, two forms of the calpain inhibitor calpastatin were identified (CAST-long and CAST-short) derived from two different genes. CAST-L and CAST-S expression were correlated with growth and fillet quality being lowered in rainbow trout strains with slower growth and softer fillets. These results suggest that CAST expression may be used to monitor fish growth and fillet quality. Additional ongoing research at the Illinois station involves the interaction of muscle and adipose tissue in growth. Myostatin null-leptin db/db mice exhibit both increased muscle growth and obesity. The increase in muscle growth, however, is delayed by adipose tissue gain, as if adipose tissue growth is restricting the growth of muscle. As the mechanism of this inhibition is unknown, further work is being undertaken to understand the interplay between these two tissues. Current work is also ongoing in the areas of glycolytic regulation both ante-and post-mortem and in the mechanisms of beta-agonist activity and other growth supplements.

b. Impact – Development of methods to improve the rate and efficiency of muscle growth in livestock species will be essential to allow animal agriculture sytems to meet projected increases in both population and demand, and to allow domestic production to remain globally competitive. This research has shown that muscle growth can be enhanced and that specific genetic and cellular events are correlated with these changes in growth patterns. Meat from animals with enhanced muscle growth rates can vary in quality but numerous techniques can be employed that will allow the meat to be very acceptable to the consumer.

c. Source of Funding – State, Multi-State

d. Scope of Impact – AZ, FL, HI, ID, IL, IN, IA, KS, MI, MN, MT, NE, NC, OH, OR, SD, UT, WA, WI

Petstravaganza! **A Day of Fun and Interactive Learning about Animals**

a. A family-friendly community event called *Petstravaganza* debuted on the University of Illinois campus on April 29, 2006. Developed

through a partnership of the University of Illinois[1], the Champaign County Humane Society (CCHS), and the Companion Animal Resource and Education (CARE) Center, the goal of *Petstravaganza* was to bring humane education about companion animals to children and families through interactive, hands-on activities.

Hosting the event's two dozen exhibits were representatives from the University of Illinois and local animal welfare groups. A list of participants and their exhibit descriptions are included in Table 1 (shown below). The requirement for all exhibits was that they promoted active learning and truly engaged the children. Kids could partake in a variety of activities, such as listening to a dog's heart with a stethoscope, brushing a rescued pony or pushing play-dough through a toy machine to simulate how pet food is made. Live animals were featured in approximately half of the exhibits; some of the species represented were dogs, cats, snakes, horses, and hedgehogs.

Providing unification among the exhibits was an official *Passport to a Humane World*, which each child received upon entering the pavilion. The passports contained useful pet care tips and kid-friendly messages about humane education. They also had pages for stamps to be earned upon completion of the different exhibits' activities. After traveling through the event, passports were inspected and prizes were distributed according to the number of stamps earned.

Along with the exhibits, there were a host of other exciting activities offered. A variety of games taught families about animal shelters, overpopulation and basic pet care. Volunteers from CCHS paraded adoptable dogs throughout the pavilion, while cats and small mammals greeted visitors in the quieter environment of the CCHS Cats & Critters room. Two short movies shown throughout the day taught kids how to be safe with dogs as well as about the importance of making an informed decision before bringing a new pet into the home. Visitors enjoyed demonstrations of bloodhound tracking and dog agility. A ventriloquist entertained children with her animal puppets, and kids lined up to receive animal-inspired face-painting and temporary tattoos. There was just the right balance of learning and entertainment to appeal to families.

[1] University support was provided by UI Extension, the College of Agricultural, Consumer, and Environmental Sciences (ACES), and the Department of Animal Sciences.

Local media outlets were very generous with coverage before, during and after the event. *Petstravaganza* received national attention as well. The event was featured on the cover of the Summer 2006 issue of *The Latham Letter*, a national humane education magazine. An article also appeared in the Summer/Fall 2006 issue of Packrat, the newsletter of the Association of Professional Humane Educators (APHE). These articles have prompted several inquiries from educators who wish to create similar events in their communities.

Table 1 - Participating *Petstravaganza* organizations and exhibit descriptions

Organization name	**Organization type**	**Exhibit description**
Companion animal nutrition researchers	graduate student group	Learn about the different nutritional needs of dogs and cats and learn how pet food is made. Find out how to body condition score your pet.
Pre-Vet Club	undergraduate student club	Meet and learn how to care for African Pygmy Hedgehogs. Also learn about careers with animals.
Illini Equestrians	undergraduate student club	Meet a real live mare and her foal! Play 'Horse Sense' and test your math skills, at the same time learning about the commitment of having a horse.
Companion Animals Club	undergraduate student club	Learn how to teach your pet a variety of different tricks and commands.
Nontraditional Species Club	veterinary student club	Learn about husbandry, handling, bite prevention, and identification of snakes, turtles, fish, and more.
Veterinary Student Outreach Program	veterinary student club	How can you tell when your dog isn't feeling well? Learn the signs of sickness that might require a visit to the vet. Listen to a dog's heart.
Behavior Club	veterinary student club	Does your dog chew on your things? Does your cat scratch the furniture? Come learn about pets' natural and learned behaviors.
Parkland Veterinary Technician Program	student club	Learn pet first aid from Jerry the CPR dog.
Care Pet Loss Helpline	CVM*-based service	Where do you turn for comfort when your special pet dies? Come learn about books, websites, and activities that can help you heal a broken heart.
A Pet's Place	CVM*-based service	Not everyone treats animals and others the way that they should. Learn what to do if you think an animal is being mistreated.

Wildlife Medical Clinic	CVM*-based service	How do real owls compare to their fictional counterparts in the Harry Potter films? Find out what to do to help injured or orphaned wildlife.
Office of Public Engagement	CVM*-based service	Learn about pets' inner workings through parasite specimens, x-rays, skeletons, and much more.
SHARE (Society for Hooved Animals' Rescue and Emergency)	nonprofit	Learn how to tell signs of horse abuse and neglect, and meet a beautiful rescued pony.
ASPCA Behavior Center	nonprofit	What is your pet trying to tell you? Learn all about dog and cat communication.
Champaign County Humane Society	nonprofit	Play lots of fun games that will teach you about animals. Meet adoptable animals.
Companion Animal Resource and Education (CARE) Center	nonprofit	Learn how our pets perceive the world. Do they see, hear, and smell it the same as we do?
CATsNAP	nonprofit	Learn what you can do to help fix the serious problem of pet overpopulation. Come meet our cats, and learn how spay/neuter saves lives!
Champaign County Animal Services Facility	government	Meet a real Animal Control Officer, and learn what these officials do to help and protect animals.
VCA Heritage Animal Hospital	local business sponsor	Learn about the special care of older pets, and how to keep pets safe during extreme weather.

*CVM = College of Veterinary Medicine

b. Impact - The debut event drew at least 500 families, putting the total number of visitors at well over 1,000. These conservative estimates are encouraging, and demonstrate families' appreciation for educational activities that involve animals. Community support in planning the event was also strong, as over 200 volunteers from all walks of life contributed their time and energy.

As families were leaving Petstravaganza, surveys were available for parents to provide feedback. Eighty-seven surveys were collected.

- When asked to rate their overall experience, the responses were:
  - Excellent (81)
  - Good (4)
  - Fair (2)
  - Poor (0)

- When asked to rate the educational value of the event, the responses were:
  - Excellent (75)
  - Good (12)
  - Fair (0)
  - Poor (0)

- When asked for suggestions to improve next year's event, here are just a few of the written responses:

  Thanks for bringing all the groups together!

  Nothing! Perfect!

  Awesome! Keep it the way it is.

  This was great – the more animals the better! Please do it again.

  More wildlife or exotic animals to see would increase the overall educational value. But – great program!

  Very fun family event.

  Just keep having it each year!!

  Keep having – wonderful. Animals are great!

  Excellent! Wonderful public service. Just keep doing what you're doing!! ☺

  The hands-on was great! Thanks for a great day!

c. Source of Funding – State, Federal

d. Scope of Impact – Illinois

Porcine Reproductive and Respiratory Diseases: Methods for the Integrated Control, Prevention and Elimination of the PRRS Virus

a. Progress – A series of field studies have been conducted with the objective of determining the influence of humoral and cell mediated immunity (CMI) on the outcome of the infection with porcine reproductive and respiratory syndrome virus (PRRSV). Evidence that a strong cellular immune response correlates with

protection against clinical PRRS was found in three of the four farms examined. However, farms and animals within farms varied considerably in their immune responsiveness and in the degree to which they were protected clinically. Increasing cellular immunity within infected herds has the potential to reduce clinical reproductive disease. The identification of the sources of intra- and inter-farm variation in the intensity of CMI to PRRSV could help increase the level of herd immunity. In addition our results indicate that poor immunity to PRRSV may facilitate re-infection and we also observed a positive correlation (r = 0.63) between the number of pigs born alive and the intensity of the virus-specific IFN-gamma response, indicating that cellular immunity provides some protection from clinical disease even for pigs housed in an environment characterized by multiple, co-circulating viral strains.

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c. Source of Funding – State, Multi-State

d. Scope of Impact – IL, IA, KS, MN, MO, NE, NC, SD, VA

Swine Nutrition and Bacterial Populations in the Gut

a. Progress - Following our previous research that showed both a mannan oligosaccharide product and an antimicrobial change in microbial populations in the digestive tract of young pigs, we have refined those observations by identifying bacterial species that appear or disappear when mannan oligosaccharide is included in

the diet. The purpose is to help us understand how the product exerts its beneficial effects so we can use it most effectively. We also described changes in microbial populations during the weeks after weaning, which will be useful in design and interpretation of further research. We have prepared critical reviews of the refereed literature on the impacts of both functional animal proteins (e.g. spray-dried animal plasma, milk proteins) and acids in the diet on health and growth performance of pigs. These reviews were commissioned by the National Pork Board, which is currently considering how best to publish them. We found that a combination of digestive enzymes added to the diet increased utilization of dietary fiber, but not amino acids, by finishing pigs. This observation promotes confidence in this product, and will likely contribute to more pork producers gaining the benefits of this and related products. Perhaps as importantly, it helps to focus development of future products on fiber digestion and away from protein digestion. We have confirmed the increased growth rate and improved feed efficiency of young pigs resulting from addition to the diet of an immune egg product containing antibodies against an enzyme involved in the inflammatory response. Our results may contribute to use of this product to the industry and to development of related products. They also suggest strongly that inflammation is costly to the animal and that reducing it is beneficial, at least in some circumstances. We have summarized a large pool of data on composition and nutrient digestibility of soybean meal from a series of earlier experiments conducted or supervised by the University of Illinois, and published the results on a website called the Soy in Animal Nutrition Database (SAND; www.livestocktrail.uiuc.edu/sand/). We expect these data to be tremendously useful to practicing nutritionists worldwide. During this year we led the establishment of a large multi-institutional project designed to improve the approaches of the U.S. swine and feed industries to management of dietary energy levels. In particular, we are measuring net energy values of diets and ingredients to assess the reliability of European net energy systems under U.S. conditions.

b. Impact -Our research will help the pork industry address its pressing need to improve the health and growth performance of young pigs while reducing the amount of antimicrobials used. The industry now has at its disposal a rich supply of products claiming to improve health and growth performance of pigs, but struggles to determine which are truly beneficial and under what circumstances. Our research program is directed to helping the industry with those determinations. The data we produced during 2006 increase the confidence pork producers, veterinarians and

feed manufacturers can place in exogenous enzymes, certain immune egg products, spray-dried animal plasma, milk products and acids. Some of these products improve health and reduce mortality rates of pigs, others improve growth performance, and several do both. The importance the industry attaches to the results of our research is shown by frequent invitations to speak at industry meetings. The sophistication of nutritional programs for food animals depends on accurate quantitative descriptions of nutritional value of feed ingredients. We contribute to improvement of those quantitative descriptions of value in two ways. First, our SAND (Soy in Animal Nutrition Database) provides new and extensive information on the nutritional value of soybean meal, the most important supplemental protein source for pigs and poultry worldwide. Second, our new research program on energy nutrition of pigs may lead to an important increase in technical sophistication of practical pig diets.

c. Source of Funding – Hatch, State, Industry, Sale of Products

d. Scope of Impact – National

Temperature and Correlated Physiologic Responses as Indicators of Well-Being

a. Progress – Currently, studies are being conducted to evaluate the potential use of body temperature as a measure of animal well being in the young pig. A pilot study was conducted to determine the reliability and accuracy of implanted temperature sensors in five site-specific places on the body of the pig. Upon weaning, four pigs were implanted with temperature sensors. In each pig, one sensor was placed in the head, flank fold, along the side of the jugular, subcutaneously near the rectum, and intra-abdominal (liver side; falciform ligament) for a total of 5 sensors per pig. Body temperatures were measured 3 times daily at all sites using an electronic sensor reader specific for these particular sensors. These measures were recorded for 25 days. Rectal temperature was also recorded at each time point. After 25 days, a study was conducted to determine the sensitivity of these temperature sensors. Pigs were subjected to exercise stress for 20 minutes. Temperatures were recorded before, during and after exercise from all 5 sensors. Changes in body temperature were detected at all 5 sites. The change from baseline at each site was on average 1.5 to 2 degrees. The extent to which temperature increased was site dependent and varied between animals. In the second study, pigs were challenged with 750 ug of LPS. The physiological response (in terms of temperature) to LPS was site dependent; at some of the sites

temperature increased and decreased at other sites. It is apparent that peripheral temperature is independent of body core temperature. Initially, temperature readings from the subcutaneous rectum sensor and actual rectal decreased substantially. The subcutaneous rectum sensor remained decreased for 120 minutes post-challenge, then increased and stayed elevated for 200 minutes but never reached the magnitude of the other sensors. At 45 minutes post-challenge, intra-abdominal went down but increased by 150 minutes. The flank fold and jugular readings followed the same pattern as the intra-abdominal readings. Rectal temperatures stayed relatively constant once they increased again and consistently fell between the flank and abdominal temperature readings. The flank fold and intra-abdominal readings were highly correlated. High partial correlations were found among the flank fold, intra-abdominal, and jugular with the rectal temperature once the adjustment was made for pig and time. These data indicate that temperature readings from temperature sensors implanted in the flank fold and intra-abdominal region of the pig body may be more indicative of body core temperature during an LPS challenge than rectal temperature.

b. Impact – Implanted temperature sensors may provide a practical and easily implemented management tool to assess overall animal well being as well as potential physiological changes. Preliminary data indicate that temperature sensors implanted in the appropriate body region could provide clues to changes in the physiological state of the animal and or health. If a clear relationship between body core temperature and other physiological parameters are identified, these temperature sensors may provide a useful and plausible management tool.

c. Source of Funding – Hatch, Industry Funds

d. Scope of Impact – National

Key Theme – Animal Production Efficiency

Differential Patterns of Mammary Development in Lactating Sows

a. Progress – The overall goal is to understand the mechanisms of mammary gland growth and development at the various physiological stages of the animal. This project is aimed at determining the role of suckling intensity during early lactation on mammary gland growth, milk production and litter growth in lactating sows. Development of three-dimensional structures in the

mammary gland occurs by a complex process of interactions between epithelial structures, cellular connective tissue components and non-cellular connective tissue components. A new method has been tested that may provide information on the three-dimensional relationships among mammary tissue components. Micro-computed tomography (micro-CT) uses the attenuation of X-rays through a subject to generate three-dimensional images of the subject. It was discovered that osmium-tetroxide stained blocks of mammary tissue provide structural information on the characteristics of the surface of the blocks. Adipose cells are distinguishable from epithelial lobules in mammary tissue from late pregnancy, and the three-dimensional structural relationships among the epithelial lobules are discernable with micro-CT. In the absence of procedural staining of mammary tissue, connective tissue components (collagen sheaths) are distinguishable from adipose lobules. The major mammary ducts are thought to use these connective tissue sheaths as a three-dimensional framework for development of the gland. This method of tissue visualization will provide unique perspectives on mechanisms of mammary gland growth and development.

b. Impact – This study will provide the critical information and identify the key variables needed to understand how mammary growth and development are regulated, especially during pregnancy and lactation. This knowledge is essential for beginning the process of developing more effective management schemes for maximizing sow productivity. Such schemes may include more defined segregation of piglets by size and age in cross-fostering, closer control of environment to maximize suckling behavior, and more refined management of sow nutrition.

c. Source of Funding – Hatch

d. Scope of Impact – National

Beef Cattle Grazing Systems that Improve Production and Profitability While Minimizing Risk and Environmental Impacts

a. Progress – There are several alternative technologies available that can increase cattle performance or reduce input costs of forage based beef production systems. How these technologies affect other aspects of the total beef system (eg. animal performance, fertilizer needs, water quality, purchased feed, grazing time, amount of harvested feed, equipment needs), however, is not completely understood. We propose to study year round beef

production systems for cow/calf producers. Detailed records will be kept so that economic analyses of the systems can be conducted. Cattle will graze crop residues and deferred pasture when possible in the winter to reduce input costs for harvested and supplemental feedstuffs. Crossbred cows and their calves with similar genetic potential will be utilized in these systems. Animals will be assigned randomly to each system and each system will be replicated each year. It will be necessary to evaluate the systems during several years to account for year to year variation. The relative economic value of each of the grazing systems will be determined by calculating revenue and costs associated with each system. Only costs that vary due to differences in the systems will be considered. These costs may include fertilizer, legume seeding, supplemental feed supplies, hay harvest costs for excess pasture growth, and any other practice associated with the different management practices among the grazing units.

b. Impact – This research will develop financial and economic information that can be used to help producers improve production efficiency while lowering production costs and serve as a key to beef industry educators in deciding what production and management areas are a concern and where educational programs can be developed to help producers. This information can be used to compare these systems to others throughout the country.

c. Source of Funding – State, Multi-State, Sale of Products

d. Scope of Impact – IL, IA, KS, NE, OH, SD

Manipulation of Photoperiod to Enhance the Sustainability of Illinois Dairy Farms

a. Progress - Management of photoperiod (the duration of light a cow is exposed to each day) in dairy cattle is a profitable tool for producers in many economic situations. Properly implemented, photoperiod technology leads to immediate milk production responses, requires little capital investment, and has a quick asset turnover. These features make the investment particularly attractive to help producers meet the current challenges and improve long term viability of the Illinois dairy industry. This project emphasizes a combination of outreach education and applied research to demonstrate, optimize and develop novel photoperiod management techniques, and thereby facilitate widespread awareness and adoption of them on dairy farms in Illinois. Outcomes of the project include:

- A heavily visited and used website that contains photoperiod management information, economic assessment spreadsheets and facility design aids for light installation.

- Saturation of the Illinois dairy industry with informational meetings regarding the application of photoperiod management.

- Cooperation on a national survey of dairy producers to assess the level of integration of photoperiod management.

Presentations were made at numerous Extension- and industry-sponsored events that reached at least 300 dairy producers and allied industry representatives in the Illinois-Iowa-Minnesota-Wisconsin region. In the first year of the project, photoperiod was a topic at the Illinois Dairy Days series, which was attended by over 900 individuals and is estimated to have reached 500 producers.

Information on photoperiod management is available at any time at the revised "photoperiod website" at *http://www.traill.uiuc.edu/photoperiod/*; the site includes data summaries, installation instructions and worksheets for estimating installation costs and economic benefits. The site continues to have high activity, with recent expansion to include information on lighting design for dry cow barns. Using key words "dairy" and "photoperiod" the site continues to rank first on the search engines Google, Hotbot, Lycos, Yahoo, AOL and others.

b. Impact –

According to a survey question posed in a *Hoard's Dairyman* survey almost one-third of herdsmen are using **supplemental (photoperiod) lighting** to extend daylength for their milking herd. This is a significant level of adoption given that this technique was essentially unheard of five years ago.

Dairy producers are clearly the primary beneficiaries of this project and work on photoperiod in general. The response has been shown repeatedly to be economically positive, with returns of $0.25/cow/d at milk prices at the farm gate of $11.00/cwt. That translates to an extra $76.25/cow/lactation profit.

c. Source of Funds – State, National

d. Scope of Impact - National

Strategies to Reduce the Response of Slaughter-Weight Pigs to Handling Stress

a. Progress – Studies were carried out to investigate the effect of administration of arginine and sodium bicarbonate to harvest weight pigs on responses to commercial pre-slaughter handling regimes or a standardized experimental handling model. The study with sodium bicarbonate involved administering this compound in the water supply (at a concentration of 2.5%) on the farm for two days prior to shipping and also during an overnight period of approximately 12 hours in the lairage at the slaughter facility. Venous blood samples were taken before shipping, on arrival at the slaughter facility, and at the time of slaughter; rectal temperatures were taken at the same time as the blood samples. Compared to untreated controls, pigs that received the sodium bicarbonate treatment had higher blood pH values at all points of measurement and had lower rectal temperatures at slaughter. The study with arginine involved feeding diets with between 0% and 3% added arginine to harvest weight pigs for seven days at the end of which the animals were subjected to a standard handling procedure. Compared to the controls (0% arginine), pigs fed the diet with 1% arginine had lower rectal temperature and tended to exhibit a lower frequency of physical indicators of stress.

b. Impact – These two studies require further research to validate the results but they clearly demonstrate that it is possible to alter the response of harvest weight pigs to pre-slaughter handling and transportation. Water delivery of sodium bicarbonate offers producers a low-cost, easily applicable approach to reducing the acid-base response to pre-slaughter handling which should reduce the incidence of losses during transportation.

c. Source of Funding – Hatch, State, Sale of Products, Other Non-Federal Funds

d. Scope of Impact – National

Illinois Horse Breeders Short Course

a. Progress - This in-depth, annual two-day course for breeders, mare owners, stud farm managers and veterinarians was developed to improve the breeding management and conception rates of

attendees. The national average conception rate for all mares bred is only about 55%, and is in part due to horse breeders lacking knowledge of equine reproductive physiology and management. The course offers hands-on experiences, wet labs, and lectures covering mare reproductive physiology, semen evaluation and shipping, stallion management, foaling, ultrasonography, and herd health.

b. Impact –
One hundred and ten horse breeders and veterinarians representing approximately 15,000 mares attended the Illinois Horse Breeders Short Course during the past five years. Eighty seven evaluation forms were returned from these attendees (79%).

- When asked to rate the instructors' teaching effectiveness on a scale from 1-5, with 5 being most effective, respondents rated the instructors 4.9/5.0.

- Respondents rated the overall quality of the course to be 4.8/5.0.

- 94% of all respondents either agreed or strongly agreed to each of the following assessments regarding the impacts of the course:

  - I gained valuable information about breeding management of mares.

  - I gained valuable information about breeding management of stallions.

  - I gained valuable information about collection, preparation and transport of stallion semen.

  - I will apply what I learned in the course to my horse breeding operation.

  - I expect that the information and techniques learned from the course will help me to improve conception rates in my horse breeding operation.

- Forty four attendees (40% of respondents) gave a quantitative answer to the question: How much improvement in conception rate for your horse breeding operation do you expect due to information and techniques learned at the Horse Breeders Short Course? Of those

quantitative responses, 4% expected up to 5% improvement, 32% expected an improvement of 5-10%, 29% expected an improvement of 15-30%, and 35% expected 30-50% improvement in conception rates.

c. Source of Funding – State, Federal

d. Scope of Impact - Illinois

Key Theme – Biofuels

Management of Grain Quality and Security for World Markets

a. Progress – The ability to monitor and modify the fermentation process used for dry-grind ethanol production is important. The objective of this research is to determine suitable Near-Infrared (NIR) wavelength regions to identify ethanol, total soluble sugars, glycerol, and organic acids in the fermentation broth for a corn dry grind process. Effects of temperature on spectral absorption were identified and related to loadings of principal component scores. The wavenumber region between 12,000 to 6,400 cm-1 had low correlation coefficients for a 0.5-mm short pathlength transflectance accessory. Wavenumbers having high correlation coefficients for ethanol were found in the region between 4,712 to 4,200 cm-1, while that for total sugars were from 5,000 to 4,286 cm-1. High RPD (ratio of laboratory standard deviation to the RMSEP) and low RMSEP (root mean standard error of prediction) values for both ethanol and total soluble sugars validated the suitability of the wavelength regions found. Lactic acid and acetic acid were present at very low levels and did not appear to separate from the other fermentation constituents for the given pathlength and concentrations observed. Distillers dried grains with solubles (DDGS) is the primary co-product of dry grind fermentation of corn. DDGS has been mainly used as a ruminant animal feed, but its use for non-ruminants is important. However, significant variation in DDGS composition (protein, fat, starch, and fiber) occurs. Certain modified dry-grind corn processes, such as quick germ, quick fiber, and enzymatic milling, reduce fiber content of DDGS from 11% down to 2% and increase protein from 28% up to 58%. Rapid techniques such as Near Infrared Reflectance (NIR) for measurement of nutrient levels in the DDGS could be useful for analytical and quality control. The objective of this work was to evaluate a sample preparation method based on enriching protein in DDGS by removal of fiber using elutriation, a separation process using the upward flow of air. Regression methods: partial

least squares (PLS1 and PLS2) and principal components (PCR) were evaluated. Best results for most constituents were obtained with the PLS1 method. Cross validation results predicted crude protein with a RMSEP (root mean square error for prediction) of 1.2 for a range of 10.4 to 41.5%; Neutral Detergent Fiber (NDF) with a RMSEP of 2.7 for a range of 21 to 69%; crude fiber with a RMSEP of 1.7 for a range of 4.1 to 16.8%; crude fat with a RMSEP of 1.1 for a range of 4.4 to 27.7%; acid detergent fiber (ADF) with a RMSEP 1.9 for a range of 10.4 to 23.2%; ash content with a RMSEP of 0.31 for a range of 2.6 to 5.5%; and total digestible nutrients with a RMSEP of 1.7 for a range of 71.1 to 93.5%.

b. Impact – Current U.S. ethanol production of 3.9 billion gallons per year is expected to soon double, creating a huge surplus of DDGS (distillers dried grains with solubles). Value of DDGS can be improved by modified processes that reduce fiber and increase protein, but rapid measurement and monitoring of fermentation processes and variability in DDGS quality is lacking. Near-infrared spectroscopy provides a rapid technology for on-line quality monitoring, but robust calibrations for constituents in fermentation broth and DDGS are first needed.

c. Source of Funding – State, Multi-State

d. Scope of Impact – IL, IN, IA, KS, KY, MI, MN, MT, NE, ND, OK, TX, WA, WI

Value-Added Processing of Corn for Ethanol and Other Uses

a. Progress – Previously we developed an enzymatic dry grind process that uses novel separation techniques and use of conventional dry grind enzymes to recover germ, pericarp fiber and endosperm fiber separately at the beginning of the process. Final ethanol concentrations in the enzymatic dry grind process were 27% higher than the conventional process. The protein content of DDGS from the enzymatic process was 58% compared to 28% for DDGS produced from the conventional process. Recently we further improved the enzymatic dry grind process by use of granular starch hydrolyzing enzymes. These enzymes breakdown granular starch and increase specific gravity of the slurry, which helps in flotation and recovery of germ and pericarp fiber. Also, in one step these enzymes can convert starch into dextrins at low temperatures as well as hydrolyze dextrins into fermentable sugars.

b. Impact – Several dry grind ethanol plants have switched to using granular starch hydrolyzing enzyme for production of dry grind ethanol. Enzymatic dry grind ethanol process can be readily incorporated in dry grind ethanol plants using granular starch hydrolyzing enzymes. Enzymatic dry grind process helps in recovery of valuable coproducts, increases ethanol production per batch and improves protein content of DDGS.

c. Source of Funding – Hatch, Industry Funds

d. Scope of Impact – National

Impact of Biofuels on Emissions-Reducing Technologies for Off-Road Diesel Engines

a. Progress – The purpose of this study is to evaluate the impact of biofuels on both present and emerging emissions reducing technologies for diesel engines. Particular attention has been paid to biodiesel and its blends with diesel fuel, and addressing the NOx emissions that typically increase with the combustion of biodiesel. NOx (oxides of nitrogen) is a key pollutant from diesel engines that is regulated by the EPA. The fact that it increases with biodiesel is a big concern. Research efforts in this project have focused initially on the use of combustion models to evaluate strategies to reduce this pollutant and also the implementation of exhaust gas recirculation (EGR), a recognized method for reducing NOx emissions from spark-ignition engines that is being implemented by many diesel engine manufacturers to meet the next level of more stringent EPA emissions regulations. A special effort was made to establish an accurate means of computing the fuel properties of biodiesel based on its fatty acid composition as these properties were used as a key input to a three-dimensional reactive flow combustion model. After calibrating the model, a number of strategies were applied via the model to evaluate their effect on reducing NOx emissions. These included retarding the start of fuel injection, applying EGR, and reducing the temperature of the intake air after being compressed through the turbocharger. In all three cases a substantial reduction in NOx emissions was realized showing that any one or combination thereof could be used to lower NOx emissions from biodiesel combustion to levels equivalent or lower than regular diesel fuel. A project was completed recently in which a low pressure EGR system was installed on a diesel engine and measurements were carried out for NOx emissions at four different speed-load settings of the engine with the EGR rate varying from zero to 25% and applied to four fuels: petroleum diesel, 100% soybean-derived biodiesel, and 2%

and 20% biodiesel blended with petroleum diesel fuel. The results from the tests confirm that EGR is an effective technique for reducing NOx emissions. It was also found that the absolute reduction in NOx emissions was greater for biodiesel than petroleum diesel, indicating that biodiesel has a greater response to EGR technology and thereby helping to nullify the higher NOx emissions.

b. Impact – The results of the project have been presented both at international conferences and to industries. At a presentation to Deere and Company in Waterloo, Iowa, it was evident that the engineers there were interested in collaborating in the study and offered to provide their most up-to-date engine fitted with the latest emissions-reducing technologies that included exhaust gas recirculation. In addition, as a result of the combustion modeling work, project proposals for the U.S. Department of Energy (DOE) were prepared in collaboration with the Department of Mechanical and Industrial Engineering at the University of Illinois in Urbana-Champaign that focused on establishing a Center of Excellence in advanced automotive biofuel combustion engines and carrying out an investigation of biodiesel fueled engines under low temperature combustion strategies, a novel combustion approach. The projects have been awarded and work began in 2006. The work from this project will form the basis for the steps in the DOE project. This low temperature combustion approach has the potential to reduce both NOx and particulate emissions by an order of magnitude, thereby helping manufacturers meet strict EPA emissions regulations that come into effect early in the next decade and require a 90% reduction relative to present levels of emissions.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Key Theme – Biotechnology

Soybean Gene Expression and Regulation

a. Progress – The objectives of this research are to understand the regulation of gene expression in soybean as revealed by examination of unusual mutations in genes that affect pigmentation of the seed coat. One of these genes shows a form of gene silencing, another affects both pigmentation and cell wall structure, and others contain mutable alleles that may be due to transposable elements. Progress includes discovery of a transposable element sequence that interrupts a flower color gene. In addition to the

element ends, the element carries host gene sequences from one location in the genome and inserts them into the gene encoding a flavanone 3-hydroxylase. In addition, we continue to investigate a tissue specific gene silencing phenomena and show that small RNAs are involved in the mechanism of inhibition seed coat pigmentation by the I locus in soybean.

b. Impact – This research will benefit the biotechnology industry and soybean producers and consumers by providing basic information on gene regulation in soybean, specifically of the flavonoid pathway and gene silencing. This information will be applicable to designing better vectors for genetic transformation that will overcome the problem of gene silencing in transgenic plants. A better understanding of molecular genetics of the flavonoid pathway may enhance our understanding of plant disease resistance or the modification of flavonoid products in the seed for improved nutritional and health value.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

The Illinois-Missouri Biotechnology Alliance

a. Progress – The broad goal of the Illinois Missouri Biotechnology Alliance is to strengthen the agriculture and food sectors in the American Midwest, especially the improvement of food safety and quality. The Alliance funds investigator-driven research under two subprograms, one aimed at enhancing profitability and one focused on economics and consumer acceptance. Nine projects were funded by the Illinois-Missouri Biotechnology Alliance in 2006. Detailed information can be found at the program website http://www.imba.missouri.edu/. Project 2006-1: Metabolomic Analysis of Soybean Nematode Interactions: A Prelude to Metabolic Engineering for Nematode Resistance by Kris N. Lambert and Vera Lozovaya, University of Illinois; Project 2006-2: Development of Corn/Soy Plastic Composites: Phase II by Richard C. Larock and Paul W. Gallagher, Iowa State University, Ames, IA; Project 2006-3: Systematically Assigning Gene Functions in Soybean Employing RNAi Technology by Zhanyuan Zhang, University of Missouri; Project 2006-4: Engineering Soybean for Enhanced Sulfur Amino Acid Content by Hari Krishnan, University of Missouri and Joseph Jez, Donald Danforth Plant Science Center; Project 2006-5: Adaptation of a Gene Switch Technology for use in Soybean Seed by Terry Woodford-Thomas, Donald Danforth Plant Science Center, St. Louis, MO; Project

2006-6: Genomic Evaluation of the Defense Response of Maize Against Herbivory by the Western Corn Rootworm by Martin Bohn, University of Illinois; Georgia Davis and Thomas L. Clark, University of Missouri; Project 2006-7: Maximizing the Value of Corn Biotechnologies in Ethanol Production by Nicholas Kalaitzandonakes, University of Missouri and Martha Schlicher, Southern Illinois University-Edwardsville; Project 2006-8: Analytical Tools for Production of Non-Food Protein Corn by Roger Ginder, Corinne Langinier, Darren Jarboe, and Lawrence Johnson, Iowa State University; and Project 2006-9: Innovation and Venture Formation In Agricultural Biotechnology by Jake Halliday and Nicholas Kalaitzandonakes, University of Missouri.

b. Impact – The Illinois-Missouri Biotechnology Alliance (IMBA) is a joint program of the University of Illinois and the University of Missouri [and a partner with Southern Illinois University in Carbondale] and is funded by a Congressional Special Grant administered by the United States Department of Agriculture (USDA). The purpose of IMBA is to fund biotechnology research that is an integral part of a research and development program directed at expanding the volume of profitable businesses in the United States food and agricultural sectors. Initially, the IMBA program was limited in scope to corn and soybeans. However, the scope of IMBA interest now encompasses all concepts of these industries including production, processing, marketing, utilization, inputs and support services, as well as economic, social, environmental, and natural resource concerns. The geographical focus of IMBA is Illinois and Missouri along with other Midwestern states having similar crops, soil, climate, and socio-economic conditions. IMBA spawned the most read journal on the economics and management of ag biotech - AgBioForum. The electronic journal was read by more than 250,000 unique readers, worldwide, in 2005. One third of the subscribers to ABF are from outside the U.S. and Canada. There has been one start-up company that has developed, based on results of research that was IMBA-supported.

c. Source of Funding – USDA Special Grant

d. Scope of Impact – Illinois, Missouri

Soybean Research Illinois – The Soybean Disease Biotechnology Center

a. Progress – For wide hybridization research between soybean and its wild relative Glycine tomentella with resistance to soybean rust,

soybean cyst nematode, bean pod mottle virus, and soybean aphid to soybean, six hybrids have been produced, and three successful crosses have produced seeds. Crosses have been identified based on morphological traits, chromosome count and SSR markers. All F1 plants were perennial and intermediate for other morphological features. All plants contained 59 chromosomes. Seedlings from one cross are in a new rooting medium developed to help shoots to produce healthy roots directly from the stem within a week. More than 20 shoots are in culture and 10 shoots were transferred to rooting medium. BC1 F1 plants have been transferred to the greenhouse. For facilitating nanotechnology-based innovations for soybean disease problems, seminars and workshops resulted in initiation of several pilot ag-nanotech projects: Development of Nanoelectromechanical System (NEMS) for the Study of Gaeumannomyces graminis Infection and Pathogenesis; Grain Traceability Using Nanoimprinting; Single Molecule Detection of Soybean Cyst Nematode DNA using Nanoparticles and Microfluidics; Pioneering Nanoscale Applications for Plant Breeding and Genetic Analysis: Nanoliter Scale Extraction and Analysis of DNA and RNA from one or a few cells; and Sequencing the Soybean Cyst Nematode Genome Using a Novel Nanotech Approach. A white paper has been drafted that focuses on the potential of nanotechnology applications in food and agriculture research. For investigation of policy and managerial implications of biotech development and adoption, an innovative approach has been identified and tailored to meet the needs of this research area. Data on actual collaborations between academic researchers and the private sector have been obtained from a number of major research universities. That data are being analyzed and will provide essential input into further analysis of the driving forces and impediments to effective university/private sector collaboration relating to agricultural biotechnology. The NSRL uses the Internet (www.vipsoybeans.org; www.stratsoy.uiuc.edu; www.nsrl.uiuc.edu) to effectively and rapidly disseminate research findings to the soybean industry, especially soybean growers. The VIPS and StratSoy sites are comprehensive tools including information spanning the soybean market channel, and the NSRL site includes presentations, publications, and news about research generated by the Center and other research programs.

b. Impact – Identifying soybean genes responding to pathogens provides information for developing disease response models and provides resistance markers for plant breeders. Hybrids between soybean and G. tomentella have high potential for resistance to soybean rust, soybean cyst nematode, bean pod mottle virus, and

soybean aphid. Nanoscale technology is the next frontier in the quest for soybean disease solutions and allows scientists to address research questions at the infection interface, sample DNA from several cells, or detect pathogens at a single cell scale. The SDBC has facilitated research collaborations among nanotech and soybean biotech scientists, and the resulting research will allow leverage of additional ag-nanotech research. Academic research has a vital role to play in the future evolution of agricultural biotechnology independently or in conjunction with nano and information technology. This research will provide an enhanced understanding of the impediments and advantages associated with collaboration between academic researchers and the private sector.

c. Source of Funding – USDA Special Grant

d. Scope of Impact – State

Key Theme – Diversified/Alternative Agriculture

Sustainability of Organic Systems in Illinois

a. Progress – Transition trials continued on the Organic Research Transition plots on the University of Illinois South Farm Research and Education Center in Champaign. Results are demonstrating the relative economics of low intensity, intermediate intensity, and high intensity agricultural 'transition to organic' production systems. The six acres of plots will be certified organic next year, and cumulative results of the project presented. The outcome will inform conventional farmers about the issues. To disseminate results from research related to organic production around the state, the Second Annual Organic Production Conference was held in January, 2006. Attendance was 40% higher than at the initial conference in 2005, and included popular presentations by researchers, Extension staff, farmers, marketers, and others interested in increasing organic production in Illinois. Research projects are being planned across the state of Illinois to test vegetable and fruit varieties for their potential use in organic production systems. Projects will be sited in northern Illinois (St. Charles Research and Education Center west of Chicago), South Farm REC in Champaign-Urbana, and the Dixon Springs Agricultural Center in southern Illinois. A 'standard' organic system, most relevant to the local environment, is being designed to test these varieties for disease and pest resistance, quality and yield, appearance, nutrient and water needs, and overall commercial organic potential. The results of current varietal trials, although generally useful for organic growers, are difficult to

interpret because of differences in soil, weed, disease, and insect pest management practices. A wide variety of small research trials are being conducted by farmers across the state, based on issues most relevant to their farms. This allows field-relevant studies to be conducted on sites that suffer from specific fertilizer and pest management problems. Results are expected to be presented in public meetings across the state. To disseminate research results, six tours were held as part of the 'Sustainable Agriculture Tour' series. The focus of these tours is to provide University of Illinois Extension, other agriculture educators and the public with an opportunity to learn 'first-hand' about the diversity of farms across the state. A survey was distributed at each of the six tours. Some items of interest: 84% of those responding to the surveys felt that tours were useful to very useful; 70% of tours provided them with answers to their questions and 75% tours provided resource materials that they could use.

b. Impact – As economic and environmental pressures mount on the current row-crop system that dominates much of the upper Midwest, alternatives for the productive, sustainable use of this land are needed. Current examples of successful farmers (including organic operators), detailed analysis of their operations, along with on-farm research, provide means for defining a diverse and robust Illinois landscape of the future.

c. Source of Funding – Hatch

d. Scope of Impact – State

Key Theme – Emerging Infectious Diseases

A Potential Mechanism for Environmental Persistence of Prion Disease

a. Progress – We examined 118 chronic wasting disease (CWD) negative and 32 CWD positive deer collected in Northern Illinois by the IDNR surveillance program. When possible, each individual deer studied was matched to a negative control by age, sex, and kill date. Absence or presence of disease was confirmed by the State diagnostic laboratory in all samples. Samples of skeletal muscle were taken from each animal and preserved in ethanol. DNA extraction was performed on the preserved samples followed by PCR amplification of the prion protein gene locus, PCR product purification and DNA sequencing. Prion sequences were compared to a consensus sequence from all Odocoileus virginianus sequences published to date. Nucleotide sequences were translated into

corresponding protein sequences and both nucleotide and protein sequences compared to the reference sequence. In total we found 13 different nucleotide polymorphic locations. Five of the nucleotide polymorphisms have previously been published; however, the majority of the differences we observed are exclusive to the Illinois samples. Multiple polymorphisms were uncommon in Illinois deer. Most of the observed nucleotide polymorphisms were silent when translated into protein sequence. A glycine to serine (G>S) change at amino acid 96, which was previously reported, was the most commonly observed polymorphism, which was present in about one quarter of the deer. The polymorphisms observed in Illinois deer in prion protein amino at acid positions 95 and 96 are present in the prion metal binding domain and metal binding is known to alter prion disease.

b. Impact – The threat that CWD poses was formalized in a declaration by the U.S. Secretary of Agriculture that "the possibility CWD from deer and elk could cause disease in humans or in domestic livestock ... is an emergency that threatens the livestock industry of this country" (Federal Register 2001). The polymorphisms observed in Illinois deer in prion protein amino at acid positions 95 and 96 are present in the octapeptide repeat region which is a metal binding domain. This domain is also at the beginning of the disease-causing protease resistant fragment (PrP 27-30). Metal binding is known to alter prion disease and may represent a mechanism for binding to metal containing-minerals in soils in the environment. It has recently been demonstrated that CWD may be transmitted to non-human primates increasing the importance of research to better understand transmission and disease process. Such research will help protect meat animal agriculture as well as natural resources.

c. Source of Funding – Hatch

d. Scope of Impact – National

West Nile Virus – Illinois

a. Progress – We examined spatial and temporal distributions of mosquito infection rates and bird seropositive rates in the vicinity of Champaign-Urbana, Illinois. The main West Nile virus (WNV) vectors were Culex pipiens and Culex restuans, outnumbering detections of all other species by 30 to 100 fold. Culex salinarius and Cx. tarsalis (implicated as major vectors in northeast U.S. and west of the Mississippi River, respectively) were present in low abundance and were only rarely positive for WNV. Numbers of

Culex pipiens peaked in August and Cx. restuans peaked in July. Degree-day and maximum temperature models (threshold 27C) predicted Cx. pipiens crossover in 2005 to within a day of observed crossover. The largest number of WNV-antibody positive birds were House Sparrows, Northern Cardinals, American Robins, Mourning Doves, and Gray Catbirds. Analysis of Culex specimens was consistent with the avian seropositive rates, verifying the role of Culex and passerine birds as primary vectors and hosts. Captures of seronegative bird species suggested either low exposure rate or high mortality rate. The temporal patterns of infection rates in mosquitoes and seropositive rates in birds did not parallel each other, except with juvenile birds, reflecting the confounding nature of seasonal bird dispersal patterns and year-to-year survivorship of antibody positive birds. We are sequencing West Nile virus strains collected from different location in Illinois. We also designed DNA probes to discriminate between Culex pipiens, Cx quinquefasciatus, Cx restuans and Cx salinarius, the main WNV vectors in Illinois. We have also developed a real-time PCR technique to detect and quantify West Nile virus vectors, which will help determine the role of each mosquito species in WNV transmission and help target our approach to surveillance and control. In addition to the PCR technique, a new marker derived from Wolbachia bacterium specific to Culex pipiens and Cx. quinquefasciatus was developed and is being used to study the distribution of the two species in Illinois.

b. Impact – These studies help determine which species of mosquitoes are likely vectors of WNV, which helps to target specific control measures. The information on bird infections will aid in assessing morbidity and mortality of Illinois wildlife to WNV, and also to predict which species can serve as bridge vectors of the virus. We showed that the distribution of one vector -- Culex quinquefasciatus -- is expanding north. Moreover, we detected intermediate forms (hybrids) of the two species during the winter. This can have very important health implications because Culex quinquefasciatus -- which bites preferentially mammals including man -- cannot overwinter, whereas Culex pipiens - which feeds mainly on birds -- can overwinter. Their hybrid forms could serve as bridge vector for the transmission of West Nile virus to humans. Using the DNA probes to discriminate between Culex pipiens, Cx quinquefasciatus, Cx restuans and Cx salinarius will help us understand the dynamics of the main WNV vectors in Illinois. The study is yielding results that will be of value in mosquito management programs, ensuring that infections of humans can be minimized through science-based management recommendations.

c. Source of Funding – USDA Special Grant

d. Scope of Impact – State

The Role of Mucolysis in Clostridium Perfringens-Induced Necrotic Enteritis

a. Progress – This research concerns necrotic enteritis (NE), a common poultry disease caused by Clostridium perfringens that leads to necrotic lesions in the intestine, resulting in growth depression or mortality. We discovered with a piglet model of total parenteral nutrition that C. perfringens is a particularly mucolytic bacterium . Our goal is to better understand the molecular basis of mucin degradation by commensal bacteria in general and C. perfringens specifically. This information may reveal novel targets to control C. perfringens growth in an antibiotic-free manner and hence control NE in birds and related disorders in pigs. The project addresses the hypothesis that Clostridium perfringens can metabolize intestinally-derived mucin to facilitate its growth, which provides a selective growth advantage to C. perfringens when intestinal perturbations increase mucus production and digesta passage. It is hypothesized that mucin-mediated growth activates quorum sensing genes and subsequent toxin production resulting in NE. Therefore, identification of the molecular basis of mucolysis by C. perfringens may reveal novel targets to control C. perfringens growth in an antibiotic-free manner and hence control NE in birds and related disorders in pigs. The past year focused on 1) completing and submitting a manuscript that describes a broiler chick model of NE we developed with researchers at the College of Veterinary Medicine at The University of Georgia, and 2) initial set-up and validation of the semi-continuous chemostats that will be used to compare the ability of a pure C. perfringens culture to grow and produce toxin A in a standard growth medium versus a medium in which mucin is the sole carbon source.

b. Impact – Clostridial or necrotic enteritis is a worldwide poultry disease caused by the bacterium C. perfringens type A or less commonly type C. The disease is seen most commonly in young broilers (2-5 weeks of age), but also occurs in older pullets and layers. Clostridia begin to proliferate in the chick small intestine after the first two weeks of life, and clinical disease with high mortality results if excessive growth takes place. Subclinical disease does not result in mortality but reduces growth performance. Traditionally, revenue losses associated with NE have been diminished via antibiotic usage. However, the European ban on sub-therapeutic use of antibiotics has led to an increase of

disease. These and impending similar bans in the U.S. are being implemented prior to the elucidation of the mechanisms underlying antimicrobial growth promotion. In addition to the effects of antibiotic removal, the prevalence of NE is increased in birds that are infected with coccidia or fed non-soluble polysaccharide feed-stuffs, both of which increase host mucus production. Recently, we demonstrated that C. perfringens is highly mucolytic, and our subsequent studies demonstrate that C. perfringens and bacterial-derived mucolysis are positively correlated to the prevalence and severity of NE in a chick model. These findings indicate a role of mucolysis in the onset of NE. The data generated from this proposal will reveal the molecular basis of mucolysis in C. perfringens, and thereby identify novel mechansims to target for disease control.

c. Source of Funding – Animal Health and Disease, Industry, Other Non-Federal Funds

d. Scope of Impact – National

Key Theme – Home Lawn and Gardening

4-Seasons Teleconference Series

a. Homeowners garden for several reasons, including enhanced beauty of property, food production, therapeutic effect, recreation, enhanced value of property, controlling chemical use in their own personal environment, exercise, saving money, and energy conservation. Gardening is the number one hobby in the United States and a major source of exercise for many Illinois residents.

To help meet the needs of gardeners, University of Illinois Extension has offered a total of 12 different sessions by distance education each year for the past four years. The attendance for the 2006 session was 3,719. For the four years the sessions have been offered, the attendance is more than 13,800.

b. Impact – Based on previous mail survey work, depending on the topic, between one in five to two out of every three will have followed up on a recommended practice. This means there have been at least 2,700 to more than 9,100 changes in practice due to the sessions.

- ♦ More than 96 percent would recommend the sessions to others.

- More than 80 percent would share the information learned with others and on average would share the information learned with at least five people.

Applying this to the total attendance of more than 13,800, information from the sessions will have been shared with more than 69,000 non-participants.

- Almost 90 percent or more than 12,400 would be more satisfied with their gardening efforts.

- Two-thirds (more than 9,200) credit the sessions with gardening to having a higher level of physical activity (exercise).

c. Source of Funds – Local, State, Federal

d. Scope of Impact – Illinois

Key Theme – Innovative Farming Techniques

Research on Agricultural Infotronic Systems

a. Progress – This research aims to develop a systems technology for information management integration using a computer. This systems technology can integrate information gathering, data processing, task planning and automated execution functions to support more effective crop production. Efforts have been focused on designing the infrastructure of a computer-integrated crop production (CICP) system. In addition, a multi-function stereovision-based intelligent control technology, capable of performing 3D crop row tracking for tractor guidance, 3D field mapping for crop growth assessment, and 3D terrain recognition for tractor rollover prevention has been developed. All the developed technologies have been preliminarily validated via field tests. Further investigation is necessary to fully develop these technologies for practical use in precision agriculture productions. The impact of this research is very significant because it will provide agricultural producers with a handy tool to make use of technologies being developed for practicing precision farming efficiently, and allow producers to benefit from the technology advancement.

b. Impact – The impact of this research is to provide crop growers a useful tool to practice site-specific management in their production. One of the major obstacles for crop growers to practice

site-specific management is the lack of effective methods to manage the site-specific operational data and make optimal operational decisions based on these data. The agricultural infotronics technology will provide a means for managing the production data automatically on the operating machinery or remotely via a central service station. Therefore, this research has both technical significance and societal importance.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Key Theme – Plant Genomics

Plant Cell Cultures as Biochemical and Genetic Tools

a. Progress – Since selectable markers are needed to select out the rare transformed cell during genetic engineering and the commonly used antibiotic and herbicide resistance marker genes are objectionable to many, we are attempting to develop new markers. One is the feedback resistant form of anthranilate synthase, the tryptophan biosynthetic control enzyme from tobacco. Expression of this gene imparts resistance to otherwise toxic tryptophan analogs. We have highly expressed this gene in tobacco and find that it increases free tryptophan levels and does impart resistance to certain tryptophan analogs. We have also inserted the cyanamide hydratase from a soil fungus into soybean and found that the plants were more resistant to the toxic compound cyanamide since the enzyme produced can convert cyanamide into the nontoxic compound area. However, we were unable to successfully select transformants using the gene and cyanamide as selection agent. We found in earlier work that soybean seed isoflavone content varied from year to year in all genotypes. Thus we carried out a controlled greenhouse experiment to determine which environmental parameters might be important. The results showed that low temperatures and high soil moisture during seed fill increased seed isoflavones but the ranking among the five cvs. used remained the same. We used the promoter from the seed globulin-1 gene to regulate the expression of the anti-fungal enzyme chitinase. This was done to have expression in the seed in order to attempt to inhibit growth of the aflatoxin-producing fungus Aspergillus flavus. Many of the transgenic lines produced did express the gene in the seed. Measurement of the enzyme using antibodies showed that expression occurred not only in the embryo of the seeds, but also in the pericarp plus aleurone and in the endosperm. Thus the enzyme was found throughout the seed. The timing of expression

was similar to that found in normal seeds beginning at about 14 days after pollination. When we tested for expression in other plant tissues some expression was sometimes found indicating that the gene may be induced throughout the plant by certain conditions and not only in the seed.

b. Impact – New selectable marker genes are needed so that antibiotic and herbicide resistance genes, that are objectionable to the public, do not need to be used. We are attempting to develop at least three different new selectable marker genes that are from plants or microbes and feel that these should not be objectionable if placed in crop plants. The large effect of temperature and soil moisture on soybean seed isoflavone content explains at least in part why the isoflavone concentrations fluctuate from year to year. The results also show that genotype still controls the final content. The globulin-1 promoter results show that the promoter regulates gene expression as expected from past measurements, but the expression seen in tissues other than seed indicate that the promoter may not be seed specific.

c. Source of Funding – Hatch, Industry, Other Non-Federal Funds

d. Scope of Impact – National

High-Resolution Physical Mapping of the Apple Genome by BAC Fingerprinting

a. Progress – Two BAC libraries of apple cv. GoldRush consisting of over 85,000 BAC clones with inserts of ~115 kb were used for fingerprinting. A total of 80,000 BACs, representing more than 10X haploid genome equivalents of the apple genome, were fingerprinted. The average clone length estimated by fingerprinting is slightly less than that estimated by NotI digestion followed by pulsed-field gel electrophoresis. This might be due to multiplets - more than one fragment is located at nearly the same position on the gel. These fingerprinted clones were subjected to band calling using IMAGE v. 3.10b, and these were assembled using FPC v. 7.2 software. A total of 5,093 (8.2%) BAC clones were removed from assembly analysis because of non-recombinant clones, cross-contamination between clones, and number of bands less than 5. The assembly of these BAC clones was conducted using the parameters of 4 x 10-12 tolerance and cutoff, and contigs were merged by querying the FPC database at various stringency conditions. This provided a structural framework for a physical map for the apple genome consisting of ~3,600 BAC contigs. At this time, the apple EST database (over 300,000 ESTs) has been

screened for SSRs, and a subset of EST-SSRs has been mapped onto a genetic map for the apple.

b. Impact – The development of a physical map for the apple will generate a set of overlapping DNA segments for the whole genome of the apple. This will provide an important platform for pursuing the complete sequencing of the apple genome as well as pursuing comparative studies of different plant genomes.

c. Source of Funding – NRI Competitive Grant

d. Scope of Impact – National

Key Theme – Plant Germplasm

Genetic Manipulation of Perennial Plants

a. Progress – The nuclear DNA content for a group of 40 Malus species and hybrids has been estimated using flow cytometry. Estimates of nuclear DNA content for this germplasm collection range from 1.45 pg for M. fusca (diploid) to 2.57 pg for M. ioensis (triploid). Among diploids, the nuclear (2C) DNA ranges from 1.45 pg for M. fusca to 1.68 pg for M. transitoria. Among triploids, the nuclear (3C) DNA content ranges from 2.37 pg /3C for M. sikkimensis to 2.57 pg /3C for M. ioensis. In another thrust, transgenic McIntosh apple lines carrying either our cloned Vfa1, Vfa2, or Vfa4 (apple scab resistance genes found clustered within the Vf locus), grown in a growth chamber, were subjected to scab inoculation using a mixture of five races (1 to 5) of Venturia inaequalis (the fungal pathogen causing apple scab). Disease symptoms were assessed for individual plants from each of the transgenic lines for quality of resistance reactions and amount of sporulation. Transgenic lines expressing the Vfa4 gene were as, or more susceptible, than control (non-transgenic McIntosh). In contrast, Vfa1 and Vfa2 increased resistance to V. inaequalis in transgenic lines when compared to control. Fewer leaves were infected, and amount of sporulation was less in Vfa1 and Vfa2 plants than in control plants. Yet in another study, transgenic tomato lines carrying either an iris ribosomal-inactivating protein (I-RIP), a maize Beta-glucanase (M-GLU), or Mirabilis jalapa antimicrobial peptide (Mj-AMP1) transgenes were confirmed for their integration into the tomato genome using Southern blot hybridization. Transcription of I-RIP, M-GLU, and Mj-AMP1 genes in various transgenic lines was determined using Northern blot analysis. Plants of selected transgenic tomato lines were inoculated with a 2-3x104 conidial spores/ml suspension of the

fungal pathogen Alternaria solani, the causal agent of tomato early blight. Compared to control (non-transgenic) plants, two transgenic lines carrying either a M-GLU or Mj-AMP1 showed enhanced resistance to early blight disease.

b. Impact – Given the complexity of the apple genome and its suggested allopolyploid origin, the flow cytometry results obtained confirm earlier reports that polyploids can easily withstand the loss of a certain amount of DNA, and that there is a slight tendency towards diminished haploid nuclear DNA content with increased polyploidy. From our scab inoculation studies, it is apparent that Vfa1 and Vfa2 genes are both functional, and they are both involved in apple scab resistance, while Vfa4 is definitively non-functional and is not involved in resistance to apple scab. While three plant defense genes were evaluated for their resistance to early blight in transgenic tomato lines, two genes, maize Beta-glucanase and Mj-AMP1, have demonstrated resistance to early blight disease in tomato, and may prove ideal candidates for genetically engineering disease resistance in tomato.

c. Source of Funding – Hatch Funds

d. Scope of Impact – National

Key Theme – Plant Health

Biology and Management of Selected Soilborne Pathogens of Field Crops

a. Progress – The primary goal of this project was to improve understanding of the biology and management of several soybean and corn diseases. The focus is on the soybean diseases, Phytophthora rot caused by Phytophthora sojae and brown stem rot (BSR) caused by Phialophora gregata, and seed and seedling diseases of corn. This year we also conducted a project on the wheat and corn pathogen Fusarium graminiarum/Gibberella zeae using fungicides applied to wheat, and found that some triazole products were more effective for disease management than others in Illinois. Our work with Phytophthroa rot was focused on identification and characterization of partial resistance in soybean breeding lines from the University of Illinois and Southern Illinois University. We characterized a range of different levels of partial resistance in these lines. Work on BSR has focused on characterization of resistance in soybean based on colonization by two different genotypes of the BSR pathogen. A project was completed on analysis of soybean stems collected from specified

soybean varieties grown in multiple field locations in Illinois for studies of the distribution and host preference of P. gregata. The data collected this year provided further evidence that two different genotypes of P. gregata are distributed throughout Illinois, and one genotype appears to have the ability to infect and differentially colonize some soybean varieties with resistance to BSR. A project was also completed on treatment of corn seed with azoxystrobin to determine when we may see advantages to the use of this product.

b. Impact – In this project we are improving our understanding of the biology and disease management practices for several important diseases of soybean and corn in Illinois. The focus has been on Phytophthora rot of soybean, brown stem rot (BSR) of soybean, and seed and seedling diseases of corn. For soybean, these studies provide information on resistance to the various races of P. sojae found in Illinois as well as the potential value of partial resistance in soybean. Our results indicate that partial resistance in addition to specific major resistance genes may provide a means to manage Phytophthroa rot in problem fields where major gene resistance is no longer effective. Studies with BSR have confirmed that diagnosis is more challenging and BSR is more widespread in Illinois than is commonly recognized due to a common lack of externally visible symptoms. Resistance to BSR resistance depends in part on the genotype of the BSR pathogen being present in different locations. Work with seed and seedling diseases of corn has demonstrated that azoxystrobin can provide a benefit to yield and stand under some conditions, especially with seed of mediocre quality that has significant levels of seedborne fungal contamination. With interest in wheat diseases in Illinois increasing, we conducted studies on management of Fusarium head blight and determined that some fungicides are very effective if used properly. These studies are leading to improved understanding of the biology and methods to reduce risk of yield losses due to selected diseases.

c. Source of Funding – Hatch and Industry Funds

d. Scope of Impact – State

Regulation and Function of Safener-Inducible Glutathione S-Transferases in the Model Grass Species Triticum Tauschii

a. Progress – We are using the diploid wheat, Triticum tauschii, as a model plant and crop to study safener-inducible herbicide detoxification genes (glutathione S-transferases; GSTs) in cereal crops. The objective of this research is to understand the

expression of these GST genes (such as when and where they are expressed in the plant), and determine how they are regulated by herbicide safeners at the molecular level. In addition to using molecular techniques to examine safener-induced expression of GST genes, microscopy techniques and immunolocalization studies are being used to identify where GST proteins are located within the cell, before and after safener treatment. We are also using proteomics techniques to identify the entire complement of GSTs and novel proteins (non-GSTs) that are either up- or down-regulated in response to safener treatment in wheat seedlings. In our current and ongoing research, proteomic methods including 2D-PAGE were used to characterize and compare herbicide and safener-induced proteins in coleoptile, leaf, and root tissues of Triticum tauschii seedlings. Growth experiments showed that the safener cloquintocet-mexyl protected wheat seedlings (root and shoots) from injury caused by the herbicide dimethenamid. In total, 31 safener-induced and 15 herbicide-regulated proteins were identified by LC-MS/MS. These proteins were classified into 3 major categories based on protein expression patterns and were further categorized into functional groups. The largest functional category of safener-responsive proteins belongs to xenobiotic detoxification and metabolism (Phases I, II and IV). Phase III enzymes were not identified; however, RT-PCR results showed that two multidrug-resistance-related protein (MRP) transcripts were highly induced by safeners and were differentially expressed in three tissues of T. tauschii. Results indicate that safeners protect T. tauschii seedlings from herbicide injury by coordinately inducing enzymes and proteins involved in an entire herbicide detoxification pathway (Phase I to Phase IV) mainly in the coleoptile and root, and therefore protect new leaves from herbicide injury. Results also suggest that herbicides and safeners may trigger different signaling pathways involving different plant hormones. These signaling pathways may antagonize each other, leading to rapid herbicide metabolism, detoxification, and prevention of herbicide toxicity.

b. Impact – Herbicide safeners are chemicals that induce herbicide detoxification enzymes in cereal crops, thereby protecting them from herbicide injury. The ultimate goal of this research is the improvement of crop varieties ability to withstand abiotic stresses such as herbicides. Our findings contribute significantly to understanding the proteins and enzymes involved in herbicide detoxification in cereal crops, as well as gaining a fundamental understanding of the basic mechanisms of herbicide safeners for improving herbicide selectivity. From our microscopy studies, the localization of GST proteins in the vacuoles of subepidermal cells

of the coleoptile following safener treatment represents a novel finding that indicates a unique function of GST proteins in cellular detoxification processes, which was previously unreported in plants. Understanding herbicide detoxification mechanisms has great potential for increasing agricultural productivity by enhancing herbicide selectivity in crops and improving weed management systems in cereals. Our proteomics research results provide the framework for targeting which proteins are critical for the safener response, and possible manipulation through biotechnology. Recent discoveries indicate that safeners trigger the expression of proteins in a defense pathway that is normally regulated by plant hormones called jasmonates. This pathway is normally stimulated in response to insect feeding or by other types of stress, but it appears that herbicide safeners also induce genes involved in stress response within the same defense pathway.

c. Source of Funding – NRI Competitive Grant Funds

d. Scope of Impact – National

Key Theme – Plant Production Efficiency

Alfalfa Management Issues for 2006

a. On February 17, 2006 **a new program delivery effort** by University of Illinois Extension was offered. A workshop titled "Alfalfa Management Issues for 2006" was conducted via University of Illinois distance delivery/latitude bridge system. This was the first time for the subject matter to be presented via distance education across Illinois.

The half-day workshop consisted of five topics addressed by two out-of-state (Purdue and Wisconsin) Extension forage agronomists, two University of Illinois Extension Educators, and a staff member of the Illinois Crop Improvement Association. Each speaker made the presentation from his office utilizing audio (phone line) and PowerPoint slides via the Internet.

Specifics about the workshop included:

- 28 sites hosted the workshop (23 sites had people present)
- 85 people attended
- Highest attendance at any one site was nine
- Average attendance per site was three

b. Impact –

Participants were asked to complete an evaluation prior to leaving the meeting site. Sixty one evaluations were returned for a response rate of 72 percent.

The survey found:

- 5,380 acres of alfalfa were represented (grown or serviced)
- 56% and 16% of the respondents were producers and dealers (seed, fertilizer, chemical) respectively
- 16% of the respondents were Extension or agency (NRCS, SWCD) employees

From the survey, the percent of respondents that strongly agree or agree with the following statements were:

- *the information presented was useful* – 100
- *the program will help me make more informed management decisions* – 95
- *distance delivery format and quality was acceptable* – 96
- *I would attend another program delivered via distance education* – 100

Plans are being developed to offer another alfalfa workshop via distance education in February 2007

c. Source of Funding – State, Federal

d. Scope of Impact – Multi-State

Crop Management Conferences

a. In February and March 2006 the University of Illinois Extension "Crop Management Conference" programs were expanded to three regional locations in Northern, Central and Southern Illinois. This delivery effort encompassed programs targeted to reflect the regional issues that spatially occur across the state of Illinois. The Crop Management Conferences were conducted in Malta, Springfield and Whittington (Northern, Central and Southern Illinois, respectively). The conferences provided an in-depth focus on current crop production and field crop pest issues.

At each location, the conference was held on two consecutive days and consisted of general sessions and concurrent break-out sessions taught by University Specialists, Researchers, and Extension Educators. The conferences addressed topics identified by producers and agribusiness in the respective geographic areas.

Nearly 300 producers and agri-business (seed, fertilizer, chemical suppliers) representatives attended the conferences.

b. Impact - At each conference an on-site evaluation was conducted and the **combined summary of the respondents revealed the following**:

- ♦ 51% response rate
- ♦ 86% were Certified Crop Advisers
- ♦ 100% indicated if the conference was held again they would attend
- ♦ 99% indicated the content of the conference met their expectations
- ♦ 92% indicated their knowledge of new crop management techniques was increased as a result of attending
- ♦ 84% indicated they will implement new crop management technique(s) learned at the conference during the upcoming cropping season

The evaluation asked participants to list crop management technique or practices they plan on implementing as a result of the educational programs.

- ♦ Scouting for Western bean cutworm
- ♦ Application of new nitrogen recommendations
- ♦ Use of crop insurance in my farming operation
- ♦ Increased awareness of soybean rust and aphids
- ♦ Potential danger of herbicide resistant weeds, rotate herbicides
- ♦ More scouting, more testing of the use of fungicides and insecticides

c. Source of Funding – State, Federal

d. Scope of Impact - Illinois

Understanding the Variety Selection Process Followed by Illinois Soybean Producers

a. Progress - The main objective of this research project is to understand the decision making process of Illinois soybean producers to select varieties annually for planting in their fields. The relevance of Internet-based soybean variety selection tools to this decision making process also is being studied. This project is being accomplished through a series of research activities including: 1) Collecting secondary data on current patterns of Internet usage in Illinois; 2) Evaluating usage of the Varietal Information Program for Soybeans [VIPS] (www.vipsoybeans.org); 3) Conducting interviews with soybean community experts and surveying Illinois soybean producers; 4) Tabulating and analyzing the data collected; and 5) Devising strategies to position web-based soybean production databases as an integral component and decision support tool in the variety selection process for Illinois producers. Activities 1 and 2 have been accomplished and previously were reported. Continuing with activity 3, the project team will conduct interviews and surveys to determine producers' strategies used to select soybean varieties for planting. This survey intends to identify the sources of information used for variety selection and factors influencing producers' selection of variety. Prior to development of a survey instrument, the project team reviewed previously published literature seeking information about variety selection strategies. The most useful information was a survey conducted between 1998 and 2000 showing that sources of information used for variety selection include: seed company dealers, seed company field day test plots, other soybean growers, university performance trials, Co-op Extension agents, Illinois Crop Improvement composition tests, web sites, and others (bankers, end-users, family members). This same survey also showed that factors influencing producers' selection of variety included: maturity group, disease resistance, oil and protein content, company reputation, resistance to lodging, resistance to shatter, herbicide compatibility, previous experience, contract specifies variety, yield, seed price, and market acceptability. The survey instrument used to gather this 1998-2000 information was adapted and will be used to determine how Illinois producers rate these sources of information used for variety selection and how they rate factors influencing selection of variety. Additionally, the VIPS website is currently being redesigned to incorporate the factors influencing producers' variety selection strategies. These website enhancements include a new user interface, redesigned query structure, and new graphics presentation for query results.

b. Impact -Information about the characteristics of soybean varieties and the sources of variety information increasingly are becoming important factors influencing producers' variety selection strategies. Previous studies suggest that educational activities can influence producers' decision criteria. This project seeks to understand the variety selection process used by Illinois soybean producers. This information will promote strategies to effectively disseminate the latest research findings relevant to farming decisions, especially variety selection.

c. Source of Funding – Hatch Funds

d. Scope of Impact – State

Assessing Crop Rotation Effects in Illinois

a. Progress – The study underway examines the effect of rotational sequence and sequence order on the yields of corn (Zea mays L.), soybean [Glycine max (L.) Merrill.], and wheat (Triticum aestivum L.). Averaged over six years (2000-2005) at Perry in west-southwestern Illinois, no-till corn yielded 6 to 8 percent less than tilled plots when corn was in rotation, and about 11 percent less when corn was grown continuously. Corn in the corn-soybean (CS) rotation produced the same yield as corn following wheat or following soybean in the three-crop rotations, and about 25 percent more than continuous corn. No-till soybean yielded 1 to 5 percent more than tilled soybean in the different rotations. Soybean in the CS rotation yielded 3 percent more than continuous soybean, but about 7 percent less than soybean in the three-crop (corn-wheat-soybean and wheat-corn-soybean) rotations, which had similar yields. Wheat following corn in the three-crop rotation yielded about 5 percent less than wheat following soybean. Tillage did not affect wheat yield when wheat followed soybean, but no-till yielded 5 percent less than tilled when wheat followed corn. Using these yield data and current crop and input (for seed, herbicide, and fertilizer only) prices, the highest net return ($641 per hectare) was with tilled crops in the CS rotation. No-till in the CS rotation returned about 4 percent less, while crops in the 3-year rotation returned 5 to 6 percent less with tillage and 9 to 10 percent less with no-till. Continuous corn returned 12 and 28 percent less with and without tillage, respectively, while continuous soybean returned 21 and 18 percent less.

b. Impact – This work is continuing to provide information that will allow crop producers to assess relative economic returns to different cropping sequences and practices, particularly when

including wheat in the rotation in an area where the corn-soybean rotation is by far the most common. While the income from soft red winter wheat in Illinois is usually less than the income from corn or soybean, higher yields of soybean in the 3-crop system (corn-soybean wheat) produced a profit potential only slightly lower than that from the corn-soybean rotation at Perry. An additional advantage of such a rotation is the spreading out of field operations, less soil erosion, and slightly greater income stability due to the fact that wheat responds to weather conditions differently than do corn and soybean. Continuous cropping of either corn or soybean is likely to produce substantially less income than when these crops are rotated, with or without wheat. No-till produced lower yields and returns than tilled crops in all cropping systems except continuous soybean. It is possible, however, that some producers can cut costs when no-tilling on a large scale, hence producing returns similar to those from tilled crops.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – State

Antimutagens and Anticarcinogens from Agricultural Processing By-Products

a. Progress – The objectives of this research are: (i) to develop rapid mammalian-cell assays to detect antimutagens, antioxidants and cancer cell growth repressors, (ii) to chemically fractionate commercial processing by-products of soybean and corn, (iii) to isolate biologically-active compounds from these fractions, and (iv) to chemically characterize the antimutagens and/or cancer cell growth suppressors. We developed a novel microplate antioxidant assay based on the ferric thiocyanate reaction that allows for the rapid analysis of chemical fractions for antioxidant activity. Antioxidants are substances that delay or prevent oxidation of a substrate. Antioxidants aid the body against reactive chemical species, such as free radicals and active oxygen radicals. Reactive oxygen species can be the result of by-products from cellular activity or produced from external factors such as ultraviolet radiation, x-rays and environmental pollutants. Free radicals can damage the genetic material, proteins, lipids and carbohydrates and are often associated with carcinogenesis, mutagenesis, and aging. Antioxidants are used by food manufacturers to prevent deterioration of many products, such as the chemical spoilage and rancidity of foods that occur through lipid peroxidation of fats. We have analyzed a methanol extract of corn distillate solids (CDS),

the primary by-product of commercial corn ethanol production. This methanol extract of CDS was isolated and fractionated over C18 reverse phase column chromatography and fractions were analyzed for antioxidant activity. One fraction, CDS 50SG80, had high antioxidant activity. This fraction was analyzed on mammalian and human cells and it repressed the induction of oxidative stress damage to genomic DNA. Finding novel biologically active chemicals from a commercial by-product of a major Illinois agronomic crop is an important scientific and economic goal.

b. Impact – The value of the isolated antioxidants, anticarcinogens and tumor growth rate repressors is that they will ultimately reduce the cost of producing corn-generated ethanol and other commercial agronomic products. With the implementation of the new energy bill and the current attention to national security and the increased demand for ethanol as a bio-fuel and as a gasoline additive, the large amount of CDS by-product will pose economic and environmental burdens. The results of this research will maximize positive and minimize negative impacts of this commercial use of corn and may result in the generation of high value marketable products. This work may lead to an increased demand for soybean and corn products.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – State

Regulation of Photosynthetic Processes

a. Progress – One hundred plus years of divergent selection for grain protein concentration has produced the Illinois Protein Strains that differ greatly in their kernel composition; and with corresponding changes in C and N metabolism in the plant. We have previously shown that many attributes in the strains are also manifested at the hybrid level, including differences in grain protein, N uptake, and the partitioning of C and N to the grain. We take advantage of the strain hybrids in this study to identify metabolite levels associated with genetic and N-supply induced differences in plant N status. Hybrids of IHP and ILP (as males) with B73, and the reference genotype B73 x Mo17, were grown in the field with five rates of fertilizer N ranging from deficient (0 and 84 kg N/ha), to optimal (168 kg N/ha), to excessive (252 and 336 kg N/ha). The penultimate leaf, the ear shank (stalk subtending the ear), and the young earshoot were all sampled at flowering for amino acid analysis. Other whole plants (all above-ground portions) were

harvested at flowering and at physiological maturity for the determination of growth and total N uptake. Increasing the N supply from deficient to sufficient (i.e. from 0 to 168 kg N/ha) caused increases in plant growth, N uptake, and grain yield for all hybrids, while N levels above 168 kg N/ha had no additional effect. For all three hybrids, Glu and Asp were the predominant amino acids in the leaf accounting for 45 and 25% of the total, respectively, while Gln was the main amino acid in the shank (48%) and the earshoot (40%). Although the total concentration of amino acids increased in all plant parts as the N supply went from deficient to sufficient (i.e. from 0 to 168 kg N/ha), the only relative changes were an increase in Asn and a decrease in Glu. Similarly, the strain hybrids differed mainly in their levels (both absolute and relative) of Asn and Glu in the leaf, and Asn in the shank and the earshoot. IHP plants also contained 25% more N (on average) than ILP plants at flowering and 34% more N at maturity. The increase in the proportion of amino N as Asn with increasing N supply, and the higher Asn levels in IHP are consistent with the idea that Asn levels serve as an indicator of the source N status.

b. Impact – Understanding how the developing sink senses the plant's N status is paramount to developing maize genotypes that yield well under low N conditions. Since amino acids are the currency of N exchange throughout the plant, responses to N are likely mediated by changes in the amount and composition of amino acids present in the tissues. Our study supports this view and shows that the ability to convert assimilated N into a storage form like Asn, rather than more metabolically active forms (i.e. Gln, Asp, Glu), allows for a high capacity for N uptake.

c. Source of Funding – Multi-State, Industry, Other Non-Federal Funds

d. Scope of Impact – FL, GU, IL, IA, KS, KY, MI, MN, MO, NE, NV, ND, OR, PA, SC, TX, WA, WI

Conservation, Management, Enhancement, and Utilization of Plant Genetic Resources

a. Progress – Five-year evaluations were completed on 12 taxa of woody perennial plants received from the Plant Introduction Station in Ames, Iowa. Over the span of these evaluations, plants were subjected to moderate drought combined with much higher than average summer temperatures in at least one season. Taxa showing the best adaptation are listed along with plants that failed to survive. Growth data is given after each plant name (height x

width in m): Fraxinus mandshurica (3.6 x 1.2), Genista tinctoria (1.0 x 1.6), Hypericum androsaemum (0.5 x 1.3), Microbiota decussata (0.4 x 2.4), Quercus prinoides (1.8 x 1.5), Rosa x 'Carefree Sunshine' (1.5 x 2.0), Rosa x 'Knockout' (1.2 x 1.5), Salix pentandra (8.7 x 5.1), Spiraea flexuosa (1.1 x 1.1), Ulmus x 'Patriot' (8.7 x 5.3), and Xanthoceras sorbifolium (1.6 x 1.4). Genista tinctoria (Ames 25525) and Spiraea flexuosa suffered extensive dieback or plant death due to drought. Hypericum androsaemum sustained losses due to winter injury. Ten-year evaluations were completed on 7 taxa of woody perennial plants: Betula platyphylla selection (now named 'Fargo') (9.0 x 3.7), Diervilla x splendens (1.6 x 3.3), Foresteria neomexicana (2.3 x 1.0), Nyssa sylvatica (4.7 x 4.4), and Spiraea miyabei (1.3 x 2.3). Substantial losses were found in Aesculus pavia and Physocarpus ribesifolius due to drought. Bare-root liner plants of four taxa of common landscape trees, Acer platanoides, Fraxinus Americana, Fraxinus pennsylvanica, and Gleditsia triacanthos inermis, were planted in the field at three depths to determine the effect of planting depth on tree performance. Planting depths included: 1) the first branch root just below the surface, 2) the first branch root 15 cm below the surface, and 3) 30 cm below the surface. Stem caliper and shoot growth were measured over two seasons. Plants were provided with initial irrigation to aid in their establishment and only once after the first season. After two seasons of growth, there were no differences in plant trunk caliper or shoot growth for any of the four taxa. Plants were subjected to a moderate drought in their second season. The most shallow plants required staking to maintain their upright position in the first season.

b. Impact – Based upon 5-year evaluations, we had excellent performance from Fraxinus mandshurica, Microbiota decussata, Quercus prinoides, Salix pentandra, Ulmus x 'Patriot' and Xanthoceras sorbifolium. These deserve continued evaluation for landscape performance over the next 5 years. Based upon 10-year evaluations, Betula platyphylla 'Fargo' produced a nice columnar habit with minimal bronze birch borer infection, Diervilla x splendens produced nice coppery new leaves and yellow flowers, Nyssa sylvatica produced a very formal pyramidal habit with excellent orange to red fall color and Spiraea miyabei produced showy large flat-topped clusters of white flowers. All of these plants merit introduction to the landscape trade. The planting depth study shows that these four species are adaptable in terms of depth of planting and show no ill effects from planting too deep in the nursery. These findings contradict common nursery recommendations. Further studies are needed to determine if this phenomenon will continue with several additional years.

c. Source of Funding – Multi-State and Other Non-Federal Funds

d. Scope of Impact – CA, DE, IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, WI

CSREES GOAL II – A Safe And Secure Food And Fiber System

Indication of the Scope of Research and Extension Programs under Goal II-See Appendix A.

Under Goal II—A Safe and Secure Food and Fiber System, areas of study at the Illinois Agricultural Experiment Station include improving knowledge to meet the nutritional needs of infants and adults in developing countries [such as people living with HIV/AIDS in Honduras], improving milk yield, and a better understanding of food/feed supply chains.

Extension staff reached a significant number of Illinois residents (347,170) through food safety programs such as the refresher courses on food handling practices to ensure that food service sanitation managers maintained their required certification status.

Key Theme – Food Accessibility and Affordability

Future Foods – Illinois

a. Progress – Outreach accomplishments include development of low cost methods to increase protein content of diets of people in developing countries, especially among demographic groups that normally suffer from high levels of malnutrition. Pilot programs for South Africa were developed in partnership with local organizations. Programs include food technology training, education, and consumer acceptance studies. In the rotavirus (RV) project, it was found that isoflavones have anti-viral activity. The compound genistin at the concentration found in soy infant formula inhibits RV infection in vitro across a 16-fold dose range in part by inhibition of an enzyme signaling pathway. In the soy fiber project, the addition of fiber to the diet of newborn infants reduced diarrheal diseases, such as that caused by Salmonella. Consumption of dietary fibers enhanced specific aspects of the intestinal immune response. Strategies aimed at producing a spectrum of fermentation products along the length of the distal intestine may infer the greatest advantage to infants at risk for pathogenic infection. A subproject focused on whether soy protein hydrolysates inhibit the growth of leukemia cells without causing programmed cell deaths. The data suggest anticancer potential of soy protein hydrolysates formed by proteases available to the food industry. A new project focused on the role of soy and specific soy peptides on food intake, body weight, adiposity, and metabolism of lipids in animal models. The methodology has been developed and validated to test the effects of soy hydrolysates on food intake and

body weight when chronically infused into the brain (hypothalamus) of rats. Major aroma-active compounds generated under ultra high temperature (UHT) conditions and their impact on soymilk were determined by sensory and instrumental methods. Sulfur and sweet aromas increased with UHT temperature. A trained sensory panel evaluated soy protein isolates containing commercial masking agents and found significant differences in both the taste and aroma compared to unmasked control. Based on the chemical compositions of twelve masking agents, a series of off-odor reducing compounds have been chosen for further evaluation for their efficacy in masking selected soy off-flavor compounds. An in-house consumer test was conducted with 108 participants to test three model food systems: soymilk, soy yogurt and soy cheese to represent liquid, semi-solid and solid matrices. Consumers preferred refrigerated soymilks, followed by non-vegan (casein containing) soy cheeses, and sweetened soy yogurts were preferred the least in terms of overall degree of liking. Flavor profiles of the samples will be analyzed using a trained panel. In Honduras, due to the closure of their feeding program that assisted people living with HIV/AIDS in May 2006, a new partner for the research on the relationship between food security and nutrition and health outcomes was identified in India. It is anticipated that testing of the survey may occur in December of 2006.

b. Impact – These pilot programs will help improve knowledge on how food supply systems can be modified and will contribute towards development of a sustainable nutrition intervention model that will be applicable to developing countries. Soy isoflavones may represent a novel nutritional strategy to reduce the rotavirus infection. Understanding the role of fermentable fiber in modulating the infectious susceptibility of infants to Salmonella will help nutritionists to be better able to design formulas to optimally meet the nutritional needs of infants during normal and compromised states. This project will impact the food and agricultural sectors by determining a physiological rationale to support a new niche market of soy fiber in infant formulas, and will provide strategies to pork producers for potential use in the post-weaning period of growth stasis where there is decreased digestive and absorptive capacity of the small intestine and increased susceptibility to infections. These findings will introduce new perspectives into the nutritional and technological evaluation of soy products. Adequate treatment during processing could modify the structure and thus enhance the safety and availability of soy products to soy allergic individuals. Studies utilizing specific soybean peptides need to be continued to determine if they can be effective in a weight loss or maintenance program. Studies on

flavor components in soy will have a significant impact on promoting the sales of soy-derived food products by providing means to reduce the undesirable taste/flavor characteristics.

c. Source of Funding – USDA Special Grant Funds

d. Scope of Impact – Global

Key Theme – Food Resource Management

Designing Public and Private Strategies for a Consumer-Driven Agriculture

a. Progress – Research has been completed on the impact of potential antibiotic bans on costs of pork production, and has been reported in several journal articles. Such bans have been proposed as a strategy for preventing the development of antibiotic drug resistance. Research has also been completed evaluating consumer acceptance of soy foods. Research is in progress to understand how subsidized soy foods can benefit HIV positive individuals in a poor country through helping them to maintain healthy weight and reduced illnesses. Survey results are being analyzed and preliminary results have been obtained. Another area of research examines the impact of food safety regulation on consumers and producers. Much of that work has been completed, and several publications have appeared this year.

b. Impact – The basic research questions addressed under this project are the appropriate roles of government, life science research, and the private sector to manage product related risks arising from a post-modern agri-food system that involves multinational firms, global trade, dynamic product innovation, biotechnology, livestock disease, and heightened food safety concerns. Our findings have identified the role of new technologies, private certification systems, and regulation in stimulating improved food system performance in risk reduction.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – Global

Membrane Technology in Food Processing

a. Progress – The recovery of additional co-products from the dry-grind ethanol process could impact the industry greatly, as most facilities today rely on subsidies and tax incentives. A process

combining solvent extraction with membrane technology was developed to recover the oil. Several nanofiltration membranes were tested for flux and rejection of selected solutes in ethanol, as well as stability. The membranes were initially conditioned with pure solvent containing increasing concentrations of ethanol. Flux decreased with increase in ethanol concentration and increased at higher temperatures and pressures. The type of solute had an influence on membrane rejection profiles. The DK membrane from GE-Osmonics showed increasing rejection of polyethylene glycols (PEG) dissolved in ethanol from 29% at a molecular weight (MW) of 200 to 80% at MW 1,000. However, the MW of sugars and lipids had little or no effect on rejection with the DK membrane; their rejection averaged 87%. In contrast, the TFC-SR1 membrane from Koch showed higher rejections with higher MW compounds: lipid rejection increased from 19% to 71%, sugars from 35% to 85% and lipids from 77% to 89%. The TFC-SR2 membrane was much more open and showed lowest rejections of all these compounds. Flux generally showed opposite trends, with the DK showing the lowest flux and the SR2 the highest. Solutions of corn oil in ethanol and the corn extract yielded clear permeates when processed through these membranes. The retentate contained zein and other potentially high-value fractions soluble in ethanol, in addition to the corn oil.

b. Impact – The data is sufficient for purposes of scaling up to pilot and semi-works scale. Apart from the additional revenue generated by corn oil (about $3 million for a 30 million gallon per year ethanol plant), other advantages of the COPE process are that low-energy and low-temperature separation and concentration methods are used, a substantial portion of the ethanol solvent is recycled and the corn oil contains high concentrations of nutraceuticals which are normally not extracted with hexane solvents.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Key Theme – Food Safety

Mastitis Resistance to Enhance Dairy Food Safety

a. Progress – Ultrasound is used to detect structural changes in the mammary gland associated with milk flow obstruction, abscessed and fibrosis. However, the usefulness of ultrasound for detecting structural changes associate with acute clinical mastitis and determining prognosis has not been established. We conducted a

prospective study to characterize ultrasonographic changes in the mammary gland, teat, and ipsilateral prefemoral lymph node during experimentally-induced E. coli mastitis. Ultrasonographic findings in cows with experimentally-induced mastitis were compared with findings in cows with naturally-occurring E. coli mastitis. Five healthy multiparous Holstein cows in early lactation were inoculated in one front mammary gland with 106 cfu of E. coli after each of two consecutive milkings. Physical examinations were performed every 2 to 12 hours after inoculation to determine the course of clinical illness. Seven pre-determined locations on the cranial and lateral surfaces of the mammary gland and midpoint of the teat were evaluated for echotexture, edema, and debris in the secretion before inoculation and every six hours thereafter, using a portable ultrasound machine with a 7 MHz transducer. Thickness of the ipsilateral prefemoral lymph node, thickness of the teat wall and diameter of the teat cistern lumen were measured. Ultrasonographic findings at the peak of experimental illness were compared with those for 10 lactating dairy cows admitted to the Teaching Hospital with naturally-occurring clinical E. coli mastitis. Debris was observed in the mammary secretion of all mastitic cows. Cows with experimentally-induced mastitis developed subcutaneous edema but had minimal change in glandular echotexture. In contrast, glandular hyperechogenicity was the most prominent finding in cows with naturally-occurring mastitis. The teat wall was thicker and the prefemoral lymph node tended to be larger in cows with experimentally-induced disease. Results suggest that pathophysiological changes accompanying experimental E. coli mastitis differ from those accompanying naturally-occurring E. coli mastitis. Any future studies investigating the prognostic utility of ultrasonography should be performed in cows with naturally-occurring disease. Because the main finding in cows with naturally-occurring mastitis was glandular parenchymal hyperechogenicity, which is difficult to quantify, the usefulness of ultrasonography for assessing clinical mastitis severity remains questionable.

b. Impact – Because we have shown that ultrasonographic changes in the mammary gland differ between cows with experimentally-induced E. coli mastitis and those with naturally-occurring E. coli mastitis, future studies on the diagnostic and prognostic utility of ultrasound should be conducted using cows with naturally-occurring disease.

c. Source of Funding – Multi-State, State Funds

d. Scope of Impact – IL, IA, KS, LA, MI, MN, MO, NYC, OH, PA, TN, VT, WA, WI

Food Toxicology and Safety

a. Progress – Genistein and daidzein are the main isoflavones in legumes. We evaluated the estrogenic potential of daidzein and synthetic (+/-)-equol on estrogen-dependent breast cancer (MCF-7) in vitro and in vivo. Equol is an intestinal bacterial metabolite of daidzein. We hypothesize that estrogenic effects of daidzein and (+/-)-equol could modulate the growth of MCF-7 cells in vitro and implanted in ovariectomized athymic mice. At concentrations between 0.001 and 50 uM, daidzein and (+/-)-equol stimulated the growth of MCF-7 cells with maximal stimulation at 1 uM. To evaluate their effects on the growth of MCF-7 cells implanted in ovariectomized athymic mice, two dietary dose-response studies [daidzein (125, 250, 500, and 1000 ppm) and (+/-)-equol (250, 500, and 1000 ppm)] were conducted. Tumor size and body weight were monitored weekly during the study. At completion of the study, we analyzed cellular proliferation of tumors using immunohistochemical staining (ki-67), pS2 expression in tumors using a real time quantitative reverse transcription polymerase chain reaction (qRT-PCR), and total daidzein and (+/-)-equol levels in plasma using liquid chromatography-electrospray tandem mass spectrometry (LC-ES/MS/MS). Dietary daidzein had a slight but significant stimulatory effect on MCF-7 tumor growth in mice. No significant induction of pS2 mRNA (an estrogen-responsive marker) in tumors by dietary daidzein was observed. Total plasma daidzein concentrations in plasma were between 0.25-1.52 uM. Dietary equol treatment (for 37 weeks) did not stimulate MCF-7 tumor growth. There were no statistical differences in tumor size, proliferation, and pS2 expression among any treatment groups. Total equol concentrations in plasma were 2.10-3.21 uM. In conclusion, daidzein and (+/-)-equol have proliferative effects on MCF-7 cell growth in vitro within the concentration range tested. Dietary daidzein had a slight but significant stimulatory effect on tumor growth whereas (+/-)-equol did not stimulate the growth of estrogen-dependent breast tumor growth in athymic mice, did not increase the cell proliferation in tumors, and did not induce an estrogen-responsive pS2 expression. Total daidzein or (+/-)-equol levels in plasma detected in mice fed the isoflavones were in the range that stimulated MCF-7 cell growth in vitro. These results suggest that pharmacokinetic and/or metabolic factors attenuate the estrogenic effects of daidzein and equol in vivo.

b. Impact – These investigations are significant because this indicates that both daidzein and its metabolite equol are estrogenic in vitro but not in vivo and suggests that these compounds do not enhance tumor growth in vivo.

c. Source of Funding – Hatch, State, and Other Non-Federal Funds

d. Scope of Impact – National

Mastitis Resistance to Enhance Dairy Food Safety

a. Progress – We have previously determined that exposure of dry cows to a short day photoperiod (SDPP) of 8 hours light:16 hours dark improved immune function during the periparturient period. In those studies, however, cows were exposed to SDPP for 8 to 9 weeks, which follows the traditional recommendation of a 60 day dry period. There is recent interest in reducing the length of the dry period to 4 to 6 weeks. The effect of that reduced duration on SDPP response is unknown. Therefore our objective is to investigate the impact of a 42 day dry period with exposure to SDPP on subsequent immune function of transition cows.

b. Impact – Results of this study will guide recommendations for application of short day photoperiod to dry cows that have a reduced duration dry period. Exposure to SDPP has been consistently shown to improve milk yield in the next lactation, and it is non-invasive and easily implemented at the farm level.

c. Source of Funding – Multi-State, State Funds

d. Scope of Impact – IL, IA, KS, LA, MI, MN, MO, NYC, OH, PA, TN, VT, WA, WI

Key Theme – Food Security

Management of Grain Quality and Security for World Markets

a. Progress – Research within this project focuses on the issue of agricultural value creation and capture from grain quality management. It suggests that there has been confusion in industry and among academics about the marketing of output traits. Many have looked at grain attributes as products, much as the pharmaceutical industry looks at drugs. This product marketing approach has not been successful for the numerous life science,

farm, cooperative, and handler organizations that have attempted to create super-commodity value. Our work suggests that an industrial marketing approach would be more effective. Such an approach would change how firms and universities attempt to commercialize grain output trait innovations. Additionally, the industrial marketing paradigm leverages knowledge management in the form of product/service bundles. Enhanced communication, active measurement and assessment, and extensive horizontal and vertical coordination are critical for suppliers seeking to serve customers' needs. While traceability appears to have limited intrinsic value in the marketplace, there are numerous second-order benefits from more effectively controlling quality and managing the input and product flows among enterprises. The twist in this approach is that grain is inherently of a very low value. Commodities continue to provide value for customers, so there exists significant 'discipline' in the marketplace for those seeking to offer customers a differentiated offer. Recent advances in nano, biological, radio frequency, and near-infrared technologies, and associated informatic systems provide an opportunity to better match the low cost per unit information costs with the underlying low value of grain attributes. A final finding from the research is the role played by industrial clusters allowing for greater value creation and capture by agricultural suppliers. Entrepreneurial rent-seeking, and both Marshallian and Krugman agglomeration economies serves as important positive feedback mechanisms.

b. Impact – The focus of this research is to better understand coordination, cost, and control challenges with open grain to food/feed supply chains. The two overriding issues explored are the management of quality going forward (identity preservation) or the management risk going back (traceability). Additionally new research has begun looking at the role industrial clusters play in the process of supplier value creation and competitiveness.

c. Source of Funding – State, Multi-State Funds

d. Scope of Impact – IL, IN, IA, KS, KY, MI, MN, MT, NE, ND, OK, TX, WA, WI

Key Theme: Foodborne Illness

Commercial Food Handlers Need to Wash Their Hands Too

a. According to the National Restaurant Association, the average food-borne illness outbreak costs a single business $75,000 including lost business, medical costs and litigation. As of 1999,

Illinois requires certified food service sanitation managers to attend a minimum of five hours of training to retain their certification. Over the past six years, 3,527 food service staff have been re-certified through refresher courses taught by University of Illinois Extension Educators. These courses have done more than meet a minimum re-certification requirement; over 79 percent reported improving one or more food handling practices as a result of the training. Since many establishments have only three or four certified employees, one can assume that this training has impacted more than 1,000 establishments (assuming 3.5 trainees per establishment).

b. Impact – 2,786 food handlers improved one or more food handling practices.

- Nine-hundred twenty-four food establishments now serve safer food.

c. Source of Funds – State, Federal

d. Scope of Impact – Illinois

CSREES GOAL III – A Healthy, Well-Nourished Population

Indications of the Scope of Research and Extension programs under Goal III – See Appendix A.

Research studies related to Goal III (A Healthy, Well-Nourished Population) conducted through the Illinois Agricultural Experiment Station include effective ways to lower cholesterol, preventing obesity, decreasing the risk for various chronic diseases including cancer, determining the impact nature exposure can have on lowering the risk of cardiovascular diseases, and the impact of elevated carbon dioxide and ozone on soybeans.

By far, the greatest number of Extension teaching contacts occurred in addressing this goal. Nearly one third of Extension's 2.8 million face-to-face teaching contacts in 2006 were involved in educational programs focusing on health and nutrition. Extension programs addressed senior wellness empowerment, healthy food choices and food preparation skills for youth, and healthy food choices and food preparation for the diabetic diet.

Key Theme – Human Health

Characterization of the Effects of Isoflavones [Gentistein] on Hepatic LDL Receptors

a. Progress – While there is an approved FDA food labeling health claim for soy protein and reduction of serum cholesterol, the exact mechanism whereby soy reduces cholesterol is not known. We hypothesized that the estrogenic properties of soy isoflavones, in part, reduces serum cholesterol and that the mechanism of action might be mediated by estrogen receptor alpha (ER-a). Male, ~55 day old ER-a knockout and wild type C57BL6 mice were assigned to receive 1 of 3 high fat, cholesterol containing diets: casein protein, low-isoflavone soy protein (ISP-) or high-isoflavone soy protein (ISP+) (n=12). ISP+ and ISP- are commercially available soy protein isolates. The major difference is that for ISP-, ethanol extraction is used during protein concentration that results in the removal of most of the isoflavones and some other bioactive compounds from the protein. A control group for each genotype was assigned to a standard laboratory pellet diet to determine usual cholesterol levels in C57BL6 mice (n=8). Mice were fed their specific diets for 12 weeks. As expected, the high fat, cholesterol-containing diets enhanced serum cholesterol and liver lipids compared to the standard lab diet. The major finding was that for both genotypes the ISP- diet resulted in elevated serum and hepatic

cholesterol levels compared to ISP+ (serum and liver) and casein diets (serum only). There was a significant effect of genotype with ER-a knockout animals having higher serum but lower liver cholesterol levels than the wild type mice. These results show that, in this mouse model, the lack of ER-a resulted in elevated serum cholesterol but decreased net liver accumulation of cholesterol. This might be the result of reduced uptake or synthesis of cholesterol by the liver. The results also confirm that cholesterol reduction by soy protein requires the presence of the isoflavone fraction from the soy protein isolate. This fraction is lost during ethanol extraction of soy protein.

b. Impact – The results to date suggest that for persons with mildly elevated serum cholesterol, the choice of soy foods containing isoflavones will be the most effective way to lower cholesterol. Most soy milks, tofu and soy nuts along with foods containing soy concentrate or soy isolate processed from water-washed soy are the best for healthy blood lipids.

c. Source of Funding – Hatch and Industry Funds

d. Scope of Impact – National

Dining with Diabetes

a. Illinois has the sixth largest prevalence of diabetes in the U.S., with approximately 567,000 adults having been diagnosed with diabetes. It is estimated that an additional three million people in Illinois are at increased risk of undiagnosed diabetes because of the risk factors of age, obesity and sedentary lifestyles.

During 2005 and 2006, 3,241 people with diabetes and/or their caregivers participated in the educational series, Dining with Diabetes. All U of I Extension Nutrition and Wellness Team Educators have been involved in the statewide implementation of this dynamic program. Not only have significant knowledge and behavior results been achieved, but coalitions have been forged with state and local agencies as well in order to improve the health and wellbeing of those with diabetes in Illinois.

Dining with Diabetes is a nutrition education program with cooking demonstrations for people with diabetes and their families. Extensively revised by Illinois Extension Educators over the past three years, the three sessions plus a six-month reunion meeting are designed to help participants better plan a healthy food intake, thus leading to better control of blood glucose levels. Each session

includes tips for managing diabetes, cooking demonstrations and taste testing of healthy recipes.

To supplement all of these activities, quarterly newsletters are made available to over 20,000 people a quarter and this year a website was established: http://www.urbanext.uiuc.edu/diabetes2/intro.cfm

The goals of Dining with Diabetes include:

- Increasing knowledge of healthy food choices for the diabetic diet.
- Presenting healthy versions of familiar foods that are easy to prepare.
- Demonstrating cooking techniques that use new or more healthful ingredients.
- Encouraging behavior changes by providing tasting of healthy foods.
- Providing opportunities for participants to share and learn from one another.

b. Impact - Overall, mean post-test knowledge scores have improved from 67% to 84% correct. There was significant improvement in the participants' belief that they could overcome barriers to achieving a healthy diet. They also felt more strongly that there were benefits to their health if they maintained a healthy diet.

Comments from participants:

"This class answered many of my questions on preparing diabetic meals."

"Portion size — I really watch my serving sizes."

"I was able to lose 22 pounds and bring my blood sugar down from 148 to 118."

"Began watching total carbs instead of just sugar."

"I am more aware of different oils and the best types for heart health. I know I can have a little sugar in meals — if controlled. I found this class very, very helpful."

c. Source of Funds - Local, State, Smith-Lever

d. Scope of Impact - Illinois

Illinois Senior Wellness Initiative- 2006

a. Progress - The overall goal of this project is to educate, inspire and empower rural seniors to improve their health and that of their community. This is a grass roots program where teams of rural seniors participate in an experientially-based holistic wellness conference and then receive a mini grant of $500 to transfer their knowledge into a local community wellness project or event. Additional goals include:

- ♦ meet new friends
- ♦ experience joy, fun and excitement
- ♦ obtain cutting-edge, credible health and wellness information for yourself and others in your community
- ♦ become acquainted with exhibitors, speakers and staff
- ♦ understand the importance of nature, laughter and health in daily well-being
- ♦ learn about leadership and activities planning
- ♦ increase knowledge of funding sources to support local wellness programs/events
- ♦ develop a realistic action plan to implement a wellness activity or event in one's community

In 2005 the Illinois Senior Wellness Initiative won a University of Illinois Extension team award for Outstanding or Innovative Program.

b. Impact –

Select Examples of Local Wellness Programs Developed by Participating Communities:

"Calhoun County Wellness" Team

- ♦ built a wellness resource collection at the Calhoun County Library
- ♦ purchased a collection of books and DVDs on the following topics: diabetes, cancer, heart disease, lowering salt, lowering cholesterol, weight training, stretching, pilates, Tai Chi, yoga, memory, meditation, walking, water aerobics, and more
- ♦ wrote a newspaper article about the Wellness Resources Collection and gave away prizes to the first 15 people to check out materials

Sangamon County "Abe's Babes" Team

- ♦ implemented the "Get Moving with Abe's Babes" wellness program that featured lectures on health and wellness
- ♦ shared healthy homemade soups and offered the recipes
- ♦ offered weekly/monthly exercise programs of walking, chair exercises, dancing and biking
- ♦ purchased and distributed "File for Life" emergency information packets to seniors.

Sterling/Whiteside "FIT for Life" Team

- ♦ offered a "Fit for Life" ten-week program designed to help people make healthy lifestyle choices and offered reduced fees for seniors to attend
- ♦ session topics included: making smart choices and preventing disease, motivation & exercise, staying flexible and maintaining balance, bone & joint health, healthy cooking, fitness options, preventing diabetes, stress relief, and working with a personal trainer
- ♦ "FIT" members enjoyed line dancing, product sampling from grocery stores, introduction to clubs and organizations, senior swim class, CPR demonstration,

YMCA and park district facility tours, safety, and yoga demonstrations

Jerseyville "Swinging Seniors" Team

- An ISWI team member became certified as an N'Balance instructor and will offer N'Balance classes throughout Jerseyville County

- offered "Be a Santa for a Senior" program where the community bought "wish list gifts for local seniors in need and held a bake sale to raise additional money to purchase items for "Be a Santa"

- bought games, cards and dominoes to play on senior activity day

- a member taught the team basket weaving

- planted flowers for homebound residents in the area

Additional Evidence of Impact:

- Conference attendees rated the 2006 Senior Wellness conference very high with a mean score of 9.78 out of a possible 10 (on a 10-point scale where 1=very dissatisfied and 10=very satisfied)

- The thirteen participating communities have implemented a total of 23 new wellness programs and events in the last year.

- Across the thirteen communities approximately 2500 individuals have participated in the wellness programs and events.

What Senior Wellness Team Members Liked Most About The Program:

- *"The infusion of the sprit toward wellness."*

- *"The variety of programs and topics offered."*

- *"I liked the people I met at the conference!"*

- *"The content and information provided at the wellness educational sessions were excellent."*

- *"You gals always do such a great job on this. You're a joy to work with all year long. Thank you."*

c. Source of Funding – This project is funded by State of Illinois, Attorney General's Office (Vitamin Anti-Trust Settlement Grant) and U of I Extension (state and federal)

d. Scope of Impact - Illinois

Regulation of Phosphatase Expression and its Impact on Body Fat Deposition

a. Progress – In contrast to experimental models of rodents, the mechanism by which humans adapt to fasting is not well understood. We used piglets as a model to study how humans mobilize stored fat in response to fasting because pigs share important characteristics with humans. Our study indicates that piglets use the same mechanism as rodents for adaptation to fasting. The results were published this year. The second study to elucidate how dietary fructose increases fat synthesis is in the stage of manuscript preparation.

b. Impact – Obesity is a growing health problem in the U.S. Agricultural and food research can play a pivotal role in preventing obesity. Understanding basic regulatory mechanisms of fat deposition/mobilization has an impact on obesity prevention in multiple ways. The knowledge can be used to 1) improve dietary recommendations for weight maintenance and reduction for consumers, 2) produce leaner meat for the animal industry, and 3) increase health benefits of products for the food industry.

c. Source of Funding – Hatch, Industry Funds

d. Scope of Impact – National

Phytochemicals and Cancer Suppression

a. Progress – The crudiferous vegetables, which include broccoli and similar plants, have been identified as possessing phytochemicals called isothiocyanates that have cancer protective properties. We have evaluated the effectiveness of these isothiocyanates as inhibitors of breast cancer. When both animal and human breast cancer cells were treated with the isothiocyanate sulforaphane, there was a marked blockage of cell multiplication. This effect of

sulforaphane was noted not only in cell culture studies, but also in an animal model for breast cancer. Furthermore, a new mechanism of action of sulforaphane was discovered, as a disruptor of the function of cell structural proteins called microtubules. This action of sulforaphane is similar to that of a class of cancer drugs currently used in therapy, called mitotic inhibitors. Currently, additional studies are being conducted to better characterize the inhibitory effect of sulforaphane on human breast cancer cells.

b. Impact – Americans are being encouraged to increase consumption of plant foods so as to decrease their risk for various chronic diseases including cancer. Our findings with sulforaphane support this recommendation and highlight another benefit that cruciferous vegetable intake may have in opposing cancer development. Information from these studies also may contribute to the development of cancer prevention strategies in which natural products alone and in combination with drugs may be used to increase cancer inhibitory effectiveness with fewer unwanted side effects.

c. Source of Funding – Hatch, Other Non-Federal Funds

d. Scope of Impact – National

Modeling Plant Cell Culture Systems for Bioactive Product Recovery and Analysis

a. Progress – In vitro cell, suspension, and organ cultures for isoflavones were developed for kudzu and red clover genotypes, and preliminary elicitation studies were conducted. Novel isoflavone C-glycosides were elicited from root cultures of Pueraria lobata (kudzu; Illinois accession). Metabolic profiling with HPLC-UV and LC-MS revealed a series of 45 isoflavone metabolites and isomeric forms. Petiole-derived suspension cultures of red clover (Trifolium pratense) proved to be the most prolific in vitro source of isoflavones, in levels comparable to field-grown plants. After chemical elicitation with CuCl2, predominant isoflavones recovered from the suspension culture were formononetin, biochanin A, daidzein, and genistein. All in vitro culture work in the past year was conducted with locally-obtained plant accessions, and herbarium specimens were deposited at the Illinois Natural History Survey herbarium.

b. Impact – By scaling up production of elicited root cultures and hairy root cultures of kudzu and red clover, a natural production factory for metabolically-active isoflavones has been engineered.

Using the same in vitro custom-constructed radiolabeling systems we previously developed for grape and berry cell cultures, we will be capable of harvesting labeled isoflavones for metabolic tracking studies, and conclusively determine the localization of these plant compounds in human organs.

c. Source of Funding – Hatch, State, Other Non-Federal Funds

d. Scope of Impact – National

Human Nature Relationships and Conservation Behavior

a. Progress – Longitudinal Conservation Study: We continue to enter data for the 7 time points in this longitudinal study. Agrarian/Urban Lifestyle Effects: We are reviewing literature and consulting with colleagues in order to develop measures to examine extent of contact with nature and its effects on environmentally-responsible attitudes and behavior. Perception of Human Naturalness/Unnaturalness: We are nearing completion of data analyses on this project. A draft manuscript is being prepared. Humans, Pets, and the Environment: We delivered a paper from our previous survey at the meeting of the Society for Human Ecology. Valuable feedback from attendees is being used to construct a questionnaire for a follow-up study. A draft manuscript has been prepared and will be submitted soon. Living Community and Environmentally-Responsible Behavior: The design of this study has been solidified and we continue to search for appropriate communities and measures. Life Experiences: We are currently interviewing an additional twenty subjects for this study in order to strengthen quantitative analyses.

b. Impact – The results indicating a positive relationship between environmental attitudes and pet animal attachment are the first to link pet keeping with a pro-environment orientation. We believe this finding provides support for the idea that people in developed countries may be trying to reduce alienation from the natural environment by bringing animals into the home. In addition, our longitudinal study of conservation behavior is among the first to examine changes in conservation over a long time period (1982-2003). Our studies of perceptions of human-nature relationships also represent the vanguard of this area of inquiry. We expect that these studies will have lasting impact not only on scientific study of human-environment relationships but also on environmental policy and management.

c. Source of Funding – Hatch Funds

d. Scope of Impact – National

Urban Nature and Human Autonomic Functioning

a. Progress – The research is designed to determine the dose-response curve for the effect of urban nature on physiological responses to stress in humans. The central hypothesis is that moderate increases in exposure to urban nature (in the form of trees, grass, and open spaces) results in measurable reductions in blood pressure, heart rate variability, and hormonal levels associated with stress. Through a series of studies, we will determine the dose of nature (concentration, duration, and frequency of exposure) necessary to produce autonomic profiles indicative of low risk for cardiovascular disease and stroke.

b. Impact – There is a critical gap in our knowledge regarding the shape of the dose-response curve for the effect of nearby nature on autonomic functioning. We expect to determine the dose of nature (concentration, duration, and frequency of exposure) necessary to produce autonomic profiles indicative of low risk for cardiovascular disease and stroke. Thus, the research is significant, because it is expected to provide the knowledge necessary to help reduce the incidence of cardiovascular disease and stroke, the number one and number three killers of North Americans, respectively. As an outcome of these studies, there is the promise of new preventative strategies for the treatment of chronic autonomic activity associated with stress. These new approaches are expected to augment the efficacy of traditional therapies significantly, especially for the 80 percent of Americans living in metropolitan areas, many of whom have little or no contact with nearby nature. In addition, the findings may be particularly important for African American residents of inner city neighborhoods due to the combination of increased risk that African Americans have for cardiovascular disease and stroke and the paucity of nature in most inner city neighborhoods. Finally, we expect the results will fundamentally advance the fields of environmental health and urban design.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Maximizing Health Benefits of Crucifers

a. Progress – Broccoli contains the glycoside Glucoraphanin that undergoes myrosinase-dependent hydrolysis to release the anticarcinogen sulforaphane (SF) when broccoli is crushed. We have shown that broccoli contains a myrosinase cofactor, epithiospecifier protein (ESP) that directs hydrolysis away from SF towards an inactive nitrile. Heating broccoli to 60 degrees centigrade for five minutes prior to crushing significantly increases bioactivity, whereas heating to 70 destroys activity. The reason for this is that heating to 60 destroys ESP, increasing SF yield, whereas heating to 70 destroys both ESP and myrosinase, and no SF is formed. Most broccoli is eaten cooked. We therefore evaluated cooking methods for their effects on SF formation. Steaming for 2-3 minutes differentially destroys ESP, whereas boiling or microwave cooking even for one minute destroys both ESP and myrosinase. Briefly heated broccoli sprouts are similarly more bioactive than fresh sprouts. When rats were fed broccoli powder from broccoli that had undergone prolonged cooking, a small amount of SF conjugate was found in the urine, indicative of bacterial hydrolysis of Glucoraphanin in the gut. This conjugate had similar bioactivity to SF when added to cultured cells.

b. Impact – Epidemiological studies show that significant protection from cancer requires that individuals include at least 3 to 5 servings a week. Yet only a very small fraction of our population eats broccoli this frequently. We have shown that by heating only briefly, broccoli can be a little more effective than when eaten raw and very much more effective than when eaten following prolonged cooking. Thus more people can gain the health benefits, even without increasing their intake.

c. Source of Funding – NRI Competitive Grant Funds

d. Scope of Impact – National

Enhancement of Food Lipids for Human Health

a. Progress – Our work with the SOYFACE project has made significant progress into the investigation of soybean quality as a result of growth in elevated carbon dioxide and ozone. We have a particular emphasis on the impact on lipids and on health related components, i.e., minerals and antioxidants. Our research has demonstrated that elevated CO2 results in a decrease in certain key minerals, namely calcium and zinc. These minerals are essential to the plant physiology as well as to human health. Due to

associations of these minerals with germination and quality as well as specific enzymes, particularly superoxide dismutase, it is expected that the change in mineral composition may dramatically affect lipid stability and human health. We are also investigating changes in phenolics, such as isoflavones, that have potential antioxidant capabilities. Oxidative stability studies of soybean oil and meal are in progress. We are continuing our ACP research into the impact of alteration of ACP isoforms on composition and content of oils in Arabidopsis thaliana plants. Leaf major isoform alterations in Arabidopsis seed are currently being studied. Our experiments investigating the substation of honey for high fructose corn syrup and EDTA (a synthetic antioxidant) in salad oils is complete and being written for publication. Blueberry honey was quite effective at reducing oxidation over a one year storage period and could be a great replacement for the sweetener and EDTA in salad dressing emulsion systems. Also, we have published our work on the antioxidant properties of honey wine (mead). We completed a human feeding trial with grapes and raisins to investigate the impact of consumption on reduction of oxidative stress. We have also generated the first comprehensive report of the ORAC (oxygen radical absorbance capacity) antioxidant capacity and phenolic composition of changes that occur in processing grapes into raisins. This research is currently being compiled into a manuscript.

b. Impact – Our work with elevated carbon dioxide and ozone is demonstrating previously unreported impacts on quality of soybeans. Our mineral work will be the first report of such a study and is already gaining much attention through our presentations at meetings. This should be a significant insight into nutritional and plant physiological implications of future atmospheric conditions affecting plants. Our work on honey as a source of natural antioxidants is popular in light of the emphasis away from high fructose corn syrup and also from synthetic chemical additives, such as EDTA. Honey performed much better than anticipated initially in stabilization of salad dressing formulations. This should be helpful to the food industry. Our grape and raisin research is expected to reveal important information regarding bioavailability of such antioxidants and their ability to protect against oxidative stress.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Key Theme – Human Nutrition

Youth Cooking Schools

a. Cooking Schools have taught basic nutrition, food safety and food preparation to youth between the ages of eight and 12 years. Directed toward low-income youth, the educational campaign is conducted at no cost to the children.

In the past four years, more than 31,500 youth have participated in more than 400 schools; each school consisting of five half-days of hands-on educational activities.

Getting children involved with food is an effective way to improve eating habits and health. Hands-on cooking experiences can expose children to new foods, teach them about healthful eating and develop their sense of self-efficacy. This experience increases the likelihood of a change to better eating habits. Plus, according to the young cooks, "It's lots of fun!"

Cooking Schools are a collaborative effort. For instance, a retired chef from Marriott donates his time at one site in Peoria. And all the programs have achieved a high degree of visibility and success in their communities.

Outcomes have been determined by pre- and post-tests. After participation in the program, more children reported following safe food practices, preparing food items and selecting foods according to the Food Guide Pyramid. Typical outcomes (summarized across multiple sites and two years of pre- and post-tests) include: over 18 percent showed increases in knowledge about how bacteria can cause food poisoning. On average, 12 percent gained knowledge on how to avoid cross-contamination of food. In a 2000 study more than 20 percent increased their post-test score in their ability to safely handle ground meat. The increase in youth who can correctly identify the number of servings of bread and cereals, fruits and vegetables, and meat and meat alternates was statistically significant across sites and years. Youths showed a statistically significant average gain of two points on the post-test after the program. Over two-thirds (68 percent) showed a gain in post-test scores over pre-test scores.

More recent schools have emphasized the role of activity increase a child's health and combating childhood obesity.

b. Impact – Sixty-eight percent of youth show gains in food safety, nutrition and preparation tests

c. Source of Funds – Local, State, Federal

d. Scope of Impact – Illinois

CSREES GOAL IV – Greater Harmony Between Agriculture and the Environment

Indications of the Scope of Research and Extension Program under Goal IV – See Appendix A.

In order to advance knowledge to create greater harmony between agriculture and the environment, areas of study at the Illinois Agricultural Experiment Station under Goal IV include the use of biofilters to reduce odor and gas emissions in livestock buildings, improving indoor air quality to reduce the impact of "sick building syndrome", and the implementation of integrated pest management programs.

University of Illinois Extension staff collaborated with both public and private organizations and institutions to offer education addressing livestock facility regulatory requirements and odor and nuisance concerns, worker protection during agricultural pesticide application, mapping of watersheds, and conservation reserve enhancement. Through these efforts and other programs such as soil and water management workshops, Extension staff members were involved in 171,000 face-to-face teaching contacts.

Key Theme – Agricultural Waste Management

Animal Manure and Waste Utilization, Treatment and Nuisance Avoidance for a Sustainable Agriculture

a. Progress – Biofilters for removing odors and gases from animal confinement building exhaust ventilation air need automatic moisture sensing and watering systems to keep the filters working. We are developing, testing and comparing two types of sensors. Our program for commercializing technology for converting swine manure and various other waste materials to a crude oil product is continuing. We have successfully demonstrated a continuous flow process for oil production. Illinois commercial manure haulers need continuing education in environmental protection and management practices. We have developed and delivered two more Level 1 and 2 training modules for a total of six in the series, and have trained a group of haulers.

b. Impact – Biofilters have been shown to reduce odor and gas emissions by up to 80%. Our moisture sensing systems will remove one of the main management barriers to widespread adoption of biofilters on Midwest mechanically ventilated livestock buildings. Conversion of swine manure and other waste solid materials to crude oil product will provide alternative

chemical feedstocks to replace petroleum, and will also represent an income stream for farms. Training of commercial manure haulers will reduce incidences of environmental impacts from improper use of animal manures, and will enhance use of manure as a substitute for increasingly expensive commercial fertilizers.

c. Source of Funding – Multi-State, State Funds

d. Scope of Impact – AL, AR, CA, CO, FL, GA, GU, HI, ID, IL, IN, IA, KY, LA, MI, MN, NE, NC, OH, SC, TX, VA, WI

ILIFT Livestock Facility Siting

a. In Illinois and the Midwest, livestock farms must compete for space with other types of enterprises including housing developments. Environmental and nuisance concerns tend to drive livestock out of the state even though the economic benefits of livestock production to the state are very significant.

The program's goal is to improve the climate for livestock production facility siting – new construction and expansion – by educating livestock producers about (1) state and federal environmental regulations and (2) odor and nuisance controls for improving neighbor and community relations.

The program was multifaceted:

- On-farm surveys of Illinois swine CAFOs to see how well the producers are adopting suggested management practices and following environmental regulations. The survey results were used to evaluate and improve our training programs and to teach producers the larger scope of how their industry is affected by environmental management.

- Train Illinois-based commercial manure haulers in day-to-day management, safety and emergency management practices. The training focuses on managing environmental impacts and nuisance issues related to land application of manure. The manure haulers' group comprises about 30 haulers around the state. The training is part of a voluntary certification program aimed at improving the image and overall performance of the manure hauling segment of the livestock industry.

- Provide web-based access to the Illinois Manure Management Plan, a book of forms, instructions and resources that help producers write a fully-functional manure management plan satisfying three state agencies' planning and reporting requirements.

- Provide web access to other environmental-compliance and management tools, such as a manure spreader calibration spreadsheet, instructions for building a sludge boat to measure solids depth in a lagoon, and the NRCS Ag Waste Management Field Handbook.

- Provide a web-based tool (EZregs) that enables users to quickly find the state and federal environmental regulations that affect producer operations.

b. Impact -

In Illinois there are approximately 3,000 production facilities of a size reached by this program. Of the 3,000 total, about 500 are considered "large CAFOs". All 3,000 facilities are considered part of our audience for various programs.

- The farm survey (36 swine CAFOs across the state) has provided valuable training information in the form of contrast between good and poor CAFO managers. Data and anecdotal information are being built into producer training sessions. Producer responses during the survey ranged from "I didn't know that regulation exists!" to "If I had seen how to put together this emergency response plan, I may have saved my farm buildings during a fire." The survey also brought out success stories, most notably how livestock operations were able to co-exist in close proximity to non-farm neighbors with minimal conflicts.

- The manure haulers' certification program has enabled several of the Illinois haulers to obtain environmental insurance at rates approximately 30-40% below market (and some haulers obtained environmental insurance for the first time due to awareness raised by the training program). Illinois and other Great Lakes states continue to coordinate development of certification modules in order to make all the training materials available to all the states as needed.

- Regulatory agencies and commodity organizations in Illinois have responded to our call for funding assistance for the web-based Illinois Manure Management Plans project, and the website development is proceeding on schedule for a February 2007 launch date. We anticipate at least 100 facilities using the web service the first year, as the producers begin to use the planner to get their Manure Management Plans constructed for compliance with Illinois regulation and for access to federal cost-share programs. Once the Manure Management Plans are on the web, the producers will use the calendar feature to add management tools, improving their operation's regular maintenance and inspection protocols.

- The main livestock facility siting website has been populated with a number of tools that can help producers with facility planning and manure management. This site will become a main portal to other projects within the scope of the livestock siting and environmental regulations focus.

- EZregs has been highlighted in regional news media, magazines, commodity group newsletters, and on several local radio stations. There are already requests within University of Illinois Extension to add regulation segments for other business entities besides livestock and crop production, e.g., day care providers. The potential audience for EZregs is huge just in the state of Illinois. http://web.extension.uiuc.edu/ezregs/

c. Source of funding – State, Federal

d. Scope of impact - Illinois

Key Theme – Air Quality

Indoor Air Quality for Livestock Buildings

a. Progress – In the past year, we have developed and installed a 3-D multipoint particle sampler in a swine grower finisher barn to measure the particle spatial distribution. A total suspended particle (TSP) sampler has been developed. Two other related projects are development of a uniflow deduster for air cleaning and a volumetric particle tracking velocimetry to characterize the air flow field. Non-intrusive, full scale, quantitative and instantaneous measurement techniques for airflow in entire aircraft cabins (versus single point measurements) are needed, especially in the

area of developing CFD models. We have developed a 3-D volumetric particle tracking velocimetry (VPTV) technology to measure the cabin air flow under iso- and non-isothermal conditions, and various obstruction conditions. The data are animated using a Cave Automatic Virtual Environment (CAVE) facility. The outcome of the study will allow scientists to gain better understanding of air flow and pollutant transmission and, ultimately, to improve the air quality and human health within airspaces. We continue to work with Deere and Company to characterize harvesting field debries and their interaction with the cooling systems. It is critical to have a clearer understanding of the physical properties, mechanical behavior and testing procedures to evaluate the performance of the air cleaning/cooling system. The objective of this proposed Phase I is to characterize the physical properties and plugging mechanisms of different types of debris.

b. Impact – Indoor air quality has a profound impact on quality of life and our economy. Increasing concern of indoor air quality is largely contributed to the awareness of poor health, the so-called sick building syndrome (SBS). The SBS of the building inhabitants can be defined as the illness and discomfort associated with poor indoor environments but with no clear identification of the source substances. Symptoms of SBS include irritation in sensory organs (eyes, noses, throat, ears and skin), fatigue, headache, respiratory disorder and nausea. Approximately one million buildings in the United States are sick buildings, within which 70 million people reside or work. These sick buildings do not include agricultural buildings such as animal facilities and grain elevators. Most of these agricultural structures have unique, often more serious, air quality problems. The air cleaning technology could also have a positive impact on off-road machinery cooling system design. The most immediate impact of this project may be the particle sampling technology (and instrumentation) that we have developed. The TSP, for example, has been used in several national air quality studies for its advantageous features of accuracy, reliability and ease of operation. It employs a unique critical flow rate controller and isokinetic sampling heads to provide a much better sampling accuracy compared with many existing samplers.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Key Theme – Integrated Pest Management

Dynamic Soybean Pest Management for Evolving Agricultural Technologies and Cropping Systems

a. Progress - Soybean growers face newer management challenges to go with longtime problems posed by bean leaf beetles, spider mites, and Japanese beetles and newer problems due to soybean aphid and soybean rust. Also among the relatively recent challenges known to soybean producers (who are also corn producers), is management of the western corn rootworm beetle (WCR) in rotated corn and soybean. Since the mid-1990's, soybean fields have been a main egg-laying (and feeding) site for WCR beetles with behavioral resistance to crop rotation. Because few soybean acres are not rotated with corn, overwintering eggs of WCR deposited in soybean fields will hatch the next year when the field is rotated to corn, the best host for WCR larval development. Soybean field monitoring is needed to determine if populations of egg-laying WCR are great enough to threaten rotated corn the following year. Few growers invest in WCR population monitoring since use of soil insecticides during corn planting or planting a rootworm-resistant transgenic corn hybrid can virtually insure that corn avoids economic injury in the following year. With the reasons why a soybean grower might make some type of foliar applications to soybean increasing (i.e., aphid- or rust-targeted insecticide or fungicides), the notion of adult WCR control in soybean is gaining attention. In practice, insecticide treatments for soybean aphid are undoubtedly killing some egg-laying WCR, though frequent interfield movement by WCR females means that multiple insecticide treatments would likely be needed to kill an appreciable number of egg-laying females and timing would be critical. Most WCR interfield movement studies focus on movement out of cornfields and into rotated crops. In this project, the focus is on WCR re-entry into cornfields from soybean fields. Abundant WCR in soybean is diagnostic of the rotation-resistant WCR. WCR entering soybean fields to feed and/or lay eggs must eventually return to cornfields feed; soybean tissues, though eaten, do not provide nutrition to WCR adults. Ingested soybean tissue inside WCR adults captured at the edges of cornfields is used to measure local levels of rotation-resistant WCR activity. Availability of EnviroLogix QuickStix detection devices specific for the CP4 EPSPS protein expressed in Roundup Ready soybean (RR-soybean) permits detection of ingested RR-soybean tissue in WCR adults for 24 hours after soybean feeding; strong evidence that a beetle has recently returned to a cornfield (a non-Roundup Ready cornfield) after feeding in soybean. In 2006 we learned the

highest proportions of soybean-into-corn movement occurred in late July, between 7-10 am and 10 am-1 pm. Few returning females advance beyond the first row of corn at the edge of the field. This method may be useful to identify areas at risk from rotation-resistant WCR: The proportion of WCR females from row 1 of cornfields that fed in a soybean field in the last 24 hours was 10 times higher in areas with known rotation resistance (0.07) vs. areas with rotation-susceptible (0.007) WCR populations. This quick test could improve IPM-based monitoring.

b. Impact - Rotation-resistant western corn rootworm beetles (WCR) use soybean fields as egg-laying sites. In areas dominated by annual crop rotation, corn grown in the former soybean fields during the next year can suffer very serious yield reductions. Unlike soybean aphid, corn and soybean producers can monitor soybean fields to assess the risk of rootworm injury to corn later grown in those fields. In this project, detailed measurement of WCR activity and interfield movement is being used to investigate new behaviorally-based monitoring tools and to consider the potential for insecticide treatments aimed at other soybean pests to reduce WCR egg-laying. Current monitoring methods cost ca. $50 for materials per field and require placement of 12 yellow sticky traps in soybean fields for 4 weeks to gather insect abundance data for determination of WCR risk to first-year corn; few growers conduct monitoring. A behaviorally-based assay that detects evidence of rotation-resistant WCR interfield movement activity returns information about local levels of this activity in a few minutes. This method would also cost ca. $50, but because the collections used to run the test are made at the edge of the cornfield and it is done only once per season, more growers may conduct monitoring. Studies indicate that ca. 10% of fields in affected areas actually have WCR populations that do not need treatment. Avoidance of unneeded treatment would save ca. $17 per acre on those acres. Over 4.7 million Illinois acres are threatened, avoiding treatment on 10% of these would save over $8 million annually.

c. Source of Funding – Multi-State Funds

d. Scope of Impact – AR, GA, IL, IN, IA, KS, KY, LA, ME, MI, MN, MS, MO, NE, ND, OH, SD, TN, TX, VA, WI

Worker Protection Standard (WPS) Compliance Program

a. Worker Protection Standard (WPS) for agricultural pesticides was implemented in 1992 to reduce pesticide exposure for employees

handling and working around pesticides in the course of their employment. WPS employer responsibilities include providing pesticide safety training, pesticide use information at a central location, accessible decontamination sites, and employee emergency assistance. The federal legislation has been amended numerous times since its inception and employers may be uncertain of their compliance responsibilities, especially pesticide safety training for employees. To address this issue in Northern Illinois, sixteen hybrid seed corn processing/conditioning facilities, a wholesale greenhouse grower and a fresh vegetable processor were surveyed to determine their need and interest in participating in a University of Illinois Extension-sponsored **Worker Protection Standard Compliance Program Update**. Responses indicated a need for the program which was held at a central location for the responding facilities.

Thirty participants from eight facilities attended the three hour program which utilized a "train the trainer" emphasis for employer WPS compliance. Program topics included pesticide safety topics as required by EPA for employee training and current WPS provisions/amendments. Also, a question and answer session was held regarding compliance and available training materials.

In addition, participants received one of the following:

--A WPS Worker Training Verification Card (valid for five years).

--A WPS Handler Training Verification Card (valid for five years).

--A certificate indicating that they have received *Worker Protection Standard Train-the-Trainer* instruction which meets the U.S. EPA's requirements to be certified to provide WPS training for employees.

b. Impact –

- A program evaluation instrument, implemented at the program conclusion, indicated 100 % of the respondents agreed the program information and discussion was ***very useful*** or ***moderately useful***.

- Participants also indicated overwhelmingly that they would prefer a *WPS Compliance Update* be offered every two-to-three years.

- Individual comments included *"thanks for all your support", "excellent PowerPoint presentation", "overall good training session", "good program", and "lots of regulations to convey in a meeting in a reasonable time frame".*

- Lastly, several facilities requested a copy of the PowerPoint pesticide safety presentation to incorporate into their WPS employee training.

c. Source of Funding – State, Federal

d. Scope of Impact - Illinois

Key Theme – Land Use

Environmental Economics and Policy: Space, Heterogeneity and Agent Behavior

a. Progress – We have made much progress on a variety of research efforts in environmental economics related to agriculture, industry, water quality and supply management, the behavior of decision makers, and valuation. 1) We are studying the potential for Miscanthus to sequester carbon in Illinois soils. We explored socially optimal land use in Illinois and the policy incentives, such as carbon credits, needed to achieve it. 2) We use data on lands enrolled in the Conservation Reserve Program and the Conservation Reserve Enhancement Program in Illinois to compare alternative policies to enroll a given land acreage. We find that CREP reduces sediments in the Illinois River, but it is very costly because it does not enroll lands selectively. 3) We are studying the potential for the adoption of plant-based oils for lubrication in the metal working industry; we have developed a conjoint choice survey that was given to metal working facility managers in 2006. 4) We have developed a defensive purchasing theory of motor-vehicle choice in which the choice made by one consumer depends on choices made by other consumers, and show that policy changes may have surprising effects on car purchases, safety, and pollution. 5) We have compiled a data set on performance, organizational structure, and merger activity of small water supply utilities in six Midwestern states. We are examining these data to understand factors that help explain changes in organizational form. 6) We have been finalizing papers that model groundwater extraction in a manner that is spatially explicit and based on the integration of economic and civil engineering concepts. This work yields very different conclusions regarding groundwater management than have emerged from the traditional literature (e.g. users of an aquifer have larger negative effects on one another than has been previously thought). 7) We investigated the determinants of firm-level technological change that reduces unregulated emissions. We found, among other things, that Total Quality Environmental Management leads firms to adopt

pollution-preventing techniques. 8) We have simulated the behavior of private land trusts, providing a spatially nuanced understanding of the impact of government conservation on behavior. We have also empirically analyzed the influence of public reserves on the size and location of private reserves, finding intriguing differences in this interaction among states. 9) We are studying the benefits of environmental remediation in three water bodies where industrial contamination has put persistent toxic chemicals into the Great Lakes. In Waukegan Harbor, Illinois, we found that the benefits to the community exceed $200 million. 10) We have studied the economic effects of suburban development on streams and downstream residents. Using watershed models and benefits transfer, we found that methods of development that aim to preserve water infiltration capacity can reduce flood damages and storm water infrastructure costs downstream. 11) We have studied the use of low cost methods for assessing natural-resource damages caused by contaminants, showing trustee agencies when simplified methods are most useful.

b. Impact – Work done by our group has informed policy makers in a variety of useful ways. Some examples are: 1) Our analysis of CREP shows state conservation policy makers that to reduce CREP costs by almost half in several watersheds, its eligible region should be limited to a narrow buffer along all streams and tributaries of the Illinois River Basin. Additionally, a land selection mechanism should be designed based on characteristics of the land parcels such as slope and distance from a water body to target cost-effective parcels for enrollment in the program. 2) Cleaning up contaminated harbors in the Great Lakes can have very large impacts on property values in nearby communities. In the case of Waukegan Harbor, our estimates were used to justify the expenditure of federal funds to accomplishing final remediation of the harbor sediments. 3) Conservation design of suburban residential developments can have important benefits not only for the residents, but also for those living downstream. A University of Illinois study of development patterns in Kane County, IL indicates that each developed acre could save $300 to $800 in downstream flood damages and infrastructure costs if principles of conservation design were used to reduce storm water runoff into streams. 4) Our research on simplified methods for damage assessment has inspired Illinois state regulators to revive efforts to develop such methods for use in damage assessment activities in Illinois.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – State

Key Theme – Natural Resources Management

Development and Evaluation of TMDL Planning and Assessment Tools and Processes

a. Progress – The objective of this project is to develop, improve, and evaluate watershed models and other approaches for TMDL development and implementation. The data collection on hydrologic and water quality from the Little Vermilion River (LVR) watershed for developing and improving computer simulation models has been completed. We are in the process of completing the analysis of the data. The long-term monitoring data from the LVR watershed are being analyzed to understand the effects of various agricultural management practices on water quality. We have completed development of a in-stream phosphorus transport model. This model simulates dissolved phosphorus and P in sediment in river or a small stream. The model has been validated with data obtained by other researchers in England. One Ph.D. student completed his research on this project this year. Papers have been presented and submitted for publication.

b. Impact – Evaluating the accuracy of a computer model using data from a single site is risky. It is of critical importance that models be evaluated with the widest range of possible conditions. This need can best be met through this multi-regional project with a broad range of conditions from which the models can be tested. Illinois studies will provide a new phosphorus transport model and evaluate its suitability for use in developing TMDL guidelines.

c. Source of Funding – Multi-State, State Funds

d. Scope of Impact – AL, AR, FL, GA, IL, IN, IA, KS, KY, LA, MD, MI, MN, NJ, NC, OK, OR, SC, TN, TX, VA, WVA

Developing Qualitative and Quantitative Models for Collaborative and Participative Management of Natural Resources

a. Progress – The project has developed a number of tools that can enhance the capabilities of local communities to be engaged in collaborative planning and participatory approaches to managing forests and other natural resources. Many of these tools have been tried and applied in a few case studies in Southeast Asia, Africa, and North America. Feedback received from local communities

indicate that the tools are useful, relevant, and easy to implement. Linkages with other scientists and research centers have been established and will facilitate the implementation of the project's future activities. Results obtained from the project have also opened new opportunities to pursue collaborative management approaches under various resource management regimes, including common property strategies.

b. Impact – The project, in collaboration with other development initiatives in southeast Asia and Africa, has been instrumental in improving the management of at least 500,000 hectares of community-managed forest and natural resource-based systems, including thousands of acres of forests in North America. Just as significant are the project's contributions to the empowerment of local communities in terms of their increased capacities to be actively involved in the planning and decision-making processes that underlie the effective management of these community-managed resources. Increased awareness and improved capacities of local communities are likely to have major impacts on the sustainable management of natural resources not only in North America, but in many forests in the developing world, most of which are degraded and under severe pressure.

c. Source of Funding – McIntire-Stennis, Other Non-Federal Funds

d. Scope of Impact – Global

Key Theme – Nutrient Management

Soil and Water Conservation Workshop

a. The quality of soil and water, two critical environmental elements needed to sustain Illinois agriculture, must be carefully managed. A workshop on maintaining the quality of soil and water was held in 2006 in five locations in Illinois through the innovative use of technology to educate the target audience – certified crop advisors. Presentations by Extension staff addressed management of nitrogen, organic matter in soil, sediment, nutrients, and vulnerable areas of water quality. One presenter was present at each of the five meeting locations while the other four presenters addressed participants via videoconferencing.

b. Impact – Total number of participants was 122.

Of the 86 who completed evaluations, 69% to 94% rated the various presentations as “good” to “excellent”. With respect to the

first time combination of live and distance presentations, 100% indicated that they would attend another workshop using the new format.

Comments on knowledge gained included:

"I learned a lot of new information."

"Some of the speakers provided hands-on information that we can take back and use."

"Most were refresher courses on information we need to pay more attention to on a day-to-day basis."

"Excellent, timely topics."

c. Source of Funding – Local, State, Smith-Lever

d. Scope of Impact – Illinois

Key Theme – Pesticide Application

Improved Application of Pest Control Substances

a. Progress – Hyperspectral remote sensing imagery was collected over a soybean field in central Illinois before canopy closure. Estimates of percent vegetation cover were generated through the processing of RGB (red, green, blue) digital images collected on the ground with an automated crop mapping system. A stand alone high-resolution remote sensing system was developed and tested. With this system, the remote sensing image data is collected every hour in an experimental field. An Unmanned Aerial Vehicle (UAV) remote sensing system has been developed as well to be used in this growing season. The helicopter used in the UAV experiment can carry about a 12 pound payload (sensors and instrument) in the field operation. High spatial and temporal resolution data are collected in the field. The experiments are designed to eliminate the errors caused by natural lighting conditions and the limitation in the remote sensing data collection process. Preliminary data has shown very promising results in increasing the sensing system accuracy in weed detection. Special weed plots have been prepared for the high-resolution system.

b. Impact – The outcome of this research is to provide the agricultural industry with the new generation technologies that result in reduced usage of herbicides at an equal or higher level of weed

control compared to conventional sprayers. This will reduce the overall variable chemical input cost in crop production and increase yield. The whole system, when made available, will increase or maintain agricultural profitability as well as reduce environmental damage.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Key Theme – Soil Quality

The Chemical and Physical Nature of Particulate Matter Affecting Air, Water and Soil Quality

a. Progress – The reduction of structural Fe in smectite is mediated either abiotically, by reaction with dithionite, or biotically, by Fe-reducing bacteria. The effects of abiotic reduction on clay surface chemistry are much better known than the effects of biotic reduction. Since bacteria are likely the principal agent for mediating redox processes in natural soils and sediments, further study is needed to ascertain the differences between biotic and abiotic reduction processes. The purpose of the present study was to compare the effects of dithionite (abiotic) and bacteria (biotic) reduction of structural Fe in smectites on the clay structure as observed by infrared spectroscopy. Three reference smectites, namely, Garfield nontronite, ferruginous smectite (SWa-1), and Upton, Wyoming montmorillonite, were reduced to similar levels by either Shewanella oneidensis or by pH-buffered sodium dithionite, then each sample was analyzed by Fourier-transform infrared spectroscopy (FTIR). Parallel samples were reoxidized by bubbling O2 gas through the reduced suspension at room temperature prior to FTIR analysis. Redox states were quantified by chemical analysis, using 1,10-phenanthroline. The reduction level achieved by dithionite was controlled to approximate that of the bacterial reduction treatment so that valid comparisons could be made between the two treatments. Bacterial reduction was achieved by incubating the Na-saturated smectites with S. oneidensis strain MR-1 in a minimal medium including 20 mM lactate. After redox treatment, the clay was washed 4 times with deoxygenated 5 mM NaCl. The sample was then prepared either as a self-supporting film for O-H stretching and deformation bands or as a deposit on ZnSe windows for Si-O stretching bands and placed inside a controlled atmosphere cell also fitted with ZnSe windows. The spectra from bacteria-treated samples were compared with dithionite-treated samples having a similar Fe(II)

content. The changes observed in all three spectral regions (O-H stretching, M2-O-H deformation, and Si-O stretching) for bacteria-reduced smectite were similar to results obtained at a comparable level of reduction by dithionite. In general, the shift of the structural OH vibration and the Si-O vibration, and the loss of intensity of OH groups, indicate that the bonding and/or symmetry properties in the octahedral and tetrahedral sheets changes as Fe(III) reduces to Fe(II). Upon reoxidation, peak positions and intensities of the reduced smectites were largely restored to the unaltered condition with some minor exceptions. These observations are interpreted to mean that bacterial reduction of Fe modifies the crystal structures of Fe-bearing smectites, but the overall effects are modest and of about the same extent as dithionite at similar levels of reduction. No extensive changes in clay structure were observed under conditions present in our model system.

b. Impact – The impact of the results from this study is a clearer understanding of the effect of bacteria on mineral properties in soils. Changes in the valence or electrical charge (oxidation state) of iron in clay minerals greatly alters the chemical and physical properties of the minerals, which in turn changes the properties of the surrounding soil. Bacteria in the soil are the principal agents for mediating these changes in iron oxidation state in soil clay minerals. Some recent studies have suggested that such bacterial activity dissolves a large fraction of the clay mineral and changes it to less reactive types of minerals. Results from the current study refute those suggestions with concrete evidence that changes in mineralogy due to interactions with bacteria, except for changes in the oxidation state of the iron, are minimal and virtually no irreversible changes in mineral structure or type are observed. The reasons for these disparate conclusions still need to be explored. One possibility is that the extensive levels of dissolution reported earlier may have occurred because of the presence of organic acids or chelating agents in the reaction mixture, rather than as a result of bacterial activity, or the absolute extent of dissolution was overestimated.

c. Source of Funding – Multi-State, Other Non-Federal Funds

d. Scope of Impact – DE, GA, ID, IL, IN, MI, MN, MO, NJ, NYC, NC, ND, SC, TX, WA, WI

Particulate Matter and Soil Nitrogen Dynamics

a. Progress – Soil organic matter (SOM) fraction characteristics need to be developed as indices that can be related to specific soil functions. The general effects of organic management on promising indices of SOM status (particulate organic matter, POM, and a rapid measure of base hydrolyzable N (the Illinois N test or IL-N)) were determined by comparing the characteristics of organic and conventionally managed soils obtained from nine long-term trials in North America. The free, light POM (FPOM; <1.6 g cm-3) not occluded within aggregates and occluded POM (OPOM; <2.0 g cm-3) were compared to an undifferentiated POM fraction (coarse fraction, CF; >53 micron) obtained by wet sieving. In the multi-site comparison, legume- and manure-based organic systems performed equally well in their ability to increase the quantity of SOM as well as enrich the proportion of POM assessed using a variety of methods. The quantity of C and N in the CF, FPOM, and OPOM were similar in soils from legume and manure-based systems. The amount of POM-N recovered using these various methods was equal to the amount of N recovered by the IL-N and more than twice that required to support a full crop of maize. Organic farming systems had greater quantities of C and N in the OPOM and CF and greater IL-N contents in all POM fractions considered. The OPOM's C/N ratio (16-19) was least in the manure + legume-based organic, intermediate in the legume-based organic, and greatest in the conventional systems ($P < 0.10$). Trends in OPOM C/N and IL-N abundance suggested occluded POM was most decomposed, and possibly a greater N reservoir, in the manured soils. The FPOM quality reflected the residues added to each system and its removal improved resolution of quality-based differences in POM associated with long-term management. Subdivision of POM revealed differences in its quality that were not evident using the undifferentiated CF. Quantification of hydrolysable N (IL-N) in POM did not enhance our understanding of management's affect on SOM quality. This multi-site comparison showed organic management simultaneously increased the size of the labile N reservoir and the amount of POM protected within aggregates; and that occluded POM is more decomposed in manure + legume than in legume-based organic systems. The characteristics of POM reveal how organic practices improve SOM and suggest the nutrient and substrate decay dynamics of organic systems may differ as a result of the N fertilization strategies they employ.

b. Impact – Identifying fractions that are sensitive enough to track short-term changes in both SOM quantity and quality is an important first step in developing fertility management tools for organic and sustainable farmers seeking to maximize the nutrient and water use efficiency of their production systems by enhancing soil quality. Our work confirms that POM has potential as such an index and reveals how fractionation strategies affect POM's qualitative and quantitative attributes and thus, its functional relevance. Our work demonstrates how the quality and quantity of POM can serve as powerful integrators of system characteristics and shows how different approaches to SOM characterization can amplify or obscure important differences in the fertility status of soils under different management strategies. Findings suggest it is possible to make direct links between POM status (quantity and quality) and soil N supply and gain an understanding of soil's physical and biological condition. Strategies for POM fractionation and interpretation should be developed to address specific problems and inform management. By refining methods used to recover the coarse fraction (>53 micron) to remove human contributions to variability, increase reproducibility, and minimizing processing time, our work will help us bring POM into use in a soil-testing context.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Key Theme – Soil Erosion

Tillage Seminars

a. Best management practices are critical to limiting soil erosion and preventing water problems. Regional tillage seminars are held annually throughout Illinois. Over the past five years, more than 2,168 participants have attended. Typically three-fourths to two-thirds of the participants are farmer owner/operators. The remaining participants are agribusiness and agency staff.

b. Impact – Total number of participants over three years – in excess of 2,168.

Typical results are that all participants rate the seminars as "good" to "excellent."

Typically, all will rate the program as useful to very useful.

As a result of attending one of the seminars this past February, 16 percent of the farm/owner operators reported intentions to make changes in their farming operations. At the top of the list was "use more no-till" and "investigate strip tilling." Other planned changes frequently mentioned included "investigate carbon credits", "do grid sampling and VRT", "reduce machinery costs", and "adopt nutrient management systems."

c. Sources of Funding – Local, State, Smith-Lever

d. Scope of Impact – Illinois

Key Theme – Water Quality

Conservation Reserve Enhancement Program (CREP) Website (http://www.ilcrep.org/)

a. Created in 2002, the Conservation Reserve Enhancement Program (CREP) website (http://www.ilcrep.org) is the most comprehensive source of information for this conservation program available to the public. The goal of the website is to provide the most current information available for both the federal and state side of the program. Individuals from around the world can access the site and learn the primary goals of the program, eligibility requirements for enrollment, financial incentives offered by the federal and state contracts, whom to contact to enroll and which conservation practices qualify. The "Contact Us" section provides visitors to the site with instant access to professionals who will answer their questions and concerns. USDA Service Center staff and State Agency individuals could access enrollment documents and download PowerPoint presentations in the non-public sector of the site.

Educational information material consists of fact sheets, presentations, websites, manuals, and other materials to create awareness and promote conservation and environmental stewardship. The CREP website provided for the coordination of information and educational materials on a very successful

program. Materials included fact sheets on frequently asked questions and eligible conservation practices. The website maintained by the educator serves as a clearinghouse for activities among Illinois Department of Natural Resources (IDNR), Illinois Environmental Protection Agency (IEPA), University of Illinois Extension, and the CREP Advisory Committee. The website serves as a primary source of information on CREP. The CREP website was a National Association of County Agricultural Agents national finalist communication award winner.

b. Impact - Since revamping the IWMC website, traffic has increased by over 1,030%. The average number of successful requests from May 2005 until May 2006 was 8,595 per month. The average distinct hosts from May 2005 until May 2006 were 1,206 per month. Distinct hosts are the number of different computers requesting information. IWMC web traffic increases have been attributed to the advertising at conferences, workshops, news releases, bookmarks, and surveys.

c. Source of Funding – State, Federal

d. Scope of Impact - Illinois

Illinois Watershed Management Clearinghouse Website:
http://www.watershed.uiuc.edu/

a. The Illinois Watershed Management Clearinghouse (IWMC) website offers resources and technical assistance to local watershed planners who need to form a local watershed group and/or need to assist in developing or implementing watershed plans. IWMC provides access to a tremendous amount of resources available from state, federal and non-governmental organizations. Completed watershed plans compile information from a variety of sources including state and federal agencies. The site supplies links to tools, case studies, and scientific research. The website is designed for local communities and professionals interested in protecting our natural resources.

Revamped as a goal of the grant, the IWMC website serves as a one-stop location for those interested in Illinois watersheds and their management. The website incorporates new information, educational materials and watershed related information. Features include a calendar of events which allows groups to post activities occurring in their area, an *Ask the Expert* section where the educator will answer the questions by working with technical experts from IEPA, IDNR, NRCS, SWCD, IDOA, FSA, and other

relevant agencies, a watershed locator that gives contact information on local watershed groups on a county and regional basis, and an internet mapping engine. The website hosted the registration information for the Connecting Illinois Watersheds conference, used to conduct a survey that was used during the formation process of the Illinois Watershed Association, and host information for the Illinois Watershed Association.

The site combines the resources of Illinois and federal agencies into one organized site. The following agencies partnered together to develop the website: Illinois Department of Natural Resources, Illinois Environmental Protection Agency, Illinois Council on Food and Agricultural Research and University of Illinois Extension. The IWMC website was marketed through displays, workshops, news releases, bookmarks, and conferences. The educators authored a journal article on the IWMC website that appeared in the Journal of Extension.

b. Impact –
- The IWMC website was a National Association of County Agricultural Agents national finalist communication award winner.

- Since revamping the IWMC website, traffic has increased by over 1030%. The average number of successful requests from May 2005 until May 2006 was 8,595 per month. The average distinct hosts from May 2005 until May 2006 were 1,206 per month. Distinct hosts are the number of different computers requesting information. IWMC web traffic increases have been attributed to the advertising at conferences, workshops, new releases, bookmarks, and surveys.

c. Source of Funding – State, Federal

d. Scope of Impact - Illinois

Resource Management Mapping Service (RMMS) Website Workshops

a. Nine Resource Management Mapping Service (RMMS) Website Workshops throughout the state were targeted to the Illinois Environmental Protection Agency (IEPA), the Illinois Department of Natural Resources (IDNR), University of Illinois Extension, Soil and Water Conservation Districts, Natural Resources Conservation Service (NRCS), and watershed groups to assist them in learning more about mapping their watershed using information available on the Internet. The objectives of the RMMS

workshops were to familiarize watershed planners with the data support available to watershed groups. Using the RMMS map tools, participants learned how to map demographic data, resource data, insert buffers, tabulate acreage for given areas, view aerial photographs, and print and/or save maps. The mapping tool is designed to provide communities and natural resource professionals with the ability to map their natural resources using information available on the Internet.

Agency staff can use the RMMS website to view natural resources, farmers can use the site to view individual fields and city planners can use the site to review town boundaries and plan future growth. Users can quickly locate, create, print, save, and email maps of large and small areas within Illinois in a few minutes. Numerous map layers from demographic data to resource data may be added to the base map to give a better idea of a specific location's resources and other important attributes. After the base map is selected users can choose resource layers (lakes, river, watershed), administrative layers (townships, legislative, IDNR districts), and economic layers (highways, county roads, railroads). The map engine allows people to buffer points, buffer critical areas, view aerial photographs and tabulate acreages on data features. Users can create maps within watersheds, farms and fields.

b. Impact –

- The IWMC website was a National Association of County Agricultural Agents national finalist communication award winner.

- Since revamping the IWMC website, traffic has increased by over 1,030%. The average number of successful requests from May 2005 until May 2006 was 8,595 per month. The average distinct hosts from May 2005 until May 2006 were 1,206 per month. Distinct hosts are the number of different computers requesting information. IWMC web traffic increases have been attributed to the advertising at conferences, news releases, bookmarks, and surveys.

c. Source of Funding – State, Federal

d. Scope of Impact - Illinois

Key Theme – Weather and Climate

The National Atmospheric Deposition Program

a. Progress- NRSP-3, the National Atmospheric Deposition Program (NADP) provides quality assured data and information on the exposure of managed and natural ecosystems and cultural resources to acids, nutrients, base cations, and mercury in precipitation. This is made possible through cooperative support (SAES, universities, government agencies-federal/state/local/tribal, and NGOs) for the 252-stn National Trends Network (NTN), 97-stn Mercury Deposition Network (MDN), and 7-stn Atmospheric Integrated Research Monitoring Network. NADP data are used by scientists, policy-makers, educators, and the public and are freely available via the Internet, which enables on-line retrieval of individual data points, seasonal and annual averages, trend plots, concentration and deposition maps, reports, and other information. In 2006, the number of registered Web site users rose to nearly 32,000. Data downloads numbered 23,664, an increase of 27% from 2005. The site received more than 1.4M hits, and the number of NADP maps viewed rose by nearly 30%, topping 121,000. In the 2006 progress report on the U.S.-Canada Air Quality Agreement, NADP data were used to evaluate progress under the agreement's Acid Rain Annex. Since signing the agreement, the U.S. and Canadian governments have reduced acidic precipitation by requiring SO2 and NOx emissions reductions. Between 1991 and 2004, Canadian and U.S. SO2 emissions decreased by about 33%. At the same time NTN and AIRMoN data showed similar sulfate deposition reductions. The number of states receiving 20 kg/ha/yr or more of sulfate deposition dropped from 12 to 1. A 20% reduction of U.S. NOx emissions similarly was accompanied by halving the area receiving nitrate deposition of 15-20 kg/ha/yr. A recent analysis estimates that the benefits of these reductions greatly exceeded the costs of controls. The report states that without atmospheric deposition monitoring networks, it would be impossible to track and confirm the air quality improvements that are taking place. 2006 highlights: 1. NADP partnered with the International Center for First-Year Undergraduate Chemistry Education to translate the NADP brochure ('Nitrogen in the Nation's Rain') into Spanish. 2. The Upper Midwest Aerospace Consortium at the University of Notre Dame produced a video that uses an NADP pH map to show the distribution of acid rain. This video appears in the public TV series 'Our Changing Planet,' which airs on 29 stations and is taped for delayed broadcast on 14 others. 3. NADP staff participated in the University of Illinois Extension Service program Environmental Stewardship Days. Approx. 250

grades 4-6 students participated in a hands-on activity in which they measured the pH of lake water, drinking water, and rain samples from NADP sites across the country. Norfolk, VA, 24-26 Oct, was the site of the 2006 scientific symposium and annual meeting, which attracted 132 participants. The symposium featured 32 talks and 35 poster papers. The highlight was a session that addressed the importance of NADP data in quantifying the atmospheric nutrient input to coastal ecosystems. Atmospheric deposition accounts for as much as 20%-40% of the nitrogen entering some eastern estuaries.

b. Impact -Testing NADP rain samples for Asian Soybean Rust (Phakopsora pachyrhizi) has proven to be a cost-effective way to track the movement of this disease. From May to September 2006, traces of DNA from the urediniospores of Asian Soybean Rust were detected and confirmed in 185 rain samples from 97 NADP sites in 27 eastern states. These data coupled with rust reports from the field will help us better understand the seasonal development and secular evolution of this disease, which has gained foothold in the United States.

c. Source of Funding – Multi-State Funds

d. Scope of Impact – CA, CO, FL, GA, IL, IN, KY, LA, ME, MD, MA, MI, NE, NYC, NC, OH, OR, PA, TX, UT, VA

An Improved Model of the Impacts of Ozone Pollution on Soybeans

a. Progress - During the past 12 months several of the data studies needed to inform the modeling effort have been completed. This year a range of soybean germplasm lines were planted in soyface and monitored for ozone effects; this has supported observations in prior years of variation in ozone response, also critical to projections of long-term responses of ozone. We have established that ozone concentrations of the levels observed in central Illinois (40 - 80 ppb) decrease photosynthesis of leaves, but only as they age. Most affected are the leaves that remain at the top of the canopy during grain filling; this is linked to the decreased individual grain mass observed under elevated ozone. We have also begun monitoring and modeling 3-dimensional canopy growth which is critical to modeling light interception and in turn photosynthesis, and how both are affected. At present we are able to predict effects of ozone on individual leaf photosynthesis. Our next phase is to integrate this into the growing canopy and finally partitioning of photosynthate to grain.

b. Impact -Soybean is the number two crop in the U.S. in terms of area planted. However, it is very vulnerable to ozone which likely lowers current yields by between 10 and 20%. The effect of ozone is also likely to be increased by global climate change. Although ozone has decreased in some parts of the U.S., it has continued to increase in many rural regions. The Intergovernmental Panel on Climate Change predict that these increases will continue through this century. Accurate forecasting of the future impacts of ozone and climate change on the soybean crop in different regions of the U.S. will be critical to planning and setting priorities for crop improvement.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Key Theme – Wetlands Restoration and Protection

Flooding Impacts on Carbon and Nitrogen Budgets of Floodplain Tree Species

a. Progress – In contrast with the general trend in other tissues, the ratios of starches and sugars to growth and to N fixed for nodules of unflooded speckled alder declined in the fall. Nodules of unflooded alders increased mass primarily in the fall when nearly three-fourths of the seasonal nodule growth and two-thirds of the seasonal root growth occurred. Moreover, in the fall, unflooded nodules maintained rates of N fixation similar to those of the summer. The roots continued to accumulate a large reserve of TNC (total nonstructural carbohydrates) through the end of the growing season while nodules were apparently expending carbohydrates for rapid fall growth and late-season N fixation. This trend underscores the importance of fall as a period of nodule development and activity in speckled alder. All seedlings flooded in the fall survived while all alders flooded earlier in the growing season died. Perhaps this difference was owing to greater stress tolerance in the fall with lowered temperatures and respiratory rates as well as an accumulation of TNC greater than that of the early summer and late summer-flooded alders. The fall-flooded seedlings grew less and accreted less TNC than unflooded alder seedlings after over wintering and early-season growth the following year. The lack of vigor in the fall-flooded alders during the spring after flooding may have resulted in part from their reduced accretion and resorption of TNC in perennial tissues relative to unflooded seedlings. This reflects the importance of fall for nodule growth and development in speckled alder seedlings.

Overall seedling growth was halved while nitrogen content was reduced by two-thirds in fall-flooded alders relative to unflooded alders during the summer growing season following treatments. This may indicate that seedling growth during the season after fall flooding was reduced not only by a decrease in reserve carbohydrates, but also a severe inhibition of nodule growth resulting in reduced nitrogen fixation in the N-free substrate following fall hypoxia. Fall flooding greatly increases resorption of foliar nitrogen relative to unflooded speckled alder, black alder, and other actinorhizal species that typically resorb a lower net percentage of foliar N than non-actinorhizal temperate deciduous trees. This increased resorption of N, but decreased net TNC resorption in fall-flooded speckled alder represents a puzzling differential effect of a seasonal environmental stress on two plant processes. Could the cause of this effect lie in a differential regulation by the plant hormone ABA, which is produced by plants under stress and underlies fall leaf senescence processes in temperate deciduous trees? Perhaps the reduced resorption of foliar TNC is a consequence of high energy demands for increased protein hydrolysis and N resorption in leaves of flooded plants? Also, flooded woody plants have reduced photosynthetic rates and would produce less photosynthate for TNC reserves.

b. Impact – Many wetlands are dominated by speckled alder trees, including those along streams, near lakes, in bogs and in wet meadows of the northern and eastern United States. Hydrological changes that would induce flooding during the growing season will kill or greatly inhibit growth and nitrogen fixation of impacted trees. Although clearly associated with wetlands, these trees are not tolerant of root inundation. They survive in wetlands by producing a shallow root system and surface root nodules giving the root system and symbiotic nodules access to oxygen to support root/root nodule growth and function. Current studies indicate that spring and summer seasonal flooding will kill speckled alder trees and fall flooding will greatly inhibit their growth. Speckled alder stands are an important source of nitrogen for supporting phytoplankton and, ultimately, fish productivity of associated streams and lakes. These results can help to predict the effects of climate change on these widespread ecosystems and allow managers to precisely predict how altered flooding regimes due to hydrological engineering will impact this key wetland tree species.

c. Source of Funding – McIntire-Stennis Funds

d. Scope of Impact – National

CSREES GOAL V – Enhanced Economic Opportunity and Quality of Life for All Americans

Indications of the Scope of Research and Extension Programs under Goal V- See Appendix A.

Although the investment in University of Illinois research related to Enhanced Economic Opportunity and Quality of Life for All Americans (Goal V) is small in comparison to other goals, the investment of dollars and time through Extension is significant and represents nearly half of the total.

Areas of study at the Illinois Agricultural Experiment Station under Goal V include examining new approaches toward the social development of young people, improving student learning and achievement in technical systems management classes, developing and implementing effective distance learning programs, improving teaching in agricultural sciences, helping professionals working with divorced parents to develop effective co-parenting techniques [even despite a history of spousal violence], broadening rural youth's awareness of the opportunities their hometown offers, for teaching youth how to contribute to their communities in meaningful ways, for building leadership skills, and for promoting communities positive regard of youth.

In addition to the 4-H program which reached 281,462 youth, other youth programs focused on leadership development, character education, and teen's decisions related to sexual activities. Volunteers who work with youth were also provided with educational programs addressing youth protection, behavior management, and risk management. Programming for parents focused on parent relationship issues. Education for adults to enhance economic opportunity included building computer skills and risk management skills for agricultural production. Extension programs also addressed community improvement and developing sustainable community recreational and leisure services.

Key Theme - Agricultural Financial Management

Andy's Project—Computer Education for Farm Men - Pilot Program

a. Many farmers in their fifties feel inadequately trained to use computers. They were out of school before personal computers became standard office equipment and educational opportunities tailored to their needs are limited. Andy is a mid-life farmer who feels left out of the computer generation. He is exposed to decision making tools that he can't use and he breaks into a sweat when it

comes time to switch records from paper to computer. His fingers are calloused from work, stiff from the beginning stages of arthritis and seem a little too fat to fit on a keyboard. His family and friends run circles around him when it comes to the computer. He is not comfortable in traditional computer education classes where students half his age are flying through assignments and what is taught in class rarely relates to his farming occupation.

Very successful farmers, like Andy, are aware of potential advantages computer-literate farmers have over them and they would like to join the ranks of regular computer users. Andy's Project is designed to meet the needs of mid-life farmers who are ready to tackle computer technology. Andy's Project was first held in Monroe County in a series of four two-hour programs in December 05 and January 06. Five farmers participated. (The program was also piloted with seven participants in Franklin County.)

b. Impact - During the first class each farmer was asked to grade himself for his computer abilities. Their responses are recorded below for the first and last class. Further evaluation is attached.

Student #	First Class	Last Class
1	D	A
2	D	B
3	D	C
4	D	C
5	D	(Had an emergency and had to leave early)

The second pilot program was held in Franklin County in late winter. Five farm men and two farm women participated. This group met a total of 14 hours in seven meetings.

Student #	First Class	Last Class
1	D	B
2	F	C+
3	F	C
4	C	B
5	C-	C
6	C	(Had to leave class due to hearing problem)
7	F	C

Participants were hands-on in using their wireless laptops from beginning to end of class time. They tried different hardware to make computer use easier.

Participants learned:

- how to use a search engine
- how to get to their e-mail while away from their home computers
- how to use the internet to get directions
- how to use spreadsheets
- where files were stored on their computer
- how to use a jump drive for file storage
- the importance of ID names and passwords
- how to sign up to use e-Gov (Monroe County location only--two out of five were successful with this assignment, the rest are in various stages of achieving success.)

Locations for Andy's Project in 2007 will be expanded statewide. In addition to a registration fee of $20 per person, the North Central Risk Management Education Center at the University of Nebraska, Lincoln, is supporting Andy's Project in 2007 with a partnership of $8,500. These funds will be used to promote the program, pay instructors' travel expenses, develop a standard curriculum and purchase educational supplies.

In the fall of 2006, Ohio inquired how Andy's Project might be used in that state.

c. Source of Funding – State, Federal

d. Scope of Impact - Illinois

Annie's Project—Education for Farm Women

a. Annie's Project—Education for Farm Women continues to increase in attendance and impact. In 2006, (4th year) Annie's Project was offered in seven locations. Classes were held in February, March, June and July 2006. Sponsors of Annie's Project

in 2006 included Farm Credit Services, Illinois Agri-Women, Illinois Farm Bureau, Illinois Risk Management Agency, and University of Illinois Extension.

Ninety-nine women and four men graduated from Annie's Project in the seven different locations. The average age of participants was 50 years old (range 16 to 74 years.) Collectively, this group represented 1,070 years of farming experience. On average this group farmed 940 acres of which the majority of land was owned.

Women (and men) enrolled in Annie's Project are schooled in five areas of risk management—production, marketing, financial, legal, and human resources.

According to a baseline survey, women in this group are concerned about:

- rising input costs and profitability
- business transition and expansion issues
- debt load and taxes
- ability to retire
- impact on families as operations become more competitive

Women worked at computers learning how to use the internet and Farm Analysis Solution Tools spreadsheets. Women in the class who are highly skilled computer users are paired with women who are not as familiar with computers.

b. Impact - From follow-up baseline surveys conducted six months following class:

- about one third of women reported improving their skills in marketing and financial categories of management
- one-in-four reported improvement in the management area of human resources

Comments from participants included:

> *"I enjoyed trying to get my computer to work with the correct information. I believe I can now work a computer with this program!" –Clark County evaluation--*
>
> *Another woman wrote on her evaluation: "I plan to purchase a computer to use my disk (FAST CD)."*
>
> *And, "I plan to use the balance sheet spreadsheet, grain marketing spreadsheet and anything else I can find time for!"*

Women with many years of farming experience became mentors to women who are not from farm backgrounds.

> *"I appreciated everyone's acceptance and help through this program" –Warren Henderson County evaluation--*
>
> *"I changed by mind about tying to help make more major decisions. I presently do help, but I will become more involved."*

Women graduating in Illinois join 2,000 other women from Iowa, Missouri, Wisconsin, Indiana, Nebraska, North Dakota, and Minnesota who have adapted Annie's Project for their states. With growing support from four Risk Management Education Centers and CSREES in Washington D.C., University of Illinois Extension staff expect to spend more time in training instructors and facilitators nationwide.

c. Source of Funding – State, Federal

d. Scope of Impact – Multi-State

Key Theme – Community Development

Community Matters – Plan, Design, Implement

a. Community Matters is an exemplar of the University's mission as a land grant institution. During this past year, University of Illinois Extension entered into a new inter-collegiate collaboration with the Department of Urban and Regional Planning in the College of Fine and Applied Arts. Community Matters brings together faculty, staff, community members, and student resources

to work with selected communities and neighborhoods throughout Illinois to address local problems.

These community engagement activities present a unique opportunity ***to promote innovative civic commitment initiatives that connect efforts across disciplines and colleges***. This project utilizes campus-wide academic excellence and engagement principles at the University of Illinois Champaign-Urbana Campus to build the capacity of communities to pursue balanced planning and development. Planning for development involves integrated land resource management for residential, commercial, industrial, agricultural, recreational, ecological and related uses, systematically addressing the economic, social and physical requirements of the state's population centers for the purpose of investment, development, reinvestment or redevelopment.

A critical element in this collaboration is the opportunity for students to get hands-on experience working in communities while working with various University of Illinois faculty, University of Illinois Extension and community leaders. This relationship provides a unique opportunity for community leaders to gain access to faculty expertise and student resources in areas which are identified as critical to their evolving role in community planning.

b. Impact –

Projects conducted during the past year in Macomb and Carlyle and applications for the current year in Fayetteville and South Central Illinois Regional Planning and Development Commission support multiple initiatives identified in the campus strategic plan.

- Our experiences during the first year of collaboration have demonstrated the ability to create high-quality, engaging educational experiences in practices linked to sustainable land use.

- In addition, our experiences in Macomb demonstrate that community learning and understanding also grows through the campus/community exchange.

- We expanded internship programs within the department, creating "professors of practice" who assisted us in staging our engagement activities.

- "…local professional planners who gave a brown bag this week about "how to get a planning job" mentioned that what is

learned in the classroom is important, but overall, planning students are smart and learn the classroom work. What they look for in a student's portfolio is the experience gained in Community Matters." One student wrote that she got her summer internship because of her experiences in Macomb and Carlyle, and continues to work with the architecture firm during the school year; another student was hired by the city of Champaign solely because of her experience in Macomb.

- Utilizing the talent and ingenuity of faculty, staff, students, and community stakeholders, new and creative solutions for community development were identified.

- Projects will demonstrate new techniques or skills in planning. Reports generated through the project will facilitate continued discussion in the community on ways to implement ideas presented and allow for the transfer of information to similarly situated communities throughout Illinois.

c. Source of Funding – State, Federal

d. Scope of Impact – Illinois

Community Swap

a. Since 1993 more than 200 communities have participated in a U of I Extension Community Swap. Teams of visitors "swap" communities for a daylong visit, where they pose as tourists, prospective business owners, relocating families, or out-of-town shoppers. The teams visit downtowns, business districts, community entrances, neighborhoods, parks, and other public places. Each team later shares its objective impressions of the host community, describing the features which were most attractive and offering suggestions for improvement. The visiting community shares this information through a written report and color slides presented at a town meeting.

In 2003 a survey was sent to the 44 leaders of community swaps which took place in 1999-2001. Twenty-seven were returned making a response rate of 61%. On average, at least 17 people participated from each community. (Projecting to 2006, there have been more than 3,400 community leaders participating in swaps over the last 23 years).

b. Impact - The survey respondents stated that Community Swap influenced planning events in their community:

Influenced Comprehensive Planning	33.3%
Influenced Development or Refinement of Economic Plan	44.4%
Influenced "Operation Main Street" or a Similar Program	18.5%
Anything Else	22.9%
Community Swap has not Influenced Anything	22.2%

- In addition, 70% of participants stated something that changed their community because of Community Swap. The most common changes mentioned were "Changes in street signs improved community appearance" and "Better planning tools; we now have an economic development plan".

- The most commonly stated use of the data provided by community swap was "Allows us to address our weak areas and take actions to fix them"

- Respondents declared that the most important outcome from Community Swap was "Provided a unique outsider's look at our community", and "Awareness of what other people think of our community."

- Almost all of the respondents (96%) stated that they would recommend Community Swap to other communities. As to why they would recommend it, respondents recommended Community Swap because it allows "Small communities to pause and reflect about what makes up their communities and how it will thrive in the future" and "Community Swap speaks to the citizens who can make things happen, in small ways, while letting the city's government know change is possible".

c. Source of Funding – Local, State, Federal

d. Scope of Impact – Illinois

Illinois Rural Recreation Development Project (IRRDP)

a. The Illinois Rural Recreation Development Project (IRRDP) helps rural communities to develop sustainable local recreation and leisure services in collaboration with organizations and individuals

in rural communities. IRRDP believes that recreation and leisure are essential to enhance individual and community life, and that rural communities are valuable and deserve recreation and leisure opportunities. Rural communities, however, lack resources and professional leadership for the provision of general recreation and park services.

In 2006, five communities participated in IRRDP. One community became self sufficient; meaning it now operates without direct IRRDP support. Also, two other communities pursued long-term park and recreation planning in partnership with IRRDP.

To enhance program sustainability regarding training, a "Train the Trainer" program was developed for camp directors to train their own camp staff. The camp director successfully implemented the program and trained 41 camp counselors.

b. Impact – Overall, approximately 565 youth and 50 adolescents (i.e., youth leaders) were served through the program.

An important goal of the Summer Daze program is to foster social connections among participants. The 2006 program evaluation revealed that on average, youth participants made **four** new friends through the program. The results indicate that the program served as a vehicle for making new contacts and forming new friendships. Over **73%** (of the youth) stated that being in the program made them want to play outdoors more often. This is a significant finding since being indoors has been shown to be the most important predictor of childhood obesity.

Satisfaction among parents of participants remained relatively high (i.e., 8.1 on a 10-point scale).

In 2007, IRRDP staff will focus on helping towns identify funding sources that will foster sustainability.

c. Source of Funding – Local, State, Federal

d. Scope of Impact – Illinois

Neighborhood and Community Factors, Social Support Networks and Preschool Children's Socio-Emotional Development

a. Data were collected on preschool children and their families that parallel data collection efforts over the previous years. Since the last reporting period, data have been collected on approximately 40 additional children and 10 additional families. Participants included preschool children who were attending the university affiliated Child Development Lab (CDL) as well as preschools in the Champaign-Urbana area. Data have been collected on classroom social structures and peer behavior as well as the nature and quality of children's relationships with their parents and parent-child narrative styles. With respect to children's socioemotional behavior and adaptation, we have collected data using classroom observations of children's behavior, social network and support interviews, and sociometric interviews of peer acceptance. Teachers also rated children's behavior using two standard social behavior rating scales. Data regarding parent-child relationships and family process were collected using laboratory procedures, home visits, and self-report questionnaires. The combined longitudinal dataset has been assembled and analyzed to test hypotheses relating to children's social behavior. Several findings contribute to the literature on how children construct beliefs about relationships. For example, our data reveal that parenting scripts derived from narrative data are significantly related to children's secure behavior during home observations. This finding supports the notion that parents who themselves have cognitions about relationships that are adaptive have children who are more likely to have a secure attachment relationship. We found this relation in two international samples as well. In addition, our classroom data reveal that children who have a mutual friend are rated by teachers and observers as more socially competent, and are less affected by small, less supportive social networks than children who do not report having a mutual friend. Finally, our data indicate that the degree to which fathers are involved with their children on a daily basis depends on how involved their spouse wants them to be, regardless of how important fathers believe their parenting role is in their lives. However, mother involvement did not depend on their spouses rating of how involved they want her to be. This finding highlights the need to examine factors related to effective co-parenting, and perhaps the various pathways of parental influence on children's behavior. Taken together, these data inform parenting and teacher programs designed to enhance the quality of life for children and families residing in rural and non-rural areas of Illinois.

b. Impact – These data highlight the utility of using a multi-method and multi-informant approach to examining young children's social development. They also demonstrate how relationships in the home, school, and community contexts influence children's behavior in classroom settings. These data served as an empirical base for a grant proposal examining how children construct beliefs about parent and peer relationships. This four-year longitudinal project was funded by NSF's Children's Research Initiative, and data collection is now completed. The assembled longitudinal data have been used to inform teacher and parenting programs in the state of Illinois, and will be used as a basis for a second NSF proposal designed to examine the transfer of mother-child and father-child relationships to children's developing belief systems about relationships. The information obtained from this project is valuable for parent, teacher, and community outreach education programs that promote the well-being of children and families. Additionally, workshops will be conducted with child-care teachers that focus on issues defined by the teachers as important in their centers. Finally, this project has served as a valuable research experience for over 115 undergraduate students since its conception, two doctoral students from the Department of Psychology, and as the basis of a thesis for two doctoral students in the Department of Human and Community Development.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – State

Tomorrow's Leaders - Understanding Illinois Local Government

a. "Tomorrow's Leaders: Understanding Illinois Local Government" was developed by University of Illinois Extension, the Illinois Municipal League, Township Officials of Illinois, and the Illinois Association of County Board Members and Commissioners. These groups comprise the Partnership for Local Government Education.

Members and staff of these local government associations felt there was a need for a program to develop citizens who care about and contribute to local communities. The curriculum consists of eight units covering topics such as local government finances, the police and court systems, safety, local government services, and how citizens can affect the governance of cities, villages, townships, counties, and various special districts.

"Tomorrow's Leaders - Understanding Illinois Local Government" is a high school curriculum designed to develop citizens who care about and contribute to their communities. By helping students discover how Illinois local governments solve the problems closest to us (such as good roads, strong schools, effective fire and police protection, and safe water supplies) the curriculum is designed to build a citizenry that is well informed as they vote and who will be more likely to assume leadership roles in their communities.

More than 90 teachers have received training since the curriculum's release. Extension staff have developed excellent working relationships with local school districts to deliver training in a very localized setting.

b. Impact - A statewide assessment of the curriculum was conducted in the spring of 2006

- During the first year the curriculum was released, 1,589 students participated in the program with the largest group of students from the ninth grade.

- In the 2005 – 2006 academic year 2,157 students participated in the program, again ninth grade students representing more than half of the students participating.

- The following were noted by the teachers as the most significant impacts of the curriculum for their school:

  - ♦ 97 percent reported students learning about government roles in their lives and the community
  - ♦ 97 percent reported students know more about what is going on in their community
  - ♦ 89 percent reported students know more about local government's role in solving problems that need to be fixed in their community
  - ♦ 83 percent reported students know more about how to get things needed for community improvement

c. Source of funding – State, Federal

d. Scope of impact - Illinois

Key Theme – Impact of Change on Rural Communities

The Adoption and Perceived Effectiveness of Innovative Educational Technologies in Rural Agriculture

a. One of the overall objectives of this project was to assess instructional activities designed to improve teaching and learning utilizing innovative technology-based instructional strategies. An outcome of this objective was to present a series of instructional activities that have been developed and implemented to improve the basic knowledge level of students entering technical systems management undergraduate level classes. Many of the students enrolling in the technical systems management classes do not have the same level of fundamental understanding of the basic principles and operations. A series of instructional activities was developed to provide students the opportunity to learn the fundamental knowledge as they start the classes. These instructional activities were primarily web-based and offered as optional activities that do not require formal instructional time. The activities are self-paced and student-centered. These activities include instructional topics such as tool and components identification, safety practices, fundamental scientific principles and applications of instructional practices. Students have the option to complete these activities, however all students are quizzed on the subject matter. All activities are completed outside of the formal class and laboratory teaching times. The primary goal of these activities is provide an opportunity for those students who do not have the expected entry level of fundamental knowledge to develop a baseline of competence. Another objective of this project was to explore strategies to improve distance learning and outreach teaching effectiveness. The outcomes related to this objective were to implement an instructional model that was developed and implemented to provide distance education classes based upon the principles of experiential learning. A series of undergraduate and graduate level classes have been offered as web-based distance education. These classes were developed based upon a conceptual model of experiential teaching and learning that is considered to be student-centered and provide an active learning environment. The classes were developed as a formal program of agricultural education to be delivered off-campus. However, many of the strategies developed have been incorporated in on-campus classes. Over the past four years five different classes have been developed and delivered utilizing the experiential learning models and strategies. This project described the development of the instructional models, the evolution of the methods of instructional delivery and the relative successes of the instructional activities.

b. Impact – The impact of this study has been the improvement of student learning and achievement in technical systems management undergraduate classes. The academic improvement was enhanced by the utilization of innovative technology-based instructional activities which allowed students to be able to study independently and work at their own pace. Technologies were developed and implemented to allow students to direct their own learning. A second impact of this project was the development and implementation of effective distance teaching and learning strategies based upon experiential teaching and learning conceptual models. Distance education delivery models for graduate education classes were applied and evaluated relative to student learning for web-based instruction. The findings of this project indicate that experiential learning models are effective for enhancing web-based teaching and learning.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Key Theme – Leadership Training and Development

Teaching and Learning for Higher Order Thinking: The Development of Teachers and Learners in the Context of Agriculture

a. The purpose of this project is to investigate the cognitive levels of teachers and learners in the agricultural disciplines at both high school and college levels of education. The project began in years 1-3 with collecting case study data from teachers (teaching perspective). In 2005, the focus shifted from collecting data regarding the teaching perspective to collecting data from the student perspective. Eight faculty members in the college who had previously engaged in the project during 2004 opened their classrooms for data collection from the student perspective. As such, students in the eight courses across a variety of agricultural sciences disciplines engaged in focus group interviews, individual interviews, and online questionnaires regarding teaching and learning in an agricultural sciences course. The final series of individual interviews was completed in November, 2005. Data analysis began in the spring of 2006, and comparisons between professor views and student views of teaching and learning in agricultural sciences courses will be made. In addition, the case study of teaching faculty at the university served as an impetus to collect data at the level of a USDA Higher Education Challenge

Grant for learner-centered approaches to teaching. Professors involved in the grant at the national level also opened their classrooms for the student data to be collected. Twelve professors who teach utilizing service-learning, problem-based learning and active learning were investigated and their students engaged in a series of two questionnaires to assess the process of learning in learner-centered courses in the agricultural sciences.

b. Impact – The agricultural industries are suffering from a brain drain in regard to human capital, meaning that there are more positions for qualified professionals in the agricultural sciences than there are individuals with agricultural degrees, a knowledge of agriculture, or a background in agricultural contexts to fill such positions. The expected impact of this project is to fill such a brain drain in the agricultural industries by improving teaching, and as a result increasing learning, in the agricultural sciences areas both at the secondary and postsecondary levels.

c. Source of Funding – Hatch, Other Non-Federal Funds

d. Scope of Impact – National

Key Theme – Parenting

Parenting Partners—When Couples Become Parents

a. During the transition to parenthood, many couples experience stress, conflict and a drop in satisfaction with their relationship. A series of twelve, two-page newsletters titled ***Parenting Partners*** were developed to assist couples with relationship issues and distributed to over 300 families in East Central Illinois.

b. Impact - Evaluation data was collected from couples who received the newsletters as an insert in age-paced parenting newsletters and from control couples who received only the age-paced parenting newsletters. Although responses were fairly comparable, the couples receiving ***Parenting Partners*** reported some positive changes that support additional consideration of this method of reaching couples.

- ♦ Because of things learned from *Parenting Partners*, almost all (96%) of the couples were more aware of the signs of parenting stress and most (74%) had tried different ways of managing the stress as suggested in the newsletters.

- Sixty percent of the couples indicated they had discussed the workload that comes from taking care of an infant as a result of things they had learned in *Parenting Partners*.

- One-third reported they had started or changed a ritual or tradition as a result of the newsletter.

- One-third also reported scheduling time for themselves as a couple as a result of reading *Parenting Partners*.

- Fifty-eight percent of the couples indicated that because of things learned in *Parenting Partners* they were more satisfied with their relationship with their partner.

- Sixty-four percent of the couples responding indicated their opinion of marriage or being in a committed relationship had gotten better because of things learned in *Parenting Partners*.

- Ninety-three percent read all or most of the articles.

- Fifty-seven percent said other people also read the *Parenting Partners* (43% spouse or partner, 25% relatives or friends).

When asked if reading *Parenting Partners* had led them to do anything differently in their couple relationships responses included:

> *"We now have "our alone time" set aside most nights after our baby goes to bed."*
>
> *"I really, really enjoyed the conversation starters in one of your issues. We found out more about one another."*
>
> *"I see I'm not the only one who thinks and feels this way."*

c. Source of Funding – State, Federal

d. Scope of Impact - Illinois

Post-Divorce Parenting when there is a History of Intimate Partner Violence

a. At present, we have completed 15 in-depth interviews with divorced mothers who experienced intimate partner violence by their former husbands during marriage. Preliminary findings suggest three patterns of post-divorce parenting with the abusive former husband. In one group, mothers report establishing effective post-divorce parenting arrangements that are safe for them and their children. A second group negotiates ongoing control and sometimes violence after divorce. Finally, a third group report no further contact by the men after divorce or contact that decreased to no contact over time. Relationships between former spouses vary from poor to very good (e.g., best friend) and no relationship at all, even among those who are still both involved in parenting their children. Themes related to forgiveness and personal transformation have emerged for those women who have been divorced longer. Next steps in data collection and analysis are to interview at least 15 more women and try to further understand how some parents manage to work out effective parenting arrangements despite a history of violence and what is going on with those parents who are not able to develop safe arrangements. Also, we plan to further explore how women reflect on their former husbands use of violence and how their own feelings of forgiveness, resentment, etc. influence how they facilitate (or not) their children's relationships with fathers. Overall, these findings will help to guide efforts to identify parents during the divorce process who have the potential to parent together safely after divorce and those in which traditional approaches (e.g., joint custody) to post-divorce parenting may not be safe or effective. The findings also further our understanding of different types of abuse experiences (e.g., a pattern of controlling violence vs. sporadic violence that occurs in the context of specific arguments) and how they influence ability to share parenting after divorce.

b. Impact – Findings from this study will help professionals who work with divorcing parents to identify those with the potential for safe and effective co-parenting after divorce despite a history of violence. For example, based on the type of violence experienced during marriage and patterns of control, professionals can help women anticipate the safety and parenting issues that may arise after divorce and help them make decisions about custody and parenting arrangements that prioritize the safety and health of women and children. It will also help us understand when joint custody and co-parenting arrangements may not be safe and effective. Such information can be used to help not only abused

mothers make informed decisions but also professionals in our court system.

c. Source of Funding – Hatch Funds

d. Scope of Impact – National

Key Theme – Youth Development/4-H

4-H Child Protection Training – Keeping Youth Safe

a. 4-H has an obligation to insure 4-H youth are protected from abuse. During 2006, 123 Illinois 4-H volunteers were trained on the topic of child protection using the new lesson "A 4-H Pledge – Keeping Youth Safe."

b. Impact - While some of the 4-H volunteers had received previous training on child abuse and neglect through their work or other volunteer roles, 78 – 90% of participants increased their knowledge related to the following:

Different types of child abuse	78.9%
Indicated reports of child abuse	89.4%
Recognizing child abuse	84.6%
Reporting child abuse	86.1%
Volunteer behavior guidelines	89.4%
Child safety recommendations	87.8%

While 4-H volunteers are not necessarily mandated reporters of child abuse/neglect, 98% of the participants indicated that they now had enough information to recognize child abuse and/or neglect.

c. Source of funding – Local, State, Federal Funds

d. Scope of impact – Illinois

4-H Project Workshops

a. A major way that 4-Hers "learn by doing" is through their 4-H projects. Ideally a 4-H project is a series of experiential learning activities planned by the member and a leader or helper. The projects involve setting goals, learning new skills (subject matter skills and life skills) and evaluating progress, all in a challenging and fun format. To capitalize on this opportunity to enhance member learning, the University of Illinois Extension State 4-H

Office conducted three regional 4-H project workshops for 133 teens, volunteers and staff in the spring of 2006. During the day-long workshop, participants explored experiential learning and how it applies to 4-H project work. Participants applied the experiential learning process in small groups that focused on 4-H projects in the areas of clothing and textiles, visual arts, horticulture, livestock, leadership, and photography.

b. Impact - An evaluation of the workshops showed that:

- ♦ 98.5% of participants agree or strongly agree that they have a better understanding of experiential learning
- ♦ 97% agree or strongly agree that they are better able and are more likely to use experiential learning in project and/or clubs
- ♦ 83% agree or strongly agree that they are more likely to teach project workshops or activities
- ♦ 84% agree or strongly agree they are more likely to use youth as teachers for project activities

A six-month follow-up evaluation is being conducted to determine if the participants have applied or used the new knowledge and skills they gained as a result of participating in the project workshops.

c. Source of funds – Local, State, Federal

d. Scope of Impact - Illinois

4-H Youth Leadership Training

a. Unit and Center Educators, as well as State 4-H staff, provided numerous educational programs focusing on leadership skills for youth and volunteers who work with youth. These included, but were not limited to, the following life skills: Understanding Self; Getting Along with Others; Communications; Managing Resources; Learning to Learn; Making Decisions; and Working with Groups.

Unit/Local 4-H Leadership Training

Training Offered	# of Hours in Training	# of Participants
Officer Training	2 – 6	475 youth; 8 adults
Leadership Academies	10-70; Varies across units	131
Leadership Conferences	6	874
Federation/Ambassadors	2 – 20; Varies across units	301
Teen Challenge	20+	27
Jr. Leadership University (on-line training)	One Semester	13
Leadership Through Community Action	20-25	146 youth; 79 adults
Take Charge Leadership Conference (C)	Unknown	380
County Youth Summit	5	90
Summer Camp Teen Volunteers	2-6; Varies across units	148
Camp Clover Assistants	3	5

Number of youth participating in training = 2,569

Teens Teaching Teens and Adults

Across the state, teen leaders were involved in being provided opportunities to learn skills and information and then, in turn, providing training to younger youth, other teens or adult volunteers.

Training Offered	# of Youth Teaching	# of Participants Taught
Making Club Meetings Better	8	25 adults
Methamphetamine Training	12	448 youth and adults
State 4-H Youth Leadership Team (Various Workshops on local, regional, state and national level)	17	300+
East Central Regional Youth Leadership Team Conference	17	87
Northern Illinois Leadership Conference	15	100+
County Workshop Instructors	67	Unknown

Total number of youth teaching other youth and adults: 136

Teens in Leadership Positions – Youth in Governance

Young people, once given adequate training and the opportunity, can serve very effectively on what are traditionally considered "adult" committees, boards and councils. Several Unit and Center Educators involve teens in this manner. In addition, several committees on the state level focus on youth and adult partnerships and involve teens and adults in planning, implementing, and evaluating various educational programs; making recommendations for changes or new policies on the state level; and more. (C - County; MC – Multi-county; R – Regional; S – State; N – National)

Group or Event & Level	# of Hours in Training or Participation	# of Youth Participants
State Fair Jr. Department Advisory Committee (S)	14	6
Youth/Adult Partnerships (R)	2-15	105
County Fair Assistants (R)	20-40	30
4-H Office Volunteers (R)	Unknown	10
Illinois 4-H Leadership Convention Planning Committee (S)	30+	8
Illinois State 4-H Youth Leadership Team (S)	50+	17
East Central Regional Youth Leadership Team (R)	15	17
Northern Illinois Leadership Conference Planning Committee (R)	35	16
Extension Councils	Unknown	6
National 4-H Event Planning Committees (N)	50+	3

Total youth in governance positions = 218

4-H Youth Development Leadership Programming Efforts Beyond the County/Unit Level

Illinois 4-H Youth Development programs provide many hours of leadership development opportunities for young people during the year. The following numbers include approximate hours of workshops and training provided as well as the number of youth participating and the level of the programming effort (MC – Multi-county; R – Regional; S – State; N – National).

Group or Event & Level	# of Hours in Training or Participation	# of Youth Participants
Methamphetamine Training (MC; S)	12	30
Citizenship Washington Focus (N)	60	26
National 4-H Conference (N)	Conference: 60 Follow-up Project: 25	8
State Fair Assistants (S)	Training: 2 Working: 100+	35
Chicago Communications Conference (R)	24	46
12-14 Conference (R)	12	19
Legislative Connection (S)	3	500+
Regional Volunteer Forums (R)	5	16
Leadership Academies (MC)	Unknown	85
Jr. Leadership Conference (S)	7	96
4-H Leadership Convention (S)	8	89
Cluster Leadership Teams (MC)	10	6
Counselor-in-Training (R)	15	15
Camp Counselor Training (R)	125	28
Northern IL Leadership Conference (R)	6	28
White House Youth Leadership Conference (N)	5	8
John Deere Leaders' Academy (N)	15	3

Number of youth participating in regional, state and national training events = <u>more than</u> 1,031.

b. Impact – Total number of 4-H Youth Development opportunities/involvement: more than 3,975.

Testimonials:

> "*I had heard that a really good discussion had taken place in one of the small groups at a Youth-in-Governance session. I was talking to the facilitators of that group later and they both said they had never really facilitated anything before and probably wouldn't have, out of fear, before coming to Citizenship Washington Focus*

(CWF). But through CWF, they came out of their shells a little bit, stepped out of their comfort zones, and did it. And they did it very well from what I heard. That put a big smile on my face. That's why I love (4-H) leadership conventions. I know I went through those changes and still do at every event, and now I am seeing others going through them also. Those are the moments that sharpen leadership skills. Those are the reasons these events need to continue and expand. I wish I knew how to let others see it as well."

Current 4-H Youth Leadership Team Member

"*From being a 4-H member to attending National 4-H Congress to joining the State Youth Leadership Team, I have seen how much I have grown over the entire decade that I was a member of the 4-H program. I really know who I am as a person and have a higher confidence in myself when facing a challenge. I understand how to work in a group effectively and how to better communicate to others while in a work-related situation. I feel as though I have better management skills and can prioritize my life to know what is truly important to me. 4-H has truly made me who I am today and I am proud to let everyone know that fact."*

4-H Alumnae
Current Advisor to State 4-H Youth Leadership Team

"*Serving on the Illinois State 4-H Youth Leadership Team since September 2005 has allowed me to gain many life skills that will help me continuously in the future. Being a part of this committee has let me be able to work with others better. When planning the different events, such as Junior Leadership Conference, I have been able to accept others ideas and then we will all work together to get something that we all agree on. Being able to serve with the other 4-H'ers across the state has allowed me to become friends with many, learn how to work as a group while all getting along, and of course I have become better at making decisions that impact others, not just myself."*

4-H Member
Current 4-H Youth Leadership Team Member

"*Having the opportunity to participate on the Illinois 4-H Youth Leadership Team (YLT) has been an awesome experience to grow with new and different people that have new ideas. This leadership position has helped me learn more effective communication skills and has helped me*

learn how to best work within a group situation. On YLT we have many responsibilities that cannot be done on time or as well by just one person, so it is very important how to learn to work with the whole team. I am a very "green" person, that is to say that I like things that are logical and somewhat in order. Being on YLT has helped me learn that this is not the only or the best way to do things and that it is more important to hear what everyone has to say before you jump in on something."

4-H Alumnus
Current 4-H Youth Leadership Team Member

"*Northern Illinois 4-H Leadership Conference is great opportunity for youth ages 13-18 to improve their leadership skills on a local level. Through working in the creation of this conference, I have learned a lot about making decisions and managing. Each year the conference grows, bringing changes to the schedule, budget and overall design of the conference, which I have helped decide as part of the Planning Committee. I have also strengthened my communication skills through coordinating the conference workshops and communicating with the approximately 15 different presenters."*

4-H Member
Current 4-H Youth Leadership Team Member

"National 4-H Conference has taught me a lot about working with groups. From the delegate perspective, I worked with my fellow Illinois delegates during the conference to take back what we learned from conference and as a result create a handbook for meeting with elected officials. As a member of the Planning Committee, I learned about working with groups through being with approximately 15 other youth from across the nation that I did not know and having the task of planning this national event. Both experiences have also taught me a lot about myself as well as getting along with others due to the diversity of the people involved."

4-H Member
Current 4-H Youth Leadership Team Member

"*My time in the 4-H program has made me who I am today. I know that sounds a bit cliche, but it is true. Even after I officially graduated from the program, I have*

continued to be involved with the State Youth Leadership Team (YLT). I am naturally a quiet person, but working with groups such as the Illinois Leadership Conference (ILC) Planning Committee and the YLT, I have learned to be comfortable leading a group of my peers. The skills that I have learned at conferences, such as ILC and through the Danforth ***I Dare You*** *program, have become almost second nature. Things like group facilitation and conflict resolution have become very natural roles in groups of people ranging from 4-H groups to classmates to school friends. My early years in 4-H taught me to be a public speaker, a skill that was honed and necessary for roles like the ILC Planning Committee and as a Youth Leader at the Junior Leadership Conference (JLC) for middle school students. YLT has given me several unique opportunities to learn. JLC is always an adventure, but it is also a practical tutorial in teaching and leading. The kids offer new perspectives and usually I learn something from them as I hope they can learn from me.*

The other opportunity was to provide a youth voice in the development of a leadership curriculum for 4-H clubs. I did not realize until I was at the meeting with several 4-H Youth Development staff that 4-H had given me all of the skills necessary to communicate effectively to a group of adults. In helping to write the curriculum, I learned more about what I had learned at all the conferences, simply because I was now trying to teach someone else. These leadership experiences have really taught me to lead group activities and to ask follow-up questions that will make the group think about the activity."

4-H Alumnae
Current 4-H Youth Leadership Team Member

Character Education Training

a. The Illinois 4-H program provides character education for youth through the traditional 4-H club, classrooms and other venues. 4-H makes a significant contribution to laying a solid foundation for character development by teaching children right from wrong through several different curricula targeting different age groups and settings.

During 2006, character education materials were used by more than 39 teachers working with more than 738 students as reported

via the online reporting site. Materials used included: Terrific Teachable Moments, Character Critters and Polite is Right.

b. Impact –

- ♦ 89.74% of the teachers found U of I Extension character education materials very useful

Teachers also reported on how the training influenced their students:

- ♦ 82.05% noticed improvement in the children's KNOWLEDGE of positive character
- ♦ 87.18% noticed improvement in the children's ATTITUDES toward positive character
- ♦ 84.61% noticed improvement in the children's CHOICES or BEHAVIOR.
- ♦ 15.38% credited most of the change to University of Illinois Extension materials.
- ♦ 74.36% credited some of the change to University of Illinois Extension materials.

c. Source of funding - State, Federal

d. Scope of Impact – Illinois

Improving Teen's Decisions in Sexual Activity

a. When teens are expected to make smart decisions about sexual behavior without being given information that can help them to make informed decisions, the results can be choices that are unhealthy or unwise. Teen R.I.S.K. (Real Issues of the Sexual Kind), is an interactive simulation and guided discussion with the goal of helping teens 'experience' a visual understanding of the costs of risky behaviors and the benefits of avoiding them. During 2006, over 1500 high school and middle school students in the West Central Region of the state have participated in Extension's Teen RISK simulation.

b. Impact - Ninety-nine percent of the students reported increased knowledge about the risks of sex, condom use, and multiple partners, 94% found the program to be highly effective to

effective, and 79% planned to avoid risky behaviors due to the program.

After having her high school students participate in the Teen RISK program for the last four years, one high school teacher remarked that it was the first year since she had been a teacher at the school, that there had been NO pregnancies. When questioned by Extension's Family Life Educator about whether she felt the Teen RISK program had been influential in this outcome, the teacher replied, "Absolutely! That is why I have you come back every year."

Hundreds of teens are learning the importance of their decisions at these simulations. One student wrote that Extension "…should go to schools from town to town. You have saved many lives today." Another wrote, "This should be a mandatory thing for students to go through. It really helped me." And another wrote "you will be in the future decisions I make."

c. Source of Funding – Local, State, Federal

d. Scope of Impact – Illinois

Behavior Management - Planning 4-H Club/Group Guidelines Together

a. Creating an appropriately structured environment for youth is a research-supported element that contributes to their positive development into competent and contributing adults. During 2006, 15 Illinois 4-H volunteers received training on the Behavior Management topic of "Planning 4-H Club/Group Guidelines Together". In addition, 26 volunteers participated in the "Techniques for Cooperation" training. Both training sessions focused on structuring environments for youth with whom the volunteers worked.

b. In rating their level of knowledge on a variety of topics included in the "Planning 4-H Club/Group Guidelines Together" with a score from 1-4 with 4 being "greatly increased knowledge", the following results were obtained:

Knowledge of:

Critical elements of positive youth development	3.21
Establishing group guidelines	3.13
Importance of P's and Q	3.43
Sharing ownership of group behavior	3.42
Setting guidelines with club/group	3.47

100% of the participants stated that they now had enough information to set guidelines with their club/group.

Using the same rating scale, 4-H volunteers who participated in the "Techniques for Cooperation" rated their knowledge gain in two areas as follows:

New ideas about planning meetings	2.56
New techniques for creating successful learning environments	2.69

Volunteers mentioned techniques to deal with adults being disruptive, ways to let youth plan their own meetings, and consequences for behaviors.

a. Sources of Funding – Local, State, Federal

d. Scope of Impact - Illinois

4-H Risk Management

a. Creating a physically and psychologically safe environment for youth is a research supported element that contributes to their positive development into competent and contributing adults. 46 Illinois 4-H volunteers attended training on the topic of risk management.

b. Impact - In the end-of-session evaluation, participants ranked their increase in knowledge learned on a scale of 1-4 with 4 being "greatly increased knowledge". Participant scores ranged from 2.20 to 3.16 on a variety of risk management terms such as risk, assets, liability, hold harmless, etc. Scores ranged from 3.07 to 3.24 on understanding strategies to retain, share, reduce, or avoid risk. The volunteers also stated that they intended to use medical forms and parental informed consent forms for events and activities.

Additionally, eight of the volunteers completed a follow up survey several months after the training. In this survey, 87% indicated

that they had made changes in how they carry out 4-H club activities. Seventy-five percent (75%) had developed a risk management plan for their club and 25% created a parental informed consent form for an activity. Fifty percent (50%) planned to or had already conducted orientation or training for those leading events and activities. Thirty-three percent (33%) made contingency plans for emergencies, created procedures for documenting incidents, applied safe food handling practices, and checked license and insurance cards of drivers for events.

c. Source of Funding – Local, State, Federal

d. Scope of Impact – Illinois

VALUED Volunteer Orientation – Role of the Volunteer in 4-H

a. A positive relationship with a caring adult has been documented through research as an element for developing youth into competent and contributing adults. 4-H volunteers assume this role when provided with appropriate training focused on working with youth. The Valued Volunteer Orientation program was conducted to provide this training in a series of modules that included 15 participants in the "Role of the Volunteer in 4-H," 34 volunteer participants in "Club Organization," and 14 volunteers in "Program Planning."

b. Impact - End-of-session evaluation forms for the module "Role of the Volunteer in 4-H" indicated that several of the volunteers learned the importance of delegating to others, of involving others in helping with the club/group, and that there are a wide variety of resources available to leaders. Several volunteers also indicated that they planned to ask parents and other adults to serve as project leaders and planned to use the volunteer role descriptions and other resources of which they were now aware.

   Completed evaluations for the "Club Organization" module revealed that participants learned important concepts through this session including ways to make club meetings more welcoming to new members, ways to help members plan and complete goals, ways to get more organized, and ways to complete paperwork correctly. Leaders indicated that they intended to use many of the tools and resources shared in the session including agenda forms, policies, *Illinois Clover*, National 4-H Supply Sourcebook, goal planning sheets, and officer packets.

Volunteers who completed the module on "Program Planning" and submitted their evaluation form indicated that important ideas learned from this module included ways to get members and parents involved in establishing the club program, creating a varied program so that it includes something for everyone, and the need for organization and advanced planning. The volunteers also indicated that they planned to use a variety of techniques to develop their club plan including brainstorming, surveys, interest forms as well as utilizing members, junior leaders, and parents in the process.

c. Source of Funding – Local, State, Federal

d. Scope of Impact – Illinois

Youthworks: Youth as Resources for Strengthening Human and Social Capital in Rural Areas

a. In this final project year, the YouthWorks intervention was completed in the target rural communities. In addition, YouthWorks was offered to the Illinois comparison sites. In total, 513 students participated. YouthWorks was also replicated in a rural Indiana community. YouthResource Directories were published and broadly disseminated in each community. YouthMappers presented their findings at school and community-based forums and were featured in media reports. The implementation and replication of YouthWorks yielded an enriched understanding of how to best perform program elements. For example, Community YouthMapping is best conducted during the summer when teens have more time. In contrast, Youth Engagement Task Forces are best formed at the beginning of the academic year when teen, school, and community leaders are generally excited about launching new initiatives. Comprehensive YouthProfile reports were prepared for each participating community. YouthProfiles presented extensive descriptive results regarding teens perceptions of existing and necessary resources, future plans for career and residence, and critical local issues. Aggregated research findings that assessed the impact of YouthWorks on the target communities were included. YouthProfiles were widely distributed and were intended to be resources for school administrators and community leaders working to improve services, enhance community receptivity toward youth, and create strategies for attracting and retaining talented young people to the community. Pre-test/post-test comparisons of the experimental and control samples revealed that, following YouthWorks, juniors and seniors in high school were

significantly more likely to report that their hometown values youth and that they could play a meaningful role in the community as adults. Approximately 75% of surveyed high school students rated the YouthResource Directories and the Youth Engagement Task Forces as helpful; 25% reported consulting the directories for information about employment, college scholarships and preparation programs, sports/recreation, leadership/volunteer opportunities, and health and well-being resources. In individual interviews, Community YouthMappers reported receiving specific benefits such as being offered employment, securing scholarships, and internships. All YouthMappers reported an increased knowledge of local resources and opportunities. Community leaders and business owners perceptions of youth and YouthWorks were positive. YouthMappers reported that community leaders were eager to ensure that their offerings were made known to youth. YouthWorks stimulated town leaders and business owners to consider ways to increase community youth involvement, e.g., by creating new volunteer or internship positions and improving recreational venues for youth. They reported that an investment in teens would make the community a better place while also enhancing youth workforce preparation. Participating youth reported being appreciative not only for having a summer job but also for the experience of discovering opportunities in their hometown of which they were previously unaware.

b. Impact – YouthWorks is a valuable tool for broadening rural youths awareness of the opportunities their hometown offers, for teaching youth how to contribute to their communities in meaningful ways, for building leadership skills, and for promoting communities positive regard of youth. Teens who participated in YouthWorks are more likely to believe that their hometown values them and that they could play a meaningful role in the community in the future. These factors enhance the likelihood that talented youth will consider living and working in the community later in life. The retention of these talented individuals will strengthen the local workforce, thereby promoting the economic and social vitality of rural communities. YouthWorks also produced improved resources and facilities for youth in the participating rural communities. The Youth Engagement Task Forces that were formed, composed of youth and business/community leaders, each addressed at least one specific youth-identified need. Taken together, these results suggest that the YouthWorks system may have broad effects, benefiting rural communities by expanding the opportunities and resources available to youth and by increasing the ability of youth to contribute to economic and social development of the community.

c. Source of Funding – NRI Competitive Grant Funds

d. Scope of Impact – National

The CDL Research Database Project: Interdisciplinary Investigations

a. Progress - During the past 12 months several of the data studies needed to inform the modeling effort have been completed. This year a range of soybean germplasm lines were planted in soyface and monitored for ozone effects; this has supported observations in prior years of variation in ozone response, also critical to projections of long-term responses of ozone. We have established that ozone concentrations of the levels observed in central Illinois (40 - 80 ppb) decrease photosynthesis of leaves, but only as they age. Most affected are the leaves that remain at the top of the canopy during grain filling; this is linked to the decreased individual grain mass observed under elevated ozone. We have also begun monitoring and modeling 3-dimensional canopy growth which is critical to modeling light interception and in turn photosynthesis, and how both are affected. At present we are able to predict effects of ozone on individual leaf photosynthesis. Our next phase is to integrate this into the growing canopy and finally partitioning of photosynthate to grain.

b. Impact -Soybean is the number two crop in the U.S. in terms of area planted. However, it is very vulnerable to ozone which likely lowers current yields by between 10 and 20%. The effect of ozone is also likely to be increased by global climate change. Although ozone has decreased in some parts of the U.S., it has continued to increase in many rural regions. The Intergovernmental Panel on Climate Change predict that these increases will continue through this century. Accurate forecasting of the future impacts of ozone and climate change on the soybean crop in different regions of the U.S. will be critical to planning and setting priorities for crop improvement.

c. Source of Funding – Hatch, State, and Other Non-Federal Funds

d. Scope of Impact – National

CSREES MANAGEMENT GOALS

Key Theme - Multicultural and Diversity

Refugee Training Program in Landscape Maintenance Pilot Program

a. Progress - Heartland Alliance data indicates that 75-85% of the refugees being resettled in the Chicago area are from Africa (Togo, Ethiopia, Somalia), as well as a small minority from Burma and Srilanka. The majority of these audiences are largely from agrarian backgrounds. Most of these refugees have spent the last 10-12 years in the UN Refugee Camps in Kenya and similar places. They have virtually no job training, education or verifiable experience to help them secure regular employment in Chicago.

A recent survey indicates that the Greens Industry represents one of the fastest growing segments of U.S. agriculture. In a survey done in 2000, Greens Industry businesses identified the ability to hire skilled labor as the most important external factor affecting business growth and success. The Illinois Greens Industry has a combined value of $4.72 billion according to the 2003 Economic Impact, Growth and Characteristics Survey (and an estimated $6.1 billion according to the USDA report which includes affiliated sales).

The goals and purpose of this project was to train refugees from agrarian backgrounds job skills in landscape maintenance that would prepare them for employment and careers in the greens industry. The second goal of this project was to enable Greens Industry employers to become more cross-culturally sensitive as they interact with the refugee employees.

Programming efforts targeted adult refugee audiences from six different countries (Somalia, Ethiopia, Eritrea, Congo, Liberia, and Srilanka). Most of the participants had challenges in English language competency and had to first learn basic horticultural terminologies over several sessions prior to starting the training.

The training program addressed the following issues:

- ♦ employment of refugees through job preparation and training
- ♦ landscape maintenance and horticulture training

- ♦ information about future career and business opportunities in the Greens Industry
- ♦ English proficiency in landscape maintenance terminology
- ♦ first aid and safety
- ♦ American work ethics, expectations and culture

b. Impact - The Refugee Maintenance training had an initial enrollment of nine participants from six countries (Ethiopia, Eriteria, Somalia, Congo, Liberia and Srilanka). Six of these participants (66%) completed the 14 week landscape maintenance training; 85% of the participants successfully passed the quizzes and final exam and they were able to answer horticultural questions knowledgeably and with ease. Everyone in the class was satisfied and glad for the training and they stated that "they had learned a lot".

c. Source of Funding – Local, State, Federal

d. Scope of Impact - Illinois

B. Stakeholder Input Process

Stakeholders provide continuous feedback in terms of programming needs as well as programming results. The College of ACES has many channels for stakeholder input. The College, the Office of Research, the Office of Extension and Outreach, all academic departments, and many programs and projects in the College have advisory councils made up of stakeholders. The advisory councils meet at least yearly, but in many instances more frequently than that, and are active participants in determining the direction of the College units as well as specific programs. Several hundred stakeholders, representing both organizations and individuals, participate in this process on an annual basis. Stakeholder input is typically oriented towards input in the nature of the decision-making within the units and projects in the College, as well as focusing directly on the results from the College's activities for the stakeholder groups or for the state population at large. Stakeholders who function in an advisory capacity typically do not distinguish between research and outreach outcomes, and they form a powerful voice for the effective integration of research and extension activities.

The Council on Food and Agricultural Research (C-FAR) was organized to increase state funding for food and agricultural research. C-FAR is made up of such organizations as the Illinois Farm Bureau, the Audubon Council of Illinois, the Illinois Dietetic Association, the Horseradish Growers of Illinois, Illinois Rural Partners, and nearly 50 other equally diverse state organizations. While these organizations frequently disagree sharply on specific aspects of agricultural production and policy, nutrition, and rural development, all agree that a results-focused research program will provide a valuable contribution to resolving many of the issues affecting the health of the Illinois population, agricultural production and rural development. C-FAR has been successful in obtaining additional funding from the state legislature to enhance College-based agricultural research at the University of Illinois and other state institutions. Because C-FAR has been willing to expend the effort to increase the support for research it has acquired a significant role in helping to define the research agenda. By focusing continuous attention on the need to solve "real-world" problems and insisting on the timely sharing of research results with constituent groups, C-FAR has made a significant impact on the way in which the research and outreach agendas are being defined in the College.

Every Extension unit has a local council, which provides ongoing input in Extension program planning and evaluation. Councils are active in helping to identify local needs and provide formal and informal feedback on Extension activities. During 2006, more than 3,000 volunteers served on

local Extension councils and planning committees throughout the State. The chair of each council, or his/her designee, also serves on the regional advisory council in each of the five regions in Illinois. Finally, Extension has a state advisory committee made up of three representatives from each region who meet at least twice a year for a multiple-day session with the state Extension administration to provide input on programming needs and Extension processes.

To strengthen the role of advisory councils at all levels, Extension has initiated an ongoing program of council training. In addition to training that takes place at the council level, Extension also provides a Council Guide to each council members that includes information on Extension policies, procedures, and programs.

Extension is currently engaged in a multi-year review of all local units, with special emphasis on programming quality, local programming impact, diversity of stakeholder input and the needs of undeserved audiences.

In program planning, Illinois relies very heavily on local input. The current state and county plans of work were built on a four-year "rolling" basis. Each year, one of the four core programming areas, Nutrition, Family and Consumer Sciences, Agriculture and Natural Resources, 4-H Youth Development, and Community and Economic Development, was engaged in an in-depth program needs assessment process.

After two years of dialogue involving different groups within Extension, the State Program Planning Committee created a framework for identifying flagship programs designed to elevate the impact and visibility of University of Illinois Extension both on campus and in communities in innovative ways. Extension staff were invited to submit flagship program proposals that featured inclusiveness of different disciplines within Extension or through cross-campus engagement Through innovative and entrepreneurial approaches, these Flagship Programs were to address local and state priority needs and issues and include provisions for long-term financial sustainability.

From over twenty pre-proposals, three have been invited to prepare and submit final proposals. These three proposals will be reviewed, and if accepted, will be provided funds for development of interdisciplinary programs that will then be added to the current portfolio of programs included in the Illinois and county plans of work.

C. Program Review Process

No significant changes have been made in this process.

D. Evaluation of the Success of Multi-State and Joint Activities

Throughout this report, integrated Extension and Research activities and multi-state Extension activities have been described with respect to programming and outcomes. Specific activities are identified and more fully described in Section E of this report with the funding support for those activities identified in Appendix A (See Figure 1).

The FY 2006 activities listed in Section E most certainly address critical issues of importance to the University of Illinois and Illinois residents as well as ones that are of concern to the public in other states. These integrated and multi-state activities focus on the broad issue areas of society's most pressing environmental challenges, economic sustainability of agriculture production, increasing economic and human capacity through informatics, and sustaining viable rural and urban communities.

All of these issues have been identified by stakeholders including members of the Illinois Council of Food and Agricultural Research (C-FAR) and the local Extension Councils in Illinois. In addition, the concerns of Illinois residents are reflected in the University of Illinois strategic initiatives and directives that also address these issues. Interstate and national discussions of College of ACES faculty, staff and administrators through conferences and multi-state meetings have provided forums for identifying issues in common across state lines and opportunities to form alliances to address them.

The activities affect and involve a wide variety of audiences with a number of activities reaching underserved or under-represented audiences including part-time farmers through the **Agroecology/Sustainable Agriculture Program** and Hispanic audiences through the **New Horizons Spanish Radio Program.** In addition, the **Green Industry Project** focuses on investing resources to meet the needs of a growing underserved Illinois green industry. The **MarketMaker** program also attends to developing food products that are in demand by individuals from various cultural groups. In addition, the activities that address community development focus on small rural communities, as well as urban areas, that are struggling to provide services with limited resources.

The impacts of **MarketMaker**, the **Agri-Ecology/Sustainable Agriculture Program (Part-time Farming)**, and **FAST Business Tools** (located on the **Farmdoc**. website) are described in Section A on pages 14, 46, and 11 respectively. The **Illinois Initiative for the Development of Entrepreneurs in Agriculture** clients developed business and marketing plans for new enterprises. The **Laboratory for Economic Development** is currently developing an educational video for the Agri-Ecology/Sustainable Agriculture program with impact to be determined.

The **Earth and Society Initiative** is a cross-campus interdisciplinary effort of six teams of faculty at the University of Illinois conducting research in the areas listed in the initiative description in Section E. College of ACES faculty (nine) are involved in research projects being carried out related to biofuels and their impacts on land use and "landinformatics" as reflected in the impact reports in section A on pages 41 and 52. This campus initiative is in its third and final year, but has garnered $100 million dollars of support with another $164 million in pending support including the recent British Petroleum Company's support to form the Biosciences Institute with UC Berkeley.

In 2006, 989 plant and pest problems were diagnosed by University of Illinois Extension's **Distance Diagnostics Program**. Additionally in 2006, the project received a Homeland Security Grant for $57,000 to enhance the system's ability to detect **potential** bioterrorism.

The **"New Horizon" Spanish Radio Program** is evaluated by the state specialist providing leadership for this program. The **North Central Regional Center for Rural Development (NCRCD**) and **e-Xtension** have an advisory or executive committee that is multi-state in membership and that reports to the North Central Regional Extension Directors at regular intervals.

The integrated and multi-state **conferences** are evaluated to determine if they have contributed to improve program development and implementation to meet the needs of Illinois stakeholders. For some, it is too soon to assess their overall impact in meeting the needs of all Illinois citizens.

Several of these activities involve using technology that has improved the effectiveness and efficiency of program delivery. The **Digital Diagnostics** program has allowed more timely and personalized response to plant problems, as well as providing users access to quality problem diagnosis and recommendations. The **FAST** tools provide web-based decision making tools that can be easily accessed and used by agricultural producers, as can the publications and databases related to decision making that are a part of the online **Farmdoc Project.** The **Plant Management Network** is also a web-based integrated activity that provides access to users at their convenience. Through audio conferencing, the **Local Government Information & Education Network** is able to bring high quality and impactful educational programming statewide to local government officials as evidenced through a recent evaluation indicating that local government officials now have improved knowledge of fiscal trends that affect their communities. Audio conferencing has proven to be another efficient as well as effective way to reach a specialized audience.

E. Description of Multi-State and/or Integrated Activities

An image of CSREES-REPT (Revised 09/04) report form for Multi-state Extension Activities may be found in Appendix A.

Program Support - Program support for new faculty and faculty who have joint research/extension appointments.

Information Technology Support - Support for services related to the design, development and web management. of research and extension programs as well as program impact and reporting systems.

ACES Afield Newspaper - Annual college update that details teaching, research and extension activities in the College of ACES for agricultural stakeholders.

Distance Diagnostics through Digital Imaging System Project – Agreement between University of Illinois Extension and the Center for Internet Imaging and Database Systems at the University of Georgia to facilitate rapid submission of text and digital images as educational tools for solving problems related to horticultural crop and landscape plants and their pests and for archiving data for future uses.

Conferences - Various multi-state extension conferences that showcase current extension initiatives. List attached.

Farmdoc Project - The goal of the Farmdoc (farm decision outreach central) Project is to improve farm decision-making under risk through education and research. To meet this goal, the Farmdoc website provides Illinois farmers with comprehensive integrated risk management information and analysis. Publications, decision tools and databases related to a variety of risk management issues are found throughout the site. Subject matter sections cover finance, marketing and outlook, management, law and taxation and policy. Specialty sections are devoted to the AgMAS (Agricultural Market Advisory Services) Project, crop insurance, farmland owners, prices and weather, and ag web resources. www.farmdoc.uiuc.edu

Market Maker - Illinois Initiative for the Development of Entrepreneurs in Agriculture (IDEA) is designed to provide high quality educational support and technical assistance to farmers and others in, or dependent on, the agriculture sector. IDEA staff believe there is an opportunity for farmers to add value to products and increase their profitability by marketing their products through alternative methods as opposed to the commodity marketing. In order to accomplish this, IDEA conducts research, develops educational products and provides services that

encourage farmers to incorporate entrepreneurial strategies which direct their marketing efforts to meeting consumer demand.
www.marketmaker.uiuc.edu

Partnership in the Plant Management Network - PMN is a unique cooperative resource for the applied plant sciences. Designed to provide plant science practitioners fast electronic access to proven solutions, the PMN offers an extensive searchable database comprised of thousands of web-based resource pages from the network's partner universities, companies, and associations. Other state university partners are SD, ND, NE, VA, OH, IN, KS, CO, AR, FL, MO.
www.plantmanagementnetwork.org

Laboratory for Community and Economic Development - Provides practical, research-based information and programs to help individuals, families, organizations, businesses, farms and rural and urban communities throughout Illinois through programs on community assessments, planning, leadership, entrepreneurship and developing tourism. Additional information may be found at
http://communitydevelopment.uiuc.edu

Illinois Green Industry Project - The goal of this project is to follow up and update the 2000 survey of the green industry; to evaluate the impact of changes within the industry on the State's economy; to assess the economic impact of the Illinois green industry as measured by sales, workforce, payroll and taxes paid; to begin to measure the changing structure of the industry; to identify constraints to business and market expansion; to provide crucial information to assist and expand existing outreach programs for training and educational purposes; to implement needs assessment for future program planning; to disseminate survey and program results to the industry and citizens of Illinois.
http://research.nres.uiuc.edu/report01-01/intro.html

Agroecology/Sustainable Agriculture Program (Part-time Farming) - The Agroecology/Sustainable Agriculture Program (ASAP) promotes research and extension which protects Illinois' natural and human resources while sustaining agricultural production over the long term. The program includes cooperative efforts of North Central land grant institutions and other partners, as facilitated and funded in part by the USDA Sustainable Agriculture Research and Education (SARE) program administrated by University of Nebraska. SARE offers competitive grants related to applied research and extension pertaining to sustainable agriculture**. http://www.aces.uiuc.edu/asap/index.html**

Illinois-Indiana Sea Grant Program - The Illinois Indiana Sea Grant Program provides up-to-the-minute information on Great Lakes issues,

emphasizing concerns in the southern Lake Michigan region. Topics addressed include water quality, aquiculture and seafood safety, biological resources, sustainable coastal development, and coastal processes. It is funded by NOAA, University of Illinois, and Purdue University. http://www.iisgcp.org/

Illinois Agricultural Entrepreneur Development Initiative - Designed to provide resources and technical assistance in business planning, product development, value added products and marketing. Program is associated with research projects funded by state funds. The "Illinois Branded Livestock Project" is an example of product development under this initiative. http://web.extension.uiuc.edu/iidea/services.htm

Farm Analysis Solution Tools (FAST) - FAST are a series of Excel spreadsheets that help lenders and farmers evaluate various aspects of a farm business. The computerized decision aids permit users to perform financial analysis, assess investment decisions and evaluate the economic impacts of various management decisions. A series of workshops will be presented in 2006. http://www.farmdoc.uiuc.edu/fasttools

Earth and Society Initiative - This initiative provides seed money to support innovative ideas and novel approaches to the complex, interdisciplinary and national environmental problems. Examples of currently funded projects include the Illinois Program on Nutrient Dynamics that is using the U of I new South Farms as a living/learning laboratory to provide better understanding of the impacts of human inputs on agricultural lands. The second project is exploring disease emergency and ecosystem health by coordinating research, education and outreach activities of a diverse assemblage of University of Illinois centers, programs, labs and individuals whose interests converge at the interface of emerging infectious diseases, anthropogenic environmental change and biodiversity conservation.
www.environ.uiuc.edu/earthandsociety/earth_society_about.html

E-Extension Assessment - Assessment along with The Cooperative Extension Services of the U.S. states and territories and with other components of Land-Grant Universities and the CSREES in cooperation to build a national extension system. The collaborative effort will allow the Extension system to more efficiently serve current and new customers in ways that provide accurate and just in time information for decision making. The information technology and the intellectual capacity for this system are in place to complement the dedicated Extension educators located in the 3000 plus counties of the U.S.

North Central Region Center for Rural Development (NCR CRD) - NCR CRD coordinates and supports research and Extension activities in

the areas of community and economic development throughout the North Central Region. The NCR CRD has a number of programmatic emphases which vary over time as the needs arise. Funding is provided to Iowa State for coordinating programs.

Local Government Information & Education Network - This program provides a variety of educational programs, materials and services to local government officials. Includes an annual series of informational updates via audio conferences, planning of annual conferences for professional associations, quarterly newsletters, fact sheets, and a series of publications on the roles and responsibilities of governmental officials. The network continues to work in areas of poverty, land use and civic education. As a result of work with the multi-state land use team, the fact sheets, written by Extension staff in Indiana and Ohio, have been adapted for Illinois. http://www.uic.edu/UI-Service/programs/UIUC289.html

New Horizon Spanish Radio Program - The program is used by the University of Illinois and is distributed bi-weekly and free of charge to communities in IL, IA, KS, MI, MN, MO, OH, and VA. The program is produced by University of Illinois students to educate and entertain and geared toward Hispanic populations who have come to the U.S. looking for a new start. New Horizon becomes a part of that new beginning by providing interviews on current topics of interest as well as informative sections related to health and Hispanic culture. New Horizon programs are also distributed to radio stations throughout the Midwest.

FY 2006 Multi-State Conferences

Conference	Location
21st Century Community Learning Institute	San Diego, CA
Agriculture Equipment Technology Conference	Louisville, KY
American Association of Pesticide Safety Educators	Raleigh, NC
American Dairy Science Association-American Society of Animal Science Annual Meeting	Minneapolis, MN
American Dietetic Association	St. Louis, MO
American Dietetic Assoc. Food & Nutrition Conf.	Honolulu, HA
American Forage and Grasslands Council	San Antonio, TX
American Society on Aging Conference	Anaheim, CA
AP Western Farm Show	Kansas City, MO
Art of Leadership Conference	San Diego, CA
Art of Leadership Conference	Burlington, VT
Association for Financial Counseling and Planning	Scottsdale, AZ
Association for State Nutrition Network Administrators Annual Meeting	Phoenix, AZ
Board on Human Services	Baltimore, MD
CSREES Administrators Conference	Rapid City, SD
Children Youth and Families At Risk Conference	Atlanta, GA
CYFAR Sustainability Orientation	Washington, D.C.
Council of Extension, Continuing Education And Public Service	Baltimore, MD Denver, CO
Crisis Response Project Workshop	Kansas City, MO
Evaluator's Institute	San Francisco, CA
Evaluator's Institute	Washington, D.C.
Extension Committee on Policy	Albuquerque, NM
Future Farmers of America National Convention	Louisville, KY
Food Safety Conference	Denver, CO
Food and Nutrition Education Program Conf	Washington, D.C.
Great Lakes Fruit, Vegetable Farm Market Expo	Grand Rapids, MI
Grazing Conference	Mineral Point, WI
Helping America's Youth Conference	Indianapolis, IN
Housing Education & Research Association	Denver, CO
IEDC Annual Conference	New York, NY
Institute for Entrepreneurship	Milwaukee, WI
Integrated Pest Management Conference	St. Louis, MO
Livestock/Youth Exposition	Oklahoma City, OK
MarketMaker meeting	Frankfort, KY
Mid-Mississippi Valley Orchard Tour	Campbell, MO
Midwest American Dairy Science Association	Des Moines, IA
Midwest Apple Improvement Association	Indianapolis, IN
Midwest Fruit and Nut Growers Meeting	Indianapolis, IN

MS Technology Education Conference	Boston, MA
National 4-H Conference	Washington, D.C.
National 4-H Congress	Atlanta, GA
National Association of Community Development Extension Professionals	San Antonio, TX
National Association of County Agricultural Agents	Cincinnati, OH
National Association of Extension 4-H Agents	Seattle, WA
National Association of Personal Financial Advisors	Grapevine, TX
National Association of State and Land-Grant Universities	Washington, D.C. McLean, VA
National Extension Technology Conference	Gainesville, FL
National Renewable Energy 4-H Training Conf.	Washington, D.C.
National Rust Symposium	Nashville, TN
National Small Farms Conference	Greensboro, NC
National State 4-H Program Leaders Meeting	Washington, D.C.
North Central State 4-H Program Leaders Meeting	Perry, IA
North Central Administrative Leadership Conf.	Indianapolis, IN
North Central Business Officers' Conference	Nebraska City, NE
North Central Extension Directors Meeting	Madison, WI
North Central Extension Leadership Development	Colorado Springs, CO
North Central Extension Leadership Development	Charlotte, NC
North Central Extension Leadership Development	Rapid City, SD
North Central Extension Leadership Development	San Antonio, TX
North Central Extension Program Leaders Mtg.	Milwaukee, WI
North Central Land Grant Association Meeting	Fargo, ND
Ohio Horticulture Short Course	Columbus, OH
Potato Farming Conference/website development	Fargo, ND
Poverty Symposium	Wisconsin Dells, WS
Public Issues Leadership Development Conf.	Washington, D.C.
Society for Nutrition Education	San Francisco, CA
Smart Marriage Conference	Atlanta, GA
Stateline Fruit and Vegetable Meeting	Delavan, WI
UCEA's Making Waves Conference	San Diego, CA
Women in Agriculture Conference	St. Louis, MO
World Congress on Soil	Philadelphia, PA

APPENDIX A

FY2006 Annual Report Statistical Tables

Table 1 – 2006 College of ACES University of Illinois Extension Funding and Teaching Contacts

	GOAL I	GOAL II	GOAL III	GOAL IV	GOAL V	TOTAL
Federal Funding - All Sources	2,163,027	1,095,063	2,809,023	867,045	5,836,855	12,771,012
State Funding	6,444,507	3,262,622	8,369,184	2,583,267	17,390,287	38,049,866
Local Funding	2,324,438	1,176,779	3,018,640	931,746	6,272,418	13,724,021
Other Funding	1,992,354	1,008,657	2,587,378	798,631	5,376,299	11,763,318
Total Estimated Expenditures by Goal	12,924,325	6,543,121	16,784,225	5,180,688	34,875,859	76,308,217
Estimated Teaching Contacts by Goal	330,967	347,170	880,555	171,272	1,108,582	2,838,547
Estimated Knowledge/Practice Changes using the conservative assumption that 50% of participants achieve some level of change	165,483	173,585	440,278	85,636	554,291	1,419,274
					Total 4-H Youth Enrolled	281,462

Note: Values are extrapolated from the Extension reporting system used to meet U of I positive time reporting requirements and monitor U of I Extension's affirmative action program. Expenditures are assumed to assume the same proportion by source across all five goals.

Expenditure data source: fy06uie-expend-source4.xls; Effort and Audience Count Source: Weighted 2006ProgramYear_Contacts by GPRA Goals.xls

Table 2 – 2006 College of ACES Research and Funding Support

UNIVERSITY OF ILLINOIS PLAN OF WORK - APPENDIX A

UNIVERSITY OF ILLINOIS PLAN OF WORK - FUNDING AND STAFF SUPPORT (FY 2006)							
	GOAL I	*GOAL II*	*GOAL III*	*GOAL IV*	*GOAL V*	*Total*	*Multi-State*
Total CSREES Research	6,097,015	598,285	1,574,365	2,701,822	454,744	11,426,231	859,538
Total Other Federal Research Funds	5,983,354	1,091,622	858,319	947,167	49,433	8,929,895	495,609
Total Non-Federal Funds	24,078,109	4,427,703	3,924,954	6,966,500	2,074,562	41,471,828	5,550,228
Total All Research Funds	36,158,478	6,117,610	6,357,638	10,615,489	2,578,739	61,827,954	6,905,375
Total Number of Research Projects	161	22	37	81	21	322	52
Scientist Years	83	9.6	14.83	30	10.3	147.73	18.67
Non-Scientist Staff Support	240.2	51.34	50.74	89.83	17	449.11	58.63
Total Staff Support	323.2	60.94	65.57	119.83	27.3	596.84	77.3

Form CSREES-REPT (Revised 09/04)

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Actual Expenditures of Federal Funding for Multistate Extension and Integrated Activities
(Attach Brief Summaries)
Fiscal Year: 2006

Select One: ☐ **Interim** **x Final**
Institution: University of Illinois
State: Illinois

	Integrated Activities (Hatch)	Multistate Extension Activities (Smith-Lever)	Integrated Activities (Smith-Lever)
Established Target %	2.2 %	0.6 %	0.6 %
This FY Allocation (from 1088)	5,240,912	8,552,147	8,552,147
This FY Target Amount	115,300	51,313	51,313
Title of Planned Program Activity			
Program support for res/ext joint appointments	240,711		228,329
Information Technology support	86,203		34,236
ACES Afield Publication	5,659		5,659
Distance Diagnostics with GA		11,500	
Conferences	3,835	130,965	3,430
Farmdoc Project	37,500		37,500
Market Maker Project	7,022		45,904
Plant Management Network	1,000	1,000	1,000
Lab for Community & Economic Dev	14,998		49,801
Green Industry Project	15,000		9,995
Part-time Farming/Sustainable Agriculture	110,822	31,610	31,610
Illinois-Indiana Sea Grant Program		33,938	33,938
IL Ag Entrepreneur Dev Initiative			58,415
FAST Business Plan Program	65,000		60,000
Earth and Society Project	68,050		24,774
E-Extension Assessment		68,970	
NCRCD Assessment		2,684	
Local Gov't Information Education Network		27,900	
New Horizon Spanish Radio Program		54,850	
Total	$655,800	$363,417	$624,591
Carryover	0	0	0

Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays represented here accurately reflect allowable expenditures of Federal funds only in satisfying AREERA requirements.

Dennis R. Campion
Director

2/8/07
Date