2012 University of Illinois Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The College of Agricultural, Consumer and Environmental Sciences [ACES]

The land-grant mission involves applied research readily translated into practice, driven by public support, done by scholars to address market failures at a local level. No college has a greater stake in land-grant, mission-oriented activities than ACES. The College of ACES requires capacity and functional programs in areas of fundamental and applied research, education, and public engagement that are highly relevant to the needs of students, employers, communities, and families, and support robust food, agricultural, natural resource, and energy systems. As Illinois's economy, the state government's fiscal condition, and the federal government's burgeoning budget deficits suggest difficult challenges for the university, the College of ACES must lead with its local, state, federal, and private partners to thrive in the uncertain landscape. The public goods and services provided for Illinois by the multidimensional mission of the university must be appropriately valued if the land-grant idea is to remain viable in Illinois.

Given a sluggish economic outlook, state pension and benefit liabilities still threaten the state's ability to maintain current funding levels for higher education. In FY 2013, the state decreased its appropriation of education assistance and general revenue funds to the Urbana-Champaign campus by 7.0%, while budgeted revenue from the tuition income fund increased by 8.6%. As a result, the contribution margin from tuition revenue is now more than two and a half times that from direct state appropriations to the campus.

The persistent reductions to the state permanent base budget led to further reallocation of resources within ACES in FY 2013. The 4.9% reduction included the permanent loss of approximately $3.1 million of sequestered funds from prior years, which affected ACES disproportionately relative to other academic units on campus. The College of ACES was able to make the necessary adjustments through prudent management of resources and the ongoing process of restructuring U of I Extension, a major subsidiary of the College. For FY 2013, the campus assessed a permanent base budget reduction of 1.75%, applied uniformly across academic and administrative units, plus an assessment of 0.25% for faculty recruitment. In addition, the campus implemented a 2.5% salary program and provided 0.5% on the filled faculty base for compression, market, equity, and retention issues. ACES applied its recent model for differentially allocating its base budget to reflect income earning activities.

University of Illinois Extension

University of Illinois Extension focused on connecting with its stakeholders and supporting field staff in their new multi-county assignments. County Directors met regularly to continue building their knowledge and skills in handling personnel and fiscal responsibilities. The final stage of staff restructuring [the hiring and reassignment of field support staff positions] was completed by mid-year. Searches continued to fill remaining vacant educator positions, as well as vacancies created by staff resignations. A total of 42 searches were conducted this past year representing approximately one-third of all educator positions. During this time, educators continued to connect in groups with like specialty titles to explore program needs and opportunities. The experienced staff played an important role in mentoring the significant

number of newly hired colleagues, many with little or no Extension experience.

The educator vacancies likely affected another decline in direct teaching contacts. The direct teaching contacts for FY12 numbered 881,155, as compared to 999,432 in FY11. Extension administrators stressed the need and encouraged use of distant education technologies and web-based resources with a daily average of 196,193 hits. This shift is likely also reflected in the reduced number of reported direct teaching contacts. In support of expanding use of technology, field Extension professionals were each provided and trained to use new iPads and the number of webinar-delivered programs increased. The use of these technologies proved to be challenging in measuring impact of programs and will be a priority to be addressed in the coming year. Efforts will also be continued to address connectivity issues in various parts of the state. Reviewers of this report may find this description helpful in interpreting the scope of the planned program reports and the evaluation of impacts.

Few publications were produced since Illinois field staff members, unlike other states, are not a part of a tenure track system with high expectations for publishing. Instead, energy was placed on creating web-based communication of information. Our Extension faculty positions are often joint appointments in research with publications reflected in the reporting of research publications. County Directors focused attention on maintaining contact with local funders to assure them that dollars invested in the new multi-county structure were still warranted. These efforts by and large were successful in ensuring that local staff positions remained at the same levels. Although funds allocated to Extension by the state legislature remained stable, the significant and growing state deficit continues to be a serious concern.

Illinois Agricultural Experiment Station [Office of Research]

The IAES administers federal formula funding provided to Illinois through USDA's National Institute of Food and Agriculture [NIFA]. The Office of Research also oversees the research enterprises in ACES that are funded from grant, donor, and university sources. The IAES coordinates with other state agricultural experiment stations across the country and with USDA/NIFA to advocate for federal capacity to undertake research and education programs related to food, agriculture, communities, and the environment. In December 2012, the President's Council of Advisors on Science and Technology called for a substantial infusion of new research investment in its **Report to the President on Agricultural Preparedness and the Agriculture Research Enterprise**. However, the current level of USDA investment is likely to be reduced from the pending combination of measures related to the federal budget, including the Budget Control Act of 2011 and the pending 'Farm Bill' legislation.

From all sources, the combined research activities of IAES/ACES accounted for $64,906,960 [40%] of the FY 2012 expenditures in ACES. As external research funding has grown, the portfolio has shifted from reliance on state and traditional USDA support toward industry gifts and grants, a broader array of federal granting agencies, and significant involvement in multi-disciplinary centers and initiatives, such as the **Institute for Genomic Biology**, the **Energy Biosciences Institute**, the **ADM Institute for the Prevention of Post-Harvest Loss**, the **Center for Agricultural, Biomedical, and Pharmaceutical Nanotechnology [CABPN]**, the **Abbott Laboratories Center for Nutrition, Learning and Memory**, the **NIH Botanical Center**, and the new **TIAA-CREF Center for Farmland Research**.

Changes in the College of ACES

Dr. Neal Merchen replaced Dr. Jozef Kokini as Associate Dean of Research and Director of the Illinois Agricultural Experiment Station in 2012. Dr. Merchen previously served as Head of the College of ACES Department of Animal Sciences. Associate Dean of Extension Dr. Robert Hoeft will be retiring in 2013 and a search for his successor is currently underway.

Changes in Planned Programs

Per a letter from Dr. Ramaswamy received in November of 2012 states are no longer required to include stand-alone planned programs for the five NIFA priority areas [Food Safety, Global Food Security and Hunger, Childhood Obesity, Climate Change, and Sustainable Energy]. While all five of these areas will continue to be addressed, several have been combined into existing planned programs. Food Safety and Food Security have been combined into a single planned program. Climate Change is now part of the Natural Resources and the Environment planned program. Childhood Obesity is now part of the Human Health and Human Development planned program. Activities focusing on human nutrition that would have previously been included in Food Safety or Food Security are also now part of Human Health and Human Development. Sustainable Energy continues as a stand-alone planned program.

Changes in FTE Calculations

For Research - Per guidelines spelled out in the September 27, 2012 NIFA AREERA State Plan of Work Newsletter, NIFA is requesting that individual planned programs include only formula-funded FTE's while the Executive Summary include all FTE's regardless of funding. In previous years, for research we have included only Scientist Years [from all funding sources] for the individual planned programs and a total for the Executive Summary. We have worked to develop data that are in line with NIFA's request and they are included in this report. It is important to note that [1] because Illinois pays only a small percentage of salaries on formula funds, FTE's will be much lower than previous years for the individual planned programs; and [2] because the Executive Summary now includes all professional staff FTE's [rather than just SY's] this number will be significantly higher than in previous years [for this year, of the 344 FTE's reported 90 are scientist years and 254 are non-faculty FTE's]. Because the data that will be collected under REEport in 2014 will be in a significantly different format than the AD 419 data collected currently through CRIS we will review again the methodology used to calculate this number next year.

For Extension - Extension has been collecting, via an online reporting site, the number of hours coded against priority program areas and program content codes and using those to identify hours of effort devoted to the various planned programs. That process still serves as the method for reporting total FTE's in the Executive Summary. However, since Smith-Lever funds are allocated as program support dollars to departments and Extension units, Smith-Lever funds are not used to support salaries. The only exception is a 0.1 FTE listed for the Human Health and Human Development planned program based on the new directions for reporting FTE's distributed by NIFA.

The Planned Programs:

Agricultural and Biological Engineering - Activities in 2012 included the development of prediction models for nitrous oxide formation related to media moisture content, the development of a volumetric particle tracking velocimetry instrument that will fill a current gap in flow instrumentation capabilities, and research addressing the growing environmental concern over airborne particles released from animal facilities. Extension programming included ongoing **Illinois Certified Livestock Manager** training, pesticide applicator training, and programming on biomass energy.

Agricultural and Consumer Economics - Activities in 2012 included research on international and U.S. biotechnology law focused on policy and regulatory measures, modeling of the economic and environmental consequences of alternate groundwater management policies, utilization of spatial econometric methods to analyze the impact of protected areas on deforestation rates in biodiverse areas and on property market impacts of environmental remediation measures, a review of Dodd-Frank rules issued by the CFTC for potential impact on agricultural producers, and the development of new features for MarketMaker. Extension agriculture economics programs focused on profitability outlook and management challenges, consumer decision making and the impact on college and high school students, and a new program focused on savings.

Animal Health and Production - Activities in 2012 included development of data suggesting that calcium oxide treatment of distillers grains with solubles [wet or dry] may be beneficial on its own, research with the goal of defining the early mechanisms of Apicomplexa-host interactions and identifying new drug candidates that can block these interactions, work to advance technology for the practical use of cryopreserved boar sperm, studies which indicate that fowlpox virus containing full-length REV is widespread in poultry, the use of a system dynamics modeling approach to explore the U.S. reproductive value chain's information markets, and continuation of Extension annual statewide programs that addressed animal production and health for swine, beef, dairy, sheep, poultry, and horses for owners, producers, and 4-H youth. The evaluation of the impact of two programs focused on livestock grazing is reported.

Community Resource Planning and Development - Activities in 2012 included the development of findings which indicate that location of entry of news stories into the news affected sourcing, planning, and morality constructions for a specific issue, a project which has laid the groundwork for a better understanding of the factors that influence immigrant women and men in sending remittances and use of discretionary income, and cross-national studies of developmental risk and resilience in migrant families. Extension activities included webinars addressing community issues for county officials, providing data gathering and process management assistance to communities for engaging residents in decision making and planning, new programs to encourage entrepreneurship, and disaster education and preparedness.

Food Safety and Food Security - Activities in 2012 included the application of research findings to improve an industrial process of zein manufacture, a project that allowed for growing markets around the world to build awareness about health benefits and food applications of soy protein products, and results that will allow for development of higher quality food products and associated materials by evaluation of important flavor-related quality indices for product development/improvement and shelf-life estimation. Extension activities focused on food safety training for employees of establishments and volunteers that prepare or serve food to the public, training for producers and employees of those producers regarding safe food production and handling to prevent food contamination, and efforts to evaluate the impact of these food safety programs. Food security programming encompassed field crop and fresh produce management and production, hunger mediation for limited resource families, and includes an impact evaluation for fruit and vegetable schools.

Human Health and Human Development - Activities in 2012 included the ongoing implementation of the **Child Development Laboratory [CDL] Research Database Project**, the development of findings focusing on marital and co-parenting relationships and their associations with well-functioning parent-child relationships, research results illustrating that children whose mothers work nonstandard hours are more at risk of developing behavioral problems, continuation of the **Even More Fun With Sisters and Brothers** program, a project that is enhancing our understanding of the mechanisms of healthy foods in chronic disease prevention and providing new knowledge for understanding how nutrition early in life shapes physiology and susceptibility to childhood obesity, and research into the role of polyunsaturated fatty acids in nutritional programming that may provide additional insight into hepatic inflammation and obesity. Extension activities included web-based parenting education resources and workshops and resources addressing food choices and management of chronic diseases. Impact studies addressed the diabetes program series, programs on building a better memory, and youth knowledge of healthy eating habits and physical exercise.

Natural Resources and the Environment - Activities in 2012 included the development of results designed to improve assessment of long-term changes in forest soils, ongoing development of the **Illinois Soil Nitrogen Test**, the analysis of behavior for previously unstudied types of forest landowners, research

showing what best explained nitrate yields in watersheds across the Mississippi River basin, results that will help land managers identify priority areas for mitigation efforts, a comparison of the ecology of ratsnakes across the complete range of this species to assess how the snakes' ecology is likely to be affected by climate change, ongoing monitoring work under the **National Atmospheric Deposition Program**, and a project that will provide us with a physiological, mechanistic understanding of how fish populations respond to stressors associated with land use changes and climate change scenarios. Extension activities addressed soil and water management, forestry, environmental stewardship, and climate change encompassed through workshops, conferences, **Master Naturalist** training, and youth conservation days. Impact evaluations conducted on private pesticide applicator training and the youth **I Think Green** curriculum documented knowledge and practice change with respect to protecting the environment.

Plant Health, Systems and Production - Activities in 2012 included a comparison of the agronomic performance of corn, soybean, winter wheat, alfalfa, and forage grass cultivars available to farmers in Illinois, the characterization of the types of herbicide resistance present in numerous waterhemp populations, work designed to extend ongoing nematode management research through the development of new tools for technology transfer and decision support, efforts to improve economic and environmental sustainability in tree-fruit production, efforts to determine the etiology, biology, and epidemiology of bacterial spot, a breeding program focused on the development of high-yield adapted wheat varieties for Illinois and surrounding states, the development of a newly designed, dynamic, visually appealing interface and template for the **Varietal Information Program for Soybeans** [VIPS] website, and a project associated with the continuation and further analysis of materials and information produced from the **Illinois Long Term Selection Experiment** for protein and oil concentration in corn grain [2012 marks the 113th growing season]. Extension activities encompassed a significant number of websites and webinars addressing horticulture topics, plant pest diagnoses, and an evaluation of the impact of training on new Master Gardeners.

Sustainable Energy - Activities in 2012 included the exploration of utilizing rapid methods to improve and speed up the process for identifying and selecting Miscanthus genotypes with desirable composition, the compression of biomass to the highest pressure level ever reported on, research into the selection of plant genetics, planting locations, harvest moisture and drying air temperatures to improve dry grind ethanol yields, an examination of the use of glycerol as a biodiesel fuel additive or fuel extender, the establishment and nitrogen management of switchgrass for sustainable bioenergy feedstock production, and experimentation which showed that additional glucose in thin stillage did not greatly accelerate fouling rates. Extension activities included presentations, tours, displays, and field days focused on tropical maize applied research, energy audits for community buildings, a webinar on wind energy siting issues for local county officials, and leadership for the **Illinois Biomass Working Group's** focus on innovative bioenergy systems. Youth were involved in 4-H energy projects and wind science experiments.

4-H Youth Development - Activities in 2012 focused on expanding staff and programs in metro areas, opportunities to engage teens as teachers, and volunteer training to ensure positive youth development. A variety of delivery systems and enhanced and expanded educational curricula were designed to increase the number of youth involved in [1] learning employment skills using simulations and career exploration; [2] experiencing healthy relationships; [3] becoming physically fit; [4] thinking green by engaging youth in investigations of living things and their environment; and [5] engaging in science. Of note, three statewide data collection studies were initiated to establish a baseline of 4-H member's interest in science, engineering, and technology, the influence of 4-H experiences related to career development, and 4-H club member's attitudes toward 4-H experiences that are associated with positive youth development.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	133.5	0.0	110.0	0.0
Actual	112.9	0.0	344.1	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- External Non-University Panel
- Combined External and Internal University Panel
- Other (Extension Staff Program Teams./Program Leaders)

2. Brief Explanation

Hatch proposals are required to undergo a peer review process at the Department level before being submitted to NIFA for consideration. In the Department of Natural Resources and Environmental Sciences, reviewers [mostly within the Department but with outside reviewers also included] are asked to evaluate proposals based on six areas: [1] Is the proposed research adequately justified? [2] Are objectives well-focused and is progress measureable? [3] Is the proposed duration sufficient? [4] Are sources of collaboration identified? [5] Is the project duplicative of ongoing efforts? and [6] Are users of the results clearly identified? In the Department of Animal Sciences all Hatch proposals are evaluated by a standing Research Committee. In the Division of Nutritional Sciences proposals are evaluated by a review panel of four Division faculty and the Division Director. In the Department of Agricultural and Biological Engineering at least two reviewers [at least one external and one internal] provide comments in consultation with Department faculty members and through professional contacts.

Due to the focus on geographic changes in assignment of field staff, implementing additional hiring processes for unfilled county director and educator positions and a process for filling over 300 support staff positions, the long-established process for conducting county program reviews continued to be suspended this past year. The major focus was on bringing academic professionals, and when applicable, support positions together to provide training on their new position responsibilities. Program leaders in family and consumer science, agricultural and natural resources, community and economic development, and 4-H youth development gave leadership in describing and leading discussions with county directors, educators, and support staff on the importance of research-based programming, inventorying and prioritizing what programming should be continued or discontinued, and encouraging use of technology and employing other innovative ways to carry out Extension education. These discussions resulted in the identification of the need to update and create Extension educational resources such as websites and curriculum.

The new Extension multi-county structure shifted review of educator performance appraisal to the County Director along with a review of an educator's accomplishments by the appropriate Program Leader who provided comments to the County Director. A section was added to the staff reporting system to emphasize the need to collect and document program impact and training was provided by the Director of Program Planning and Assessment on creating and submitting impact reports. The Director of Extension

also made two-day visits to multi-county units to view and gather information about the scope and quality of programs through visits with staff and clientele. University of Illinois Extension recognizes the need to explore additional program review processes that more formally involve external source input for future merit review of program content and delivery.

It should be noted that the articulated vision of restructuring field staff into multi-county assignments included assigning responsibility for statewide Extension programs to campus faculty which has brought some challenges due to retirements or resignations from positions that will not be filled with resulting reductions in the expertise and capacity to deliver statewide programs. State Program Leaders play an important role in communicating with and connecting campus and field staff with respect to educational needs and program activities.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public

Brief explanation.

The Dean of the College of ACES [Dr. Robert Hauser] and the Associate Deans for Research [Dr. Neal Merchen] and Extension [Dr. Robert Hoeft] are very active in working with stakeholders and seeking external input on programs in the college. Dr. Merchen invests significant time in interacting with stakeholders in the state of Illinois and nationally, including producer groups, state and federal legislators, and academic and corporate partners. The External Advisory Committee of the Office of Research includes members from commodity groups [Illinois Soybean Association, Illinois Corn Growers Association, Illinois Pork Producers Association, Illinois Milk Producers Association], other academic institutions [University of Minnesota, University of Missouri], private industry [Kraft Foods, Abbott Laboratories], and the Illinois Farm Bureau. Annual meetings of this committee create a venue for input on the research programs of the College and IAES from a diverse group.

The Department of Natural Resources and Environmental Sciences hold several programs throughout the year the obtain stakeholder input. These include Stewardship Week [a twenty-plus year program providing natural resource management guidance to elementary educators and students], a field day related to grassland management for private landowners, and workshops for forest-farm owners. In the Department of Crop Sciences annual meetings are held with their State Advisory Committee [made up of representatives of the many areas that relate to Crop Sciences]. Faculty in the Department of Agricultural and Biological Engineering strive to be in constant contact with government funding agencies, corporate partners, and other users [and potential users] of their research. Faculty members in the Department of Animal Sciences regularly participate as ex-officio members for the beef, swine, dairy and equine state associations as well as cooperating with stakeholders on educational programs and applied research activities.

Extension Councils were combined from single into multi-county councils and County Directors were expected to seek their input. The scope of that input likely varied and focused on immediate needs related to stabilizing the local budget, facility, and staffing with discussions to identify priority issues for educational programming constituting a small portion of that input. Educators whose new geographic assignment encompassed the same county where they had been assigned continued their programming interactions with external groups and individuals in that county and continued expanding relationships and interactions with groups and individuals in the additional counties. A smaller number of experienced educators and newly hired ones accepted assignments in a totally new geographic multi-county unit where the need to devote time to the process of interacting with traditional stakeholders and explaining new areas of focus and delivery was critical.

A survey was developed and distributed by county staff to all Extension volunteers to assess their experiences and needs to support their volunteer involvement [1,800 responded]. In addition, a strong cadre of educators with community and economic development responsibilities helped community leaders and officials develop surveys and planning processes for local residents to complete. Examples of surveys distributed this past year included a health assessment survey in conjunction with a local hospital, development of a survey to assist a local radio station better meet the needs of the community, a survey to determine successful practices of farmer markets, and one to assist La Esperanza, a community organization, to better meet the needs of its members. Results from these surveys initiated by others also provided access to information on issues that Extension might address. In addition, all educators enhanced their efforts to seek feedback through end-of-program evaluations completed by program participants who provided information on additional educational needs as well as feedback on the quality of the current programs. Efforts have also been made to collect names of participants that can be used to invite additional feedback and participation in future programs.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Open Listening Sessions
- Use Surveys

Brief explanation.

The Associate Dean for Research is engaged with interacting directly with individual stakeholders and organizations representing groups of stakeholders. Since assuming the role of Associate Dean, Dr. Merchen has met with the Illinois Soybean Association and with the Advisory Committee for the Dixon Springs Agricultural Center [one of the off-campus research and education centers of the College of ACES]. He has also met with multiple corporate representatives that have interests in ACES research. He has participated in meetings of the Illinois Agricultural Legislative Roundtable and made visits to individual congressional representatives from Illinois in conjunction with the APLU/CARET meetings in Washington.

In the Department of Crop Sciences members are invited to serve on their State Advisory Committee based on the recommendations of faculty members. In the Division of Nutritional Sciences recommendations are solicited from Division faculty with an eye toward having significant representation from both industry and academia. In the Department of Agricultural and Biological Engineering stakeholders are identified through outreach and engagement activities as well as

professional meetings. In the Department of Animal Sciences corporations, commodity groups, and the general public are represented on their External Advisory Committee. Development, Corporate Relations, and Engagement staff in the College and campus-wide also play a significant role in identifying stakeholders.

Extension Advisory Council members and local Extension volunteers remain as keys to provide advice on who should be targeted for an invitation to a specific program or a particular input opportunity. Multi-county staff meetings and educator meetings with colleagues who had the same expertise and responsibilities were used to generate ideas and information on stakeholders they should contact. Extension staff members also relied on their involvement in meeting with community collaborations and key leaders who were both targets for input andr for identifying other representative stakeholders to contact regarding identifying program opportunities. Community planning and economic development Extension activities also by their very nature involved stakeholder input through surveys and community discussions.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

Brief explanation.

Stakeholder interactions will be expanded in 2013. The Associate Dean for Research will reach out to additional Illinois commodity groups [Corn Growers Association, Pork Producers Association, Beef Association, Milk Producers Association] as well as to the Illinois Farm Bureau. We anticipate continued growth in partnerships with the corporate sector. There will be more extensive interaction with the six off-campus research and education centers through participation in Field Days and research showcases. The Office of Research will have a significant presence at the national Farm Progress Show.

Faculty in the Department of Agricultural and Biological Engineering have frequent face-to-face meetings and telephone conversations with stakeholders to discuss issues related to agricultural production, renewable energy, environmental impact, and the farm of the future. The Department of Crop Sciences is in frequent contact with commodity groups, industry, community colleges and high schools. Methods utilized by the Department of Natural Resources and Environmental Sciences include focus group surveys, seminars and workshops held with landowners, forest preserve managers and natural resource professionals, and an event held to teach eight-grade girls about the impact of urban environments on local water supplies which provided discussion opportunities with educators and participants.

The College Office of News and Public Affairs also plays a crucial role in informing stakeholders and soliciting input. Each year NPA distributes over 800 news releases with regular placements in agricultural publications, online news outlets, newspapers, and in international

publications. NPA also produces over 250 radio feature stories per year that are distributed to over 60 outlets representing over 1,500 stations nationwide and featured locally on Illinois Public Media WILL-AM 580. Approximately 40 video stories are produced and distributed as well.

NPA produces publications to share research and Extension findings with the public and invite feedback. **ACES@Illinois** is a 24-page magazine with an additional outer cover for alumni which is produced twice each year. A link to the publication is provided to alumni [**http://aces.illinois.edu/about/glance**] and hard copies are mailed to other alumni and donors. In addition, the winter and summer 2012 issues were printed on lighter weight paper and inserted into FarmWeek where it reached approximately 78,000 landowners in Illinois. **Food for Thought** is a 28-page special publication which was produced to highlight research in the area of food science, human nutrition, obesity prevention, and world hunger. In addition to being posted online [**http://research.aces.illinois.edu/reports/special**] the publication was mailed to college stakeholders, legislators, and distributed at various college events. It was also reprinted on lighter weight paper and inserted into the Chicago Tribune to reach 100,000 subscribers. Personal feedback in the form of emails and phone calls were received from over 50 people.

As mentioned in section III-1, a key statewide survey process was designed to collect input from Extension volunteers including 4-H volunteers, **Master Gardeners**, **Master Naturalists**, and Extension Council and committee members. Other surveys were limited in geographic scope. The process most often used to collect input involved informal conversations proactively initiated by professional staff with current funders, key community leaders, Extension Council members, and Extension volunteers. End-of-program surveys seeking suggestions were expanded.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Action Plans
- To Set Priorities

Brief explanation.

The College of ACES strives to incorporate stakeholder input and evaluation into decision making at all levels. Areas include the allocation of resources, the development of Extension programs, the determination of areas of focus for College publications and other outreach materials, identification of opportunities to improve communication with stakeholders [or to identify stakeholders who were previously underrepresented], and the identification of new faculty hires who will address currently unmet needs identified by stakeholders. Through their funding decisions grant-awarding agencies play a very significant role in guiding College research activities [and indirectly in promotion and tenure decisions for faculty].

The Department of Animal Sciences strives to conduct research that will have an immediate and long-lasting impact and will provide basic and applied research relevant to stakeholders based on the needs and emerging issues they have identified. In the Department of Crop Sciences stakeholder recommendations are considered both in faculty meetings and in Departmental Research Advisory Committee meetings. In the Division of Nutritional Sciences a report from the Division External Advisory Committee is shared with faculty members and discussed with the

Division Executive Committee [the report typically includes several specific recommendations]. In the Department of Natural Resources and Environmental Sciences input is used in evaluating teaching, research, and Extension as well as providing a guideline for trends that impact course content for both graduate and undergraduate students.

Extension Council input last year primarily was used in developing the local budget and reexamining staffing positions. Staff members were encouraged to involve Extension Council members in selecting 3-5 priorities to be reflected in a FY12 multi-county plan of work. Input through program evaluation responses has been used to make adjustments in both the content and program delivery method to better meet the needs of participants and to determine how to more effectively market programming and use various methods of technology.

Brief Explanation of what you learned from your Stakeholders

The Associate Dean for Research invested significant effort in consultation with leaders of agricultural commodity groups [corn, soybeans, pork, beef, and dairy] and with colleagues at other Midwestern Agricultural Experiment Stations to better understand applied research needs. There remains a high degree of interest and attention given to activities at the seven research and education centers in Illinois and strong commitments to support those activities from stakeholder groups. Areas of research that draw greatest interest include crop variety trials, integrated livestock production [especially beef cattle production], bioenergy research and alternative cropping to provide substrate for biofuel production, and use of byproducts from ethanol production. Stakeholders expressed strong appreciation for continued support of 'mission-based' agricultural research by the IAES. Stakeholders continue to find great value in the management and economic information provided through the **farmdoc** [**http://www.farmdoc.illinois.edu/**].

The Associate Dean for Research also participated in a visioning exercise with Illinois agricultural leaders that resulted in a comprehensive review of Illinois public agricultural research and compilation of a report titled '**A Consensus Report of Illinois Agricultural Producer Leaders and University Agricultural Research Administration**'. This report concluded that the Illinois agricultural sector [including producers, ag business, and public universities] should collaborate to develop and agree upon a future-focused priority agricultural research agenda. This effort should align the needs of all stakeholders, provide the basis for 'right-sizing' the Illinois agricultural research platform, justify funding investments by both public and private sources, and clearly communicate the value of past and future efforts of this endeavor. Further activities of this task force will focus on action items that attempt to address the considerations in these conclusions.

Stakeholders expressed to the Division of Nutritional Sciences strong support for work related to nutrition regulatory affairs, Extension and outreach programs, and international activities. The Department of Crop Sciences annually provides their State Advisory Committee with a report of actions taken in response to their recommendations. Stakeholders of the Department of Agricultural and Biological Engineering felt that faculty members were very proactive in maintaining communication with them and greatly appreciate being actively sought out to participate in research discussion meetings. Stakeholders for the Department of Animal Sciences expressed support for research focusing on sustaining forage-based beef cattle production systems, integrated approaches to enhancing feed efficiency in beef cattle, and investigating the metabolic relationships in the supply of nutrients for dairy calves.

Extension stakeholders who serve as Extension volunteers remain strong supporters of the **4-H Youth Development program** and **Master Gardener program** and for a local physical presence in each county allocating financial resources to sustain that presence. Volunteers who completed the statewide survey indicated that Extension does important work and recognizes that staff both

support and appreciate the contributions of volunteers. Responses to end of program evaluations indicated that participants are pleased with the quality of the programs in which they participate and vary with respect to their use of educational technology, but are becoming more comfortable over time.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
9497167	0	6796049	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	6024587	0	8202485	0
Actual Matching	6024587	0	8202485	0
Actual All Other	56538647	0	37497855	0
Total Actual Expended	68587821	0	53902825	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	6024587	0	5899647	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Agricultural And Biological Engineering

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management	10%		15%	
133	Pollution Prevention and Mitigation	5%		10%	
141	Air Resource Protection and Management	55%		10%	
401	Structures, Facilities, and General Purpose Farm Supplies	5%		15%	
402	Engineering Systems and Equipment	15%		25%	
403	Waste Disposal, Recycling, and Reuse	10%		5%	
404	Instrumentation and Control Systems	0%		10%	
405	Drainage and Irrigation Systems and Facilities	0%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	5.0	0.0
Actual Paid Professional	0.0	0.0	2.7	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
12049	0	388246	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
12049	0	388246	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
113077	0	1141668	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities included the development of prediction models for nitrous oxide formation related to media moisture content [these models will help biofilter designers and operators avoid creation of excess greenhouse gases otherwise caused by improper control of biofilters] as well as improvements to the design of the novel moisture sensing system [which will greatly enhance odor and ammonia mitigation performance of biofilters, reducing the need for biofilter media moisture monitoring by the operators and reducing release of greenhouse gases into the atmosphere], the development of a volumetric particle tracking velocimetry instrument that will fill a current gap in flow instrumentation capability by enabling the measurement of much larger scale flows than the existing measurement technology, research addressing the growing environmental concern over airborne particles released from animal facilities [numerous efforts have been made to determine their physical, chemical, and biological properties with particle size distribution [PSD] being of particular interest because many of the environmental and health effects of particles are size-dependent], development of a vision-based imaging system combined with new lighting for liquid spray and other particle size measurement [compared with the existing commercial droplet measurement tools, the new system is designed to be lower cost and portable to the field], and the implementation and design of six methane measurement chambers for quantification of methane production in cattle.

Conference presentations included the American Society of Agricultural and Biological Engineers, American Society of Heating, Refrigeration and Air Conditioning Engineers, North Central Weed Science Society, National Agricultural Aviation Association, Illinois Natural Resource Conservation Service, Illinois Environmental Protection Agency, Illinois Department of Agriculture, Illinois Pork Producers Association, Illinois Beef Association, Illinois Farm Bureau, and the Ecological Society of America.

Extension activities related to this planned program are interdisciplinary in nature and relate to other planned programs featured in this report [including Sustainable Energy and Animal Health and Production]. Much effort was devoted to education focused on livestock manure management through eleven statewide **Certified Livestock Manager Training** workshops and an online five-part quiz series, both of which meet state training requirements for livestock producers [livestock producers with 300 or more animal units must be recertified through training and/or examination every three years].

With limited Extension specialist FTE's, Extension has chosen to expand outreach through website development. **The Illinois Manure Management Program** website [**www.immp.uiuc.edu**] helps livestock producers to develop manure management plans to more efficiently and safely use manure as a fertilizer. The website allows users to customize the plan to meet their needs and facilitates any required annual

updates. Other websites include: [1] **Manure Share**, an exchange program that brings gardeners and landscapers searching for organic materials for use in composting or field applications in contact with livestock owners with excess manure [just under 20,000 page views]; [2] **Small Farms Manure Management** website for individuals with less than 300 animal units [4,000+ page views]; and [3] **EZregs** for users who have established accounts to store their questions and Extension educator responses related to identifying environmental regulations that pertain to specific agricultural and horticultural operations and practices in Illinois [just over 35,000 page views].

The **Soil and Water Management** webinar included a presentation on biofilters and their impact on water quality in field tile runoff and a segment on irrigation scheduling. Online modules for certified crop advisers on drainage water management and bioreactors were also developed. With respect to education regarding equipment, **Operation S.A.F.E. Fly-in** was conducted in Illinois as well as other states by an Extension pesticide safety education staff member to ensure aerial applications of fungicides to corn are made accurately and safely.

Extension faculty and staff with agricultural engineering expertise have also provided leadership in programming that addresses sustainable energy [see Sustainable Energy planned program] and soil drainage research findings [see Natural Resources and the Environment planned program]. In addition, this year's **2012 4-H National Youth Science Day: The EcoBot Challenge** reached more than 3,500 youth ranging from elementary school through high school and allowed them to grow more familiar with the engineering design process [see 4-H Youth Development planned program].

2. Brief description of the target audience

Members of the target audience included agricultural engineers, environmental consultants, researchers in the livestock industry, animal scientists, livestock producers, manufacturers of ventilation fans and other livestock facility equipment, the Illinois Environmental Protection Agency, the Illinois Natural Resources Conservation Service, government regulatory agencies focusing on air quality and animal facilities, companies focusing on air quality control technologies, Illinois commercial and private pesticide applicators and aerial applicators nationwide, consultants, custom manure haulers, regulatory agency representatives, livestock commodity group representatives, and graduate and undergraduate students in agricultural and biological engineering and animal sciences. In addition, Extension audiences included crop producers, certified crop advisers, gardeners, landscapers, and youth.

3. How was eXtension used?

eXtension was not used in this program.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	378	2683	1785	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	1

Patents listed
TF12087-PRO - Particle Tracking System

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	20	20

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Projects

Year	Actual
2012	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number Of Subsurface Bioreactor Acres In Illinois

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	110

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nutrient runoff from agricultural fields into water bodies is of particular concern in the Midwest, where increased nitrate leaching into the Mississippi River has been identified as a major contributor to growing hypoxia in the Gulf of Mexico. There is a strong correlation between improved drainage and elevated nutrient transport from cropped land. Scientists recommend implementing a variety of practices that lead to a reduction of both nitrogen and phosphorus fluxes.

What has been done
To reduce nutrient loading from subsurface drained fields, we have been developing and promoting the use of fixed-bed, in-field subsurface bioreactors. Systems were installed for an additional 110 acres this year. A subsurface bioreactor is a buried trench with woodchips [or some other carbon source] through which the tile water flows before entering a surface water body. Organisms from the soil colonize the woodchips. Some of them break down the woodchips into smaller organic particles. Other microorganisms use the carbon produced by the woodchips as an energy source and reduce nitrate to nitrogen gas, which exits the bioreactor into the atmosphere. Through this mechanism, nitrate is removed from the tile water before it can enter surface waters.

Results
We have proposed a protocol for the sizing of subsurface bioreactors and have developed an interactive routine in which this protocol has been implemented. We proposed that bioreactor sizing be based on 10-year, 24-hour peak monthly drain flow, and are developing a database of county-level soil, rainfall, and temperature information to determine these peak flows for states in the Midwest. This database is fully populated for Illinois, and is near completion for Ohio, Indiana, North and South Dakota, Minnesota, Iowa, Missouri, and Wisconsin.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities

Outcome #2

1. Outcome Measures

Producer Reported Changes/Improvement In Manure Management And Application Method To Reduce Odor

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Development And Use Of A Manure Management Plan

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	484

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
These activities are Extension and outreach-based, and involve improving livestock and poultry waste management methods and stakeholder understanding of key issues related to proper manure management. The goal is to minimize negative impacts from livestock and poultry production to the environment.

What has been done

In the last year, Extension specialists: [1] have implemented a novel new Comprehensive Nutrient Management Plan [CNMP] course for Technical Service Providers [TSPs] who act as consultants for livestock producers that need to implement improvements to manure management on their farms; [2] continued to maintain and update the Illinois Manure Management Planner website [http://web.extension.illinois.edu/immp/auth/login.cfm] which is used by stakeholders to learn about manure management and to access resources to create Manure Management Plans for facilities; and [3] have conducted training, certification and testing programs for custom manure haulers in western Illinois. Operators who haul and apply manure to cropland for hire are not regulated in Illinois, but through collaboration with other Great Lakes states a voluntary training and certification program is provided. Annual training for the Certified Livestock Manager Program was conducted at 10 sites across the state. This state program requires livestock and poultry producers to attend training and become certified once every 3 years. The curriculum includes key information on best management practices, nutrient management information, and updates on regulations and associated information.

Results

Results include: [1] the new CNMP course is a nation-wide training program, with 31 participants representing about 500 individual CNMP or Nutrient Management Plans [the course provided 24 CCA Continuing Education Credits]; [2] the Illinois Manure Management Planner website received 5,527 accesses, with 72 new accounts created and 16 plans updated and/or modified; [3] thirty-five manure haulers, environmental managers and their employees attended the Custom Applicator Training Program. Collectively, their production units and clients represented over 500 million gallons of annual manure application. Eight individuals took the Level 1 examination and 20 individuals took the Level 2 examination, for a total of 28 exam takers out of 35 attendees; and [4] last year, 553 people attended our Certified Livestock Manager Training programs. According to the survey data, 87.5% of attendees responded that they currently had manure management plans. Of these respondents, about half had updated and used their plan recently, and half had a written plan but had not recently updated it.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
403	Waste Disposal, Recycling, and Reuse

Outcome #4

1. Outcome Measures

Implementation Of Global Engineering Solutions Using Agricultural Machinery

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The purpose of this project is to develop a framework and methodology for collecting information and evaluating field-based supply chain logistics. The supply chain logistics include not only commodities from the agricultural industry but also other industries [the supply chains of which exhibit some commonality with the agricultural industry]. Coupled with the technological aspects of agricultural machinery systems are the issues of environmental impact and energy usage. System characterization on a global scale will need to account for social, political and cultural factors.

What has been done
In collaboration with Deere & Company, machine performance and logistics data were collected from large farming enterprises located in Iowa and Kansas and a preliminary analysis has been completed of their grain production systems.

Results
The machine performance and logistics data collected in collaboration with Deere highlighted the impact on productivity and efficiency of large grain production farms greater than 10,000 acres. Fields were widely distributed requiring longer travel times than would be expected from smaller farms. The preliminary results pointed to the need to treat such farms as agro-industrial type enterprises and to apply some of the same logistical tools used by industry. Results associated with engineering solutions for biomass feedstock production have emphasized the impact of work day probabilities on planning and operation of production systems. In the case of miscanthus, an energy crop, the optimal harvest period is December-February, for which work day probabilities are generally not considered for traditional grain production systems. A reduced workday probability was predicted with a corresponding impact on machinery requirements and overall logistics. A further issue was the location of storage and pre-processing facilities relative to farm fields. Results from an optimization model showed that distributed storage and pre-processing affected overall production costs considerably because of transport requirements. The use of field-side bagging was a potential technique to create flexibility for storage in local large grain production systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
401	Structures, Facilities, and General Purpose Farm Supplies

402	Engineering Systems and Equipment
404	Instrumentation and Control Systems

Outcome #5

1. Outcome Measures

Improved Understanding Of The Environmental Impact Of Anthropogenic Nanoparticles On Photosynthetic Cyanobacteria

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One of the salient features of biological, agricultural and environmental applications of nanotechnology is that the nanoscale devices and systems are of the same size-scale as biomolecules. While the size similarity offers unique and powerful routes to directly manipulating biomolecules, the increased application of nanotechnology raises concerns about potential unintended interactions and consequences between nanoparticles and living systems. This research program focuses on the environmental impact of anthropogenic nanoparticles on an important group of bacteria, photosynthetic cyanobacteria. These organisms convert solar energy to simple sugars and are primary producers in most aquatic ecosystems. We are developing novel analytical capabilities as well as experimental methodologies to quantify the risk associated with various nanoparticles on the growth and photosynthetic capabilities of cyanobacteria.

What has been done
Research included activities on understanding the impact of nanotechnology on living systems. We have been developing a protocol to study the impact of hydrophobic nanoparticles through continuous solubilization studies. A novel strain adapted to high levels of cadmium toxicity [one of the components of quantum dots] has been developed and is being characterized.

Results
Hydrophobic nanoparticles are considered to be safe because they do not dissolve in water and are therefore considered biologically unavailable. However, we have been developing protocols that help us understand how such insoluble particles may dissolve into water through a change in their surface chemistry. This new knowledge allows us to understand nanotoxicology in a new light - something previously considered unavailable has the potential to become bioavailable over long enough times. This information will be critical in the total life cycle analysis of a nanoparticle

in the environment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management

Outcome #6

1. Outcome Measures

Improved Regulation Of Animal Feeding Operation Emissions

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is a growing environmental concern over airborne particles released from animal facilities. Numerous efforts have been made to determine their physical, chemical, and biological properties. Among these properties, particle size distribution [PSD] is of particular interest because many of the environmental and health effects of particles are size-dependent. Lognormal distribution is the most frequently used particle size distribution [PSD] model in agricultural air quality research, and a proper determination of volume median diameter [VMD] and geometric standard deviation [GSD] is crucial for model applications. In this study, the prevalent linear regression approach was compared to the nonlinear regression approach with PSD data monitored in 15 animal buildings using four particle size analyzers: Horiba, DSP, Coulter and Malvern.

What has been done
Results showed that the linear regression approach significantly underestimated VMD values, and the resulting relative errors were higher overall than those yielded by the nonlinear regression approach. As a measure of model approximation, the values of the sum of absolute differences [SAD] derived from linear regression were considerably larger than those offered by nonlinear regression. The relative errors and SAD values both suggested a poorer performance of the

linear regression approach. The SAD values and the relative errors in estimated VMD and GSD decreased as R2 approached 1. However, even at R2 = 0.98, the linear regression approach misestimated VMD values by up to 30% and yielded SAD values of around 20% to 40%. A strong interference of minor PSD peaks on the linear regression results was identified, which partly explains the inferior performance of the linear regression approach as compared to the nonlinear regression approach. For future studies, the limitations of the linear regression approach should be recognized, and a preliminary comparison between different PSD parameter estimation approaches is recommended.

Results
Particulate matter from animal buildings contains a large portion of coarse particles and, thus, has a different particle size distribution [PSD] than ambient aerosols. These findings suggest a default use of the prevalent lognormal distribution model can lead to significant misestimates of PSD parameters such as mean diameter, median diameter and variance. Other models, such as the gamma and Weibull distribution models, may be considered as alternative options. Because of the complexity in the shape of measured PSD profiles, the goodness-of-fit for each of the different PSD models must be compared before selecting one for data regression, parameter estimation and reporting. This research provides a database for future regulations on animal feeding operations emissions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment

Outcome #7

1. Outcome Measures

Improving Application System Efficiency And Reducing Herbicide Use

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This research is designed to explore the possibilities of: [1] developing new droplet size measurement tools to improve the current application system efficiency; and [2] providing the agricultural industry with new map and sensor-based variable-rate technologies that could result in reduced usage of herbicides. The results will reduce the overall chemical input cost of crop production and reduce the negative environmental impact of agriculture production practices.

What has been done

[1] A vision-based imaging system combined with new lighting has been developed for liquid spray and other particle size measurement. Compared with the existing commercial droplet measurement tools, the new system is designed to be lower cost and portable to the field. This project has devoted significant effort to sensor comparison, lighting testing and droplet image processing. The new system was evaluated together with existing measurement systems for their performances. Also, the new measurement tool has been evaluated for use in the field instead of being limited to only indoor lab conditions. An agreement has been signed between the University and a private company to build the prototype system for industry evaluations. Multiple units have been built with industry support and field evaluations are in progress. [2] An auto pilot system for an unmanned aerial vehicle [UAV] remote sensing system has been tested in this growing season. With the auto pilot system, the helicopter was used in field sensing operations. High spatial and temporal resolution data collected with the system have been processed. The results are very promising in increasing the sensing system accuracy in field crop monitoring. New cooperative proposals have been submitted to use the UAV system in research projects focusing on pest control and in major crop breeding experiments. These projects will help further develop the current technology.

Results

This research seeks the development and commercialization of two technologies: [1] a new droplet size measurement tool to improve the current application system efficiency; and [2] new map and sensor-based variable rate technologies that could result in reduced usage of herbicides. The results will reduce the overall chemical input cost of crop production and reduce the negative environmental impact of agriculture production practices. The UAV system will help researchers and producers to better understand crop growing conditions in the field and help in decision support systems including pest management.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment
404	Instrumentation and Control Systems

Outcome #8

1. Outcome Measures

Improved Monitoring Of The Health Of Livestock Via Breath Analysis

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To date, the analysis of breath biomarkers for clinical and veterinary diagnostics is not used because of the lack of reliable baseline values in each animal species and because there is no consensus for how exhaled breath and its condensate should be collected, stored, and processed. Further investigations are necessary to evaluate the effect of collection variables and to propose a standardized collection protocol for each species. Results from this research will also serve as the basis for future development of non-invasive systems for breath-based analysis of biomarkers of disease, health and biosecurity. There is a need for non-invasive systems that can be used routinely by farm workers to: [1] monitor animal well-being; [2] identify animals that are susceptible to influenza or respiratory disease; and [3] detect the onset of influenza or respiratory disease and separate infected animals from the herd.

What has been done
Predictive models for hydrogen peroxide and ethanol sensing in exhaled breath samples, both in the condensate [liquid] and vapor phases, were developed that could be used in the standardization of breath collection for health assessment of humans and animals. Also, a protocol for determining the uncertainty of hydrogen peroxide and ethanol in breath samples was developed to help users of enzyme-based biosensors and predictive models determine the accuracy of their measurement or prediction.

Results
Results from these experiments and activities were presented at the annual meeting of the Institute of Biological Engineers, published as a dissertation, and manuscripts were submitted to peer-review journals. Presentations at professional society meetings have resulted in the exposure of agricultural and biological engineers to the applications of enzyme-based biosensors in health assessment [both in humans and other mammals] and how to quantify the uncertainty of measurements and predictions when using biosensors. Since biosensors have a great deal of

application in food safety and in food bioprocessing, their function, specificity, sensitivity, and accuracy need to be well-understood.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
404	Instrumentation and Control Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Private Pesticide Applicator Training

A survey of practice changes was distributed for completion prior to beginning private pesticide applicator training sessions this past year. The 629 completed surveys represent approximately 16% of those who completed the training and had participated in previous training sessions. In response to the question 'Because of knowledge gained in previous PSEP training session, I have made the following practice changes' respondents could check up to 16 practice changes.

Key Items of Evaluation

Private Pesticide Applicator Training

69.4% [403] calibrate their sprayer regularly to ensure accurate application rates as a result of a previous Pesticide Safety Education program session. Note that findings for other practice changes are included in the Natural Resources and the Environment planned program.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Agricultural And Consumer Economics

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management	0%		10%	
602	Business Management, Finance, and Taxation	50%		15%	
603	Market Economics	0%		10%	
604	Marketing and Distribution Practices	0%		10%	
605	Natural Resource and Environmental Economics	0%		10%	
606	International Trade and Development	0%		10%	
607	Consumer Economics	30%		15%	
610	Domestic Policy Analysis	0%		10%	
801	Individual and Family Resource Management	20%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	0.0	14.0	0.0
Actual Paid Professional	0.0	0.0	2.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
120492	0	603140	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
120492	0	603140	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1130773	0	2545197	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Activities included research that explored bioenergy, invasive species, sustainable agriculture and regulatory barriers to small-scale farming, ongoing development of the **Varietal Information Program for Soybeans** [VIPS] website [**www.vipsoybeans.org**] as well as a series of new reports summarizing VIPS data, continuing research on international and U.S. biotechnology law focused on policy and regulatory measures, work focusing on U.S. and EU conservation policy and U.S. food and agricultural legislation, a review of Dodd-Frank rules issued by the CFTC for potential impacts on agricultural producers, the development of new features for **MarketMaker** [including new profile-to-profile connections that allow farmers to link with others that they do business with, updating of the growing zones of the most common fruits and vegetables grown in field conditions in the U.S. to correspond with the new USDA Plant Hardiness Zone Map, and the development of a working relationship with Feeding America, the nation's leading hunger relief organization and network of food banks to allow growers to communicate information about excess product more easily], a study of the effects of biofuel policies on not only greenhouse gas emissions but also on nitrogen use and pollution, comprehensive analysis of alternative biofuel policies and the implications of biofuel production in India, modeling of the economic and environmental consequences of alternate groundwater management policies, and utilization of spatial econometric methods to analyze the impact of protected areas on deforestation rates in biodiverse areas and on property market impacts of environmental remediation measures.

Additional activities included efforts to explain the role of storage, harvest technology, humidity, rainfall, and temperature on grain quality and loss in tropical grain farms [leading the industry in Mato Grosso, the largest agricultural state in the world, to explore research and outreach activities related to grain quality and grain loss; this in turn led to a collaboration with EMBRAPA, the corn and soybean association of Mato Grosso, and the ADM Institute at the University of Illinois], the development of knowledge regarding how identity preservation and segregation of genetically modified commodities affects prices in world grain markets, the design of an abstract mathematical model of how genetically modified crops have bifurcated world grain markets [creating two physically separate marketing chains, one for genetically modified grains and the other for conventional grains], research that provided important insights into how food price increases impact household welfare in developing countries [these findings have impacted how international NGOs set their policies for conducting food aid], research that impacts the ability of decision makers to understand and quantify the effects of energy infrastructure, land use, soybean disease, and legislative boundary-making on society, efforts focusing on the potential for reducing transaction costs and marketing losses in Africa through new market institutions [including commodities exchanges], and research on agricultural policies and technologies in developing countries that has shown that U.S. access to international markets can be a key for poverty alleviation in developing countries.

Conference presentations included the International Conference on Food Studies, Ecological Society of America, California Low Carbon Fuel Standard Sustainability Workgroup, University of Illinois Organic Farming Field Day, World Congress Unione Mondiale Degli Agraristi Universitari, Weed Science Society of America, Pan American Congress on Plants and Bioenergy, American Society of Plant Biologists, National Value Added Agriculture Conference, Great Lakes Fruit and Vegetable Conference, United Fresh Food Marketing Institute, American Meat Institute, National Association of State Departments of Agriculture Food Show, National Academy of Sciences, USTR-USDA Agricultural Policy Advisory Committee, International Food and Agricultural Trade Policy Council, Center for Advanced Study in International Competitiveness, and the University of Illinois Environmental Sustainability Summit.

Extension specialists conducted the annual **Illinois Tax Schools** in 30 locations throughout the state and five regional **Illinois Farm Economics Summits.** The summit presentations addressed farm profitability outlook and management challenges including direction of prices, government reports and data, estate planning, forecasting returns, crop insurance choices, and changes to farm programs. In addition, four **FAST [Farm Analysis Solution Tools]** training workshops dispersed throughout the state included one-day hands-on experiences using the **Crop Insurance Decisions** and new **Grain Farm Budget and Projection** tools. A corn and soybean margins presentation was also delivered at each of the seven **Corn and Soybean Classics** events held throughout Illinois.

Programs offered by the Extension Educators with consumer economics as their area of expertise included the **Financial Wellness Peer Educator** program and webinars on finances for college students, **All My Money** [a train-the-trainer curriculum for working with limited resources audiences], **Plan Well, Retire Well** e-newsletters sent to 2,200 subscribers, and **America Saves** [a pilot program kicked off during America Saves week that involved over 700 people in a friendly competition format that challenged them to set a savings goal]. Topics on credit/credit reports identifying theft, predatory lending, and taxes were popular with seniors who clearly expressed knowledge gained and actions taken in their responses to an evaluation seeking their input. Staff and volunteers in 29 counties conducted and evaluated knowledge gained by participants in **Welcome to the Real World**, a simulation that gives students [age 12 through young adults] a taste of managing future income and expenses.

2. Brief description of the target audience

Members of the target audience include agricultural producers, individuals and firms that conduct business with agricultural producers, policymakers and other decision makers, the fruit and vegetable industry [with emphasis on those businesses in the supply chain beyond the farm gate], academics and policy makers focusing on environmental concerns, federal and city policy makers focusing on stormwater concerns, water resource managers, government agencies and NGOs working on forest management programs, private conservation agents trying to improve conservation planning under uncertainty, and policy makers, agricultural producers, and individuals concerned about the environment and environmental policy. Extension targeted audiences this past year included livestock producers, land owners, financial advisers, tax consultants, youth, college students, senior citizens, and consumers and families facing financial challenges.

3. How was eXtension used?

Five Extension staff are members of the Financial Security for All eXtension Community of Practice.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	7354	5510	2205	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	49	49

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Projects

Year	Actual
2012	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Page File Requests Made To Farmdoc [Note That Projections Have Been Significantly Modified Per Request Of PI]

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	10699752

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The goal of these tools is to provide farmers with expert advice on insurance product selection. These second-generation tools will be part of the iFARM collection of tools that is available in the crop insurance section of farmdoc [www.farmdoc.uiuc.edu]. The tools will include a yield analyzer, an insurance plan selector, and a marketing-crop insurance selector.

What has been done
Since its inception over a decade ago the farmdoc project has consistently delivered unbiased and timely economic information to agricultural producers and businesses. The farmdoc website sets the standard for round-the-clock access to seamless and integrated information and analysis. There is no doubt that agricultural producers and managers will continue to need sound answers to tough economic questions in the future. The goal of the farmdoc project is to be at the forefront of harnessing the power of the Internet to bring those answers right to their desktop.

Results
In 2012 well over 10 million page request were made to farmdoc [http://www.farmdoc.illinois.edu/] or to farmdoc daily [http://www.farmdocdaily.illinois.edu/]. The goal of the farmdoc project is to provide crop and livestock producers in the U.S. Corn Belt with round-the-clock access to integrated information and expertise to better manage their farm businesses. While the goal has remained constant, the technology available to meet that goal has undergone enormous changes during the last dozen years. Smart phones, iPads, blogs, and social networks are now commonplace but scarcely imagined just a few years ago. The new farmdoc daily site has an eye towards not only the technology people are increasingly using to access information but also the desired form of the information. Information needs to be easily accessible across a variety of platforms [desktops, laptops, and mobile devices] and in a condensed format that fits the needs of busy people with hectic schedules.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
603	Market Economics
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics

Outcome #2

1. Outcome Measures

Number Of Web Hits On The Varietal Information Program For Soybeans Website

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	309905

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The main goal of this research is to share soybean production research information in a useful and cost-effective manner to enable public institutions to communicate information to growers and the agriculture community about the activities, investments, and outcomes of grower-supported public research. This program includes three phases: Phase I - Investigate communication technologies and information outlets [modes] used by soybean growers and the agricultural community for soybean production and marketing information; Phase II - Select new modes and design applications to create a new, technologically-driven communications environment for growers; and Phase III - Assess the usage and effectiveness of new modes and applications.

What has been done
A newly designed, dynamic, visually appealing interface and template for the VIPS website, www.vipsoybeans.org, was developed. A series of new reports summarizing and highlighting VIPS data were released reporting on yield, protein, oil, disease resistance, and amino acid levels. New search features were added allowing users to search by protein and oil content and find amino acid profiles. PDF capabilities and a flip-book interface to provide another method of interacting with the data were added. We added functionality through the Estimated Processor

calculator. An expanded resource section including newly-released publications on soybean management practices was added. These outputs have been communicated to target groups through online efforts, attendance at grower meetings, and in print media.

Results
The availability of this data and the communications efforts to increase knowledge and usage of that data led to the outcome of Illinois soybean growers using third-party data to manage variety selection. With this data, over 2,500 users are able to search for soybean varieties that will perform well on their farms. Additionally, they have access to reports from University of Illinois staff that summarize the data and provide statistical analysis of the data. Variety management is particularly important when addressing the issue of low composition quality throughout the Midwest. Resources from this project allowed for the creation of these reports and additional mediums through which to explore the data.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
603	Market Economics
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Number Making Decisions To Reduce Risk In Agriculture Production

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Percentage Increase In Post-Farm Gate Business Registrations For MarketMaker

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2012 13

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The vision of MarketMaker is to be a national information technology platform that enables all food producers, processors, wholesalers and retailers electronic access to geographically-referenced data, thus enhancing the opportunity for food and agricultural entrepreneurs to identify and develop new and profitable markets and improve the efficiency and profitability of food systems in the United States and eventually globally. Giving farmers easier, more efficient access to emerging markets also impacts policies related to rural economic development, since agriculture is among the potential economic drivers in rural communities. Finally, an electronic medium such as MarketMaker supports and aids the development of new value-added markets for agriculture. The diversification of agriculture is critical for minimizing farmer dependency on commodity crop subsidies.

What has been done

New features developed this year will allow researchers to better study the business interactions of produce growers. First, there are three areas in which the registered member can specify their preferences to receive emails and or text messages generated from the MM system: [1] Buy & Sell Forum; [2] Trade Alerts; and [3] New Members, with the purpose of notifying users of new products, alerts or members with similar characteristics or interests. Secondly, the new profile-to-profile connections allow farmers to link with others that they do business with. As these online linkages develop, MM will build a wealth of data for future research on business relationships of produce farmers. The 2012 USDA Plant Hardiness Zone Map is a recent update that reflects temperature patterns in the U.S. For the first time the information is available as an interactive GIS-based map. The MM team is developing a web-based app that will allow users, based on location, to identify fruit and vegetable products in season for any given location. This information will be integrated with other information on the MM platform. For example, the app will identify the location of the user, enable searches for fresh fruits and vegetables in season, and identify producers that offer selected fruits or vegetables in that area. During 2012 the MM team updated the growing zones of the most common fruits and vegetables grown in field conditions in the U.S. to correspond with the new Plant Hardiness Zone Map. The MM team spent considerable effort researching solutions to the limitations of the MM database in 2012. Currently, each business profile has unique properties with minimum common ones such as name, phone number and address. The improvement requires MarketMaker to have more properties in common across the profiles. During 2012 MM has developed a working relationship with Feeding America, the nation's leading hunger relief organization and network of food banks. In 2013 MM will be launching a pilot project in Georgia in collaboration with Feeding America that allows Georgia produce growers to communicate excess product more effortlessly.

Results

Although there were many farmer-oriented programs and tradeshows attended by the state MarketMaker [MM] program staff, this project focused on downstream food industry players. Overall, traffic to the MM website for the past 12 months average just over 1.23 million hits per month. More specifically, the last 12 months showed an average of 92,056 unique visitors per month, which was a 28% increase over the previous 12 month period. A more critical metric for this project is that the last 12 months have shown an increase in post-farm gate business registrations of 13%. We will continue to monitor these metrics as we continue with the project and add new features.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
603	Market Economics
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
606	International Trade and Development
607	Consumer Economics

Outcome #5

1. Outcome Measures

Applying Policy Analysis And Behavioral Quantification To Inform Policies For Environmental Conservation, Renewable Energy Production, And Water Management

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public policies affect choices that farmers, conservation groups, and other agents make about the use of land, other natural resources, and investments in housing and other durable goods. This research will reveal the likely effects of selected public policies toward elements of the environment including industrial contamination, biofuel development, groundwater pumping, and stormwater management. Thus, our research will improve policy design. This research will also help private agents make choices regarding the natural environment that make better use of their scarce resources.

What has been done
This project applied tools of policy analysis and behavioral quantification to inform policies for environmental conservation, renewable energy production, and water management. The applications emphasize environmental attributes of land, water bodies, and innovative products from crops. Activities under this multi-investigator project included: [1] studying the effects of biofuel policies on not only greenhouse gas emissions, but also on nitrogen use and pollution; [2] undertaking a comprehensive analysis of alternative biofuel policies and examining the

implications of biofuel production in India; [3] studying the incentives for voluntary environmental management and its effectiveness; [4] illustrating how to use portfolio theory to reduce conservation uncertainty under climate change; [5] analyzing stream flow and habitat impacts of seasonal agricultural groundwater pumping; [6] modeling the economic and environmental consequences of alternate groundwater management policies; [7] utilization of spatial econometric methods to analyze the impact of protected areas on deforestation rates in biodiverse areas and on property market impacts of environmental remediation measures; [8] studying the adequacy of existing large-scale social and environmental data sets to support study of human interactions with water environments; [9] studying how management can reduce honeybee colony mortality; [10] analyzing policies to preserve the Monarch Butterfly in Mexico; [11] exploring the potential for spatial panel data methods in agricultural and environmental economics; [12] estimating the values of improved stormwater management; and [13] estimating the benefits of grassland restoration projects.

Results

Our research yielded the following findings: [1] carbon taxes would cause a significant increase in nitrogen use in association with a shift from petroleum to biofuels, and a second-best carbon pricing policy would stop short of a first-best price in order to moderate the impacts on carbon; [2] the effects of biofuel policies have the following features: [a] the Renewable Fuel Standard [RFS] could reduce greenhouse gas emissions by the U.S. by 5% but this would be considerably offset by indirect land use changes in the rest of the world and by a rebound effect in the fuel market [the net reduction may be as low as 0.5%]; [b] the increase in crop prices under the RFS is likely to be about 20% in most cases; [c] the tax credit for corn ethanol and import tariffs that accompany the RFS can delay the transition to advanced biofuels and worsen the negative impact of the RFS on food prices; and [d] both the RFS and LCFS [low carbon fuel standard] have the potential to lead to economic benefits for the U.S. by lowering the price of fuel imports and raising the price of agricultural exports; [3] pollution prevention methods are effective in reducing toxic releases but their effects are transitory; [4] efficient spatial diversification can significantly reduce uncertainty in overall conservation returns in the future for only a small reduction in expected returns, but analysts should be wary of taking shortcuts in measuring costs and benefits for the analysis; [5] analysis of in-stream flow damages from groundwater pumping shows that to achieve ecological flow requirements, pumping restrictions may need to vary across space and time in complex ways; [6] tradable permit schemes for groundwater pumping should be able to increase farm profitability while achieving stream flow constraints; [7] whereas conventional estimates of avoided forest loss suggest that conservation initiatives do not protect forest cover, we found evidence that the conservation measures are preserving forest cover; [8] the generalized method of moments estimator offers an effective way to integrate property value estimates generated by stated as well as revealed preference strategies; [9] while some underused honey-bee management practices successfully reduced colony loss for low costs, other common methods had costs that exceeded benefits; [10] the combined payment for environmental service and logging ban successfully protected forests in the overwintering region for Monarch Butterflies in Mexico; [11] in a number of areas, the use of formal spatial panel methods in economics would improve estimates; [12] people are willing to pay for improved hydrology in addition to flood reduction and improved water quality as outputs of stormwater management; and [13] people value several different elements of restoration success in grasslands, but the marginal values of some attributes are lower when the levels of others are high.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

602	Business Management, Finance, and Taxation
603	Market Economics
605	Natural Resource and Environmental Economics
606	International Trade and Development
607	Consumer Economics
610	Domestic Policy Analysis

Outcome #6

1. Outcome Measures

Number Increasing Knowledge Of The Costs Of Independent Living

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	913

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Older youth and college students need knowledge and skills to assist them in selecting careers and managing income and expenses in order to live as an independent adult. Between the ages of 18 and 25, young adults transition from making decisions about how much money to spend on entertainment to making life-changing decisions about credit use, whether to buy a house or not, utilizing job benefits such as retirement plans, and much more.

What has been done
Annually Extension field staff members provide Welcome to the Real World training and curriculum materials for teachers and a simulation for their middle and high school students that allow them to explore careers and money management [balancing income and expenses] in adult life. The simulation allows students to start with a monthly income and visit various booths to spend their income on items typically in a family budget [such as housing, utilities, food, transportation, insurance, and child care]. This past year 4,004 youth from 29 counties participated in Welcome to the Real World.

The University of Illinois Financial Wellness Program targeted young adults with outreach education to help them make informed financial decisions. Students connect with the program through Facebook, Twitter, FourSquare, Google+, and YouTube. Since the Financial Wellness

program began in the fall of 2008, 58 college students have been trained as Peer Educators, more than 1,000 young adults have attended presentations that encourage financial planning such as budgeting and using credit wisely, and more than 4,000 students have talked informally with Peer Educators at events and office hours. This past summer Cash at College, a series of webinars, was offered to college students.

Results

At the end of the Welcome to the Real World simulation, evaluation forms were completed and collected from 1,281 youth participants located in eight counties. The evaluation was designed to identify increased knowledge of financial management. Using a scale of 1-4 [4=strongly agree, 1=strongly disagree], students rated the simulation on four factors: [1] interest; [2] useful information; [3] helpful activities; and [4] helpfulness for the future. The ratings results for each of these factors averaged 3.4 or higher for the students who completed the evaluation. The evaluation also asked students to evaluate six money management skills choosing between learned how to do or already knew how to do. Of the 1,281 youth respondents, 880 [68.7%] indicated that they learned at least one of the six skills. Complete evaluation results can be found in the evaluation results section of this planned program.

Using a pre-test and post-test given to 85 Cash at College webinar participants and completed by 33, results indicated an improvement in the confidence level of students when asked 'Please select the phrase that best describes your confidence in managing your money while in college'. With a rating of 5 being confident and 1 being not confident, the score average went from 3.1 to 3.6 [notable for one hour of programming]. The Financial Wellness E-News newsletter has over 800 subscribers and click-through data shows that college students are reaching out to Financial Wellness tools such a budgeting and tracking spending worksheets as well as checking their credit report online.

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
801	Individual and Family Resource Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The **MarketMaker** project is given direction by a Policy Advisory Committee [PAC], an advisory board made up of regional representatives that meets six times per year to set

direction for the project. In March 2012, the PAC met and decided upon the following three action steps: [1] marketing to the rest of the market beyond farmers, including businesses, consumers, economic development leaders, chambers of commerce, and non-NGOs; [2] the involvement of a significant private partner to help keep state partners active; and [3] presentations and displays at industry tradeshows and follow-up trade publication articles.

At the end of the **Welcome to the Real World** simulation, evaluation forms were completed and collected in seven counties from 1,281 [32%] of the 4,004 participants in the state. The evaluation was designed to identify increased knowledge of financial management. Using a scale of 1-4 [4=strongly agree, 1=strongly disagree], students rated the simulation on four factors: [1] interest; [2] useful information; [3] helpful activities; and [4] helpfulness for the future. The ratings results for each of these factors averaged 3.4 or higher for the students who completed the survey.

The evaluation also asked students to evaluate six money management skills choosing between 'learned how to do' or 'already knew how to do'. Over one-half of the students responding to the related questions indicated that they already knew how to complete at least five of the six tasks/skills. However, 650 [50.7%] reported learning how to balance income and expenses; 516 [40.3%] gained skill in keeping track of savings; 506 [39.5%] learned how to open a savings account; 484 [37.8%] learned how to balance a checkbook; 427 [33.3%] gained skill in exploring career possibilities; and 319 [24.9%] learned how to write a check.

Key Items of Evaluation

Welcome to the Real World simulations help youth to recognize the challenges of independent living. There is a need to determine the scope of the use of curriculum materials in the schools where the simulation was conducted.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Animal Health And Production

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	10%		15%	
302	Nutrient Utilization in Animals	10%		15%	
303	Genetic Improvement of Animals	5%		15%	
305	Animal Physiological Processes	0%		10%	
307	Animal Management Systems	20%		10%	
311	Animal Diseases	5%		15%	
315	Animal Welfare/Well-Being and Protection	45%		20%	
806	Youth Development	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	8.0	0.0	28.0	0.0
Actual Paid Professional	0.0	0.0	5.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
30123	0	1578320	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
30123	0	1578320	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
282693	0	9800418	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities included the use of a system dynamics modeling approach to explore the U.S. reproductive value chain's information markets [the stylized model focuses on four key performance and commercial herd profitability metrics: litter size, number of pigs born alive, weaning weight, and leanness], development of data suggesting that calcium oxide treatment of distillers grains with solubles [wet or dry] may be beneficial on its own without treatment of the corn stover [this is a much less laborious procedure and will save producers time and money], the use of microfluidics to study biological systems [because microfluidics can deal with a small number of cells, the characteristics of cellular structure and function and the microenvironment of the stem cells can be understood in a more precise manner], and an experiment investigating the influence of genes important in the proliferation of organ cells on the growth of skeletal muscle.

Activities also included research with the goal of defining the early mechanisms of Apicomplexa-host interactions and to identify new drug candidates that can block these interactions, work to advance technology for the practical use of cryopreserved boar sperm to improve opportunities for profitable pork production, project outputs that demonstrate the utility of high-density marker platforms such as the PorcineSNP60 Genotyping BeadChip to identify regions of the genome harboring QTL for economically-important production traits, experiments to assess changes in circulating androgen concentrations and in androgen biosynthesis in three different groups of pigs [Ossabaw pigs, Ossabaw pigs fed a high fat diet that became obese, and Landrace pigs], results from a project which show clearly that diet components can meaningfully improve pig health and thus the efficiency of pork production [these findings are so striking that we can now confidently argue that the diet should be part of a swine herd health management program], identification of molecules on the porcine oviduct that bind sperm, and studies which indicate that fowlpox virus containing full-length REV is widespread in poultry [since virus isolation is time consuming and expensive, isolation of viral genome from the formalin fixed tissue section for genetic characterization provides essential information].

Conference presentations included the Illinois Cattle Feeders Meeting, International Embryo Transfer Society Annual Meeting, American Society of Animal Science Midwest Section, National Veterinary Scholars Symposium, Midwest Conference on Stem Cell Biology and Therapy, National Congress of Swine Production, Midwest Swine Nutrition Conference, Pork Expo, V Colegio Latinoamericano de Nutricion Animal, Society for the Study of Reproduction, Association for Applied Andrology, Gordon Conference on Fertilization and Activation of Development, National Cattlemen's Beef Association, Youth Beef Industry Council, North American Regenerative Medicine Association, International Poxvirus Asfarvirus and Iridovirus Conference, American Association of Avian Pathologists, American Veterinary Medicine Association, Orthopaedic Research Society, Veterinary Orthopaedic Society, and the North

American Veterinary Regenerative Medicine Association.

Drought management was a major focus for 2012 with information delivered at a series of meetings, webinars, blogs, and news releases that addressed pasture management/hay shortages and feeding strategies. Two Extension educators located in research stations provided leadership for a number of programs that focused on beef production that included beef field days, three regional winter cow-calf days, and the **Illinois Cattle Feeders Meeting** and **Southern Illinois Beef Conference.** In addition, Illinois hosted the **Heart of America Grazing Conference.** The annual sheep and goat workshop was offered in the northeastern part of the state, and the annual **Illinois Dairy Days** and three **Dairy Summit** meetings were held throughout the state for dairy producers. Illinois continued to collaborate on delivering the latest dairy production information on milk quality, increased feed efficiency, milk marketing, improved animal health, and lowering consumer milk prices at the **Four-State Dairy Nutrition Management Conference** sponsored in conjuction with Iowa, Wisconsin, and Minnesota. The University of Illinois College of Veterinary Medicine also offered the **Executive Pork Producers Program** which addressed essential skills for excellence in swine business management and the **Executive Veterinary Program in Swine Health Management** which covered the essential aspects of swine production medicine for veterinarians. An **Illinois Horse Breeders Short Course** and **Certified Livestock Manager Training Workshops** targeted at manure management are examples of programs that were delivered by Extension staff to audiences at campus and off-campus sites.

A number of Extension campus faculty and staff members help conduct horse, poultry, dairy, meats, and livestock judging contests for 4-H members. Other 4-H activities include the state **Dairy Quiz Bowl**, regional and state **Horse Bowl/Hippology**, and speech contests. The Extension faculty specialist in poultry taught teachers how to use the curriculum and incubators for the 4-H chick incubation and embryology project in 313 classrooms that included nearly 14,000 youth during the 2011-12 school year [also discussed in the 4-H Youth Development planned program]. In addition, Illinois 4-H and FFA members completed the seven modules of the online **Quality Assurance and Ethics Certification** training and quiz for beef, dairy, goats, horses, sheep and swine covering topics related to care and administration of medicine for livestock.

2. Brief description of the target audience

Members of the target audience include pork producers, beef cattle producers, those who influence diet formulations and health programs for swine, practicing nutritionists, geneticists, biologists, pathologists, veterinarians, reproductive biologists, animal scientists, commercial egg producers and poultry nutritionists, and academic veterinarians and clinicians. Extension activities focused on livestock producers, custom manure haulers, regulatory agency representatives, livestock commodity group representatives, veterinarians, horse owners and breeders, the livestock feed industry, companion animal owners, community leaders, and youth.

3. How was eXtension used?

Eight Extension staff are members of various animal-related eXtension Communities of Practice including Beef Cattle, Companion Animals, HorseQuest, and Livestock and Poultry Environmental Learning Centers.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1901	2272	13665	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	1

Patents listed

TF08051-DIV2 - Composition And Method For Facilitating The Internalization Of A Therapeutic Agent In A Cell

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	63	63

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Research Projects

Year	Actual
2012	9

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased Knowledge Of Livestock Care And Management
2	Utilization Of Waste Management Tools Such As The Illinois Manure Management Plan Workbook And Website
3	Treating Forages Prior To Feeding To Improve Feeding Value
4	Defining The Early Mechanisms Of Apicomplexa-Host Interactions
5	Improved Control Of Porcine Reproductive And Respiratory Syndrome [PRRS]
6	Identification Of Genes Responsible For The Economically-Important Traits Of Food Animal Species
7	A More Holistic Understanding Of Tissue Response To Infection
8	Increased Knowledge Of Best Practices In Grazing

Outcome #1

1. Outcome Measures

Increased Knowledge Of Livestock Care And Management

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2812

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Humane care of animals helps young people to develop social and emotional skills.

What has been done
Training is provided to 4-H youth enrolled in livestock projects via an online module on ethical treatment of animals that also includes an examination to certify that they have the required knowledge. In addition, face-to-face training is offered in some locations that combines ethics and actual livestock production basics.

Results
Online module training records indicate that 2,812 youth were successfully certified in 2011-12.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection
806	Youth Development

Outcome #2

1. Outcome Measures

Utilization Of Waste Management Tools Such As The Illinois Manure Management Plan Workbook And Website

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Treating Forages Prior To Feeding To Improve Feeding Value

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
After corn grain is harvested, the remaining parts of the corn plant are termed corn stover. Historically, corn stover has been left on the field as a carbon source, grazed by cattle, or baled and fed as poor quality forage. In feedlot cattle diets, forage is limited to less than 15% of the diet to maximize energy intake; however, if forage digestibility is improved, concentrations included in feedlot diets could be increased. Therefore, research is needed to improve the quality of stover so it can be used as a forage replacement for feedlot cattle without impacting performance.

What has been done
The following trials were designed to evaluate a 'new technology' concept: treating forages or high fiber energy sources prior to feeding to improve feeding value. Calcium oxide treatment of either corn stover [a mature forage source] or distillers grains with solubles [wet-WDGS, dry-DDGS] was employed. The first experiment focused on the value of treating corn stover versus feeding an immature fiber source [corn silage] to feedlot heifers. In this study, heifers consuming the corn silage ration gained better than the heifers consuming the untreated corn stover ration, despite having similar dry matter intake. Therefore, the heifers fed corn silage-based diets were more efficient. Heifers consuming a treated corn stover diet ate less than those fed untreated corn stover or silage, and gained less as well. Further analysis of these data is ongoing. The second

trial evaluated the effects of corn stover treatment versus WDGS treatment on steer performance. Contrary to our hypothesis, steers fed untreated corn stover gained more than steers fed treated stover or treated WDGS. This is likely because steers fed untreated corn stover ate more than those fed treated stover or treated WDGS. Further analysis of these data is ongoing. In the third trial conducted, diets containing 50% DDGS or 50% MWDGS were fed to 140 steers. DGS were either treated with 2.5% CaO or untreated. There was no effect of treatment on gains; however, treatment with CaO reduced DMI.

Results
Because of the reduction in DMI without impacting gain, cattle were more efficient, regardless of type of DGS inclusion. Efficiency is a large driver of economics in the feedlot industry and improving efficiency in cattle fed 50% DGS diets will improve producer profitability. These data are contradictory to information published by other institutions that show improved performance when cattle are fed diets containing CaO treated corn stover. Currently, industry is telling producers to treat corn stover to improve feeding value. This process is laborious and requires equipment that not all producers may have. Our data suggest that CaO treatment of DGS [wet or dry] may be beneficial on its own, without treatment of the corn stover. This is a much less laborious procedure and may save producers time and money. Further trials will be conducted to investigate these findings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #4

1. Outcome Measures

Defining The Early Mechanisms Of Apicomplexa-Host Interactions

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The phylum, Apicomplexa, contains some of the most significant pathogens infecting humans and animals. Of the more than 4,000 species of apicomplexan parasites, malaria parasites, Toxoplasma gondii, and Cryptosporidia are the most important pathogens of humans, causing death or disability for millions of people each year.

What has been done
The goal of our research in this area is to define the early mechanisms of Apicomplexa-host interactions and to identify new drug candidates that can block these interactions. We have developed a battery of complementary in vitro and in vivo assays that allow us to quantitfy Cryptosporidium, Toxoplasma, and Plasmodium microbial adhesion, microneme secretion, gliding motility, in vitro and in vivo infectivity, and to determine the mechanism by which the infectivity/growth of these parasites is inhibited by selected inhibitors of parasite microneme secretion.

Results
These studies are now culminating in the screening of novel small molecular weight inhibitors of CDPK for the development of new drugs that show broad efficacy for treatment of apicomplexan parasitic diseases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #5

1. Outcome Measures

Improved Control Of Porcine Reproductive And Respiratory Syndrome [PRRS]

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Porcine reproductive and respiratory syndrome [PRRS] is arguably the most troublesome swine disease the industry faces. Our observations that certain plant extracts reduce serum concentrations of the virus that causes PRRS, that one yeast-derived mannan product reduces fever in pigs with PRRS, and that another such product improves feed efficiency of pigs with PRRS may lead the industry to use these products to control the damage caused by this widespread disease. More broadly, proper function of the immune system is essential to keep pigs healthy, but excessive immune activation is quite costly as it reduces pig growth and other productive functions by cutting feed consumption and diverting energy and amino acids from production to immune function.

What has been done

Our research makes clear that several feed components [yeast-derived mannans, certain plant extracts, and spray-dried plasma] dampen the costly excessive immune activation. We have shown this in disease-challenged animals, in ex vivo or in vitro studies with immune cells taken from pig lungs, and in measures of expression of immune genes. This dampening of immune function is likely one of the mechanisms through which these products improve growth performance and our work provides further confidence in the value of these products. Our findings with mice suggest that feeding spray-dried plasma to stressed sows may improve their reproductive success. We found that acids in diets of young pigs do not necessarily improve their growth performance; this result will likely influence choices made by nutritionists. Our emphasis is on pigs, but our results may be relevant to other species, including humans.

Results

The results of this project show clearly that diet components can meaningfully improve pig health, and thus the efficiency of pork production. These findings are so striking that we can now confidently argue that diet should be part of a swine herd health management program. Diseases continue to impair pig well-being, the efficiency of use of valuable resources in pork production, herd productivity, and the profits of pork producers. Young pigs soon after weaning are especially susceptible to enteric diseases. Our work has shown that inclusion in the diet of certain plant extracts or certain clays or insoluble fiber [as found in distillers dried grains with solubles] can reduce clinical enteric disease. We fully expect the industry to use these new tools effectively in improving the health of young pigs, and perhaps older ones as well.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #6

1. Outcome Measures

Identification Of Genes Responsible For The Economically-Important Traits Of Food Animal Species

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A major challenge is to identify additional genes and the accompanying genetic mechanisms that are responsible for the economically-important traits of food animal species. Only a few of the 'low hanging fruits' have been harvested for direct application by the livestock industry. By using the complete DNA sequences of the human, mouse, cattle, and pig genomes, and by applying comparative genomics and other advanced technologies developed at Illinois, we will be able to identify many more genes affecting economically-important traits.

What has been done
The results of resequencing the two dairy bull genomes demonstrate that haplotype reconstruction of an ancestral proband by whole-genome resequencing in combination with high-density SNP genotyping of descendants can be used for rapid, genome-wide identification of the ancestor's alleles that have been subjected to artificial selection. Diagnostics for eight of the mutations causing abnormalities in cattle and sheep have been released for public use.

Results
To date, these diagnostics have been used in more than 200,000 individuals worldwide. For many of these mutations, the allele frequency within specific populations has decreased significantly. The pig genome sequence provides an important resource for further improvements of this important livestock species, and our identification of many putative disease-causing variants extends the potential of the pig as a biomedical model.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
305	Animal Physiological Processes

307	Animal Management Systems
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #7

1. Outcome Measures

A More Holistic Understanding Of Tissue Response To Infection

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mastitis is the most frequent and most costly disease of dairy cattle in the U.S. It adversely impacts milk production, milk quality, and animal well-being and often requires administration of antibiotics.

What has been done
Profiling of microRNA in healthy mammary tissue and S. uberis-infected mammary tissue was completed. In addition, bioinformatics analysis of gene targets of the microRNA analyzed was performed to study the potential functional implications of altered microRNA expression during infection.

Results
The combined analysis of microRNA profiles and their target genes allowed for a better mechanistic understanding of the molecular adaptations of the mammary gland during mastitis infection. Changes in mammary tissue immune, metabolic, and cell growth-related signaling pathways during infection might have been mediated in part through effects of microRNA on gene transcription. Differential expression of microRNA supports the view from nonruminant cells and tissues that certain microRNA might be essential for the tissue's adaptive response to infection. The combination of microRNA profiling, microarrays, and bioinformatics analyses was essential for generating a more holistic understading of tissue response to infection.

4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #8

1. Outcome Measures

Increased Knowledge Of Best Practices In Grazing

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	101

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To maintain profitability of certain livestock enterprises and quality production of meat animals to meet consumers' demands, producers need to use best forage management practices. This past year Illinois producers experienced dramatic drought impact [no pasture to graze, very little hay made/stored for winter feeding, high concentrate and hay prices] and increased prices for all classes of cattle. Producer's concerns over the economic viability of feeding cattle during this coming year are expected to continue.

What has been done
Extension educators and specialists assisted in organizing, promoting and teaching a number of events which include field days at livestock research field stations, beef cow-calf workshops, pasture walks, and web postings. The Heart of American Grazing Conference was held in Mt. Vernon, Illinois on January 25 and 26, 2012 and included 12 separate topical sessions as well as a producer panel discussion. The 145 attendees were also able to visit with various vendors who provided relevant exhibits. In addition, a pasture drought clinic was held that included six topics to meet the educational needs of 52 livestock producer attendees from Illinois. The results below summarize responses to items included in an end-of-conference evaluation that was distributed and collected from 86 of the 145 individuals [59%] who attended the Heart of America Grazing Conference and from 22 of the 52 individuals [38%] who attended the Illinois Pasture Drought Clinic.

Results

Heart of America Grazing Conference participants were offered an option to rate the knowledge they gained through each of the individual sessions using a 1-5 scale [1=None/Already knew and 5= Learned a great deal]. All but three of those who responded checked at least one topic as a 4 or 5, while 65 checked a 5 rating for at least one session topic. Participants were asked to list one management technique learned at the conference that they plan to implement [39 responded]. Most frequently mentioned were techniques related to planting cover crops and warm season grasses. Using the same evaluation structure and rating scale, participants in the Pasture Drought Clinic indicated the most knowledge gained about the following topics: [1] effects of cover crops on crop insurance; [2] alfalfa and hay management; and [3] soil moisture trends. Details are included in the evaluation section of this planned program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Heart Of America Grazing Conference

Participants were offered an option to rate the knowledge they gained through each of the individual sessions using a 1-5 scale [1=None/Already knew and 5= Learned a great deal]. All but three of those who responded checked at least one topic as a 4 or 5, while 65 checked a 5 rating for at least one session topic. Topics rated 4 or 5 by the largest number of those who responded were: [1] Warm Season Grasses-Place and Economics -- rated 4 or 5 by 65 individuals [80%]; [2] Grazing for Parasite Prevention -- rated 4 or 5 by 62 individuals [77%]; [3] Cover Crops and Their Implications for Grazing -- rated 4 or 5 by 59 individuals [71%]; [4] Mob Grazing-Does it Work on Midwest Soils and Pastures? -- rated 4 or 5 by 59 individuals [71%]; and [5] Benefits of Grazing and Added Value of Clover -- rated 4 or 5 by 58 individuals [70%]. Participants were asked to list one management technique learned at the conference that they plan to implement [39 responded]. Most frequently mentioned were techniques related to planting cover crops and warm season grasses.

Pasture Drought Clinic

Using the same evaluation structure and rating scale, participants in the Pasture Drought Clinic indicated the most knowledge gained about the following topics: [1] Effects

of Cover Crops on Crop Insurance -- rated 4 or 5 by 15 respondents [79%]; [2] Alfalfa and Hay Management -- rated 4 or 5 by 12 individuals [63%]; and Soil Moisture Trends -- rated 4 or 5 by 10 respondents [53%].

Key Items of Evaluation

All livestock producers who completed the evaluation gained knowledge primarily through one or more of the presentations and 65% identified drought risk grazing management actions they plan to take including planting difference forages, increasing rotational grazing, monitoring rainfall, and adjusting stocking rates.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Community Resource Planning And Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
608	Community Resource Planning and Development	80%		70%	
802	Human Development and Family Well-Being	0%		10%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	5%		10%	
805	Community Institutions, Health, and Social Services	5%		10%	
806	Youth Development	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	15.0	0.0	2.0	0.0
Actual Paid Professional	0.0	0.0	0.3	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
975983	0	74147	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
975983	0	74147	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
9159261	0	377093	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities included cross-national studies of developmental risk and resilience in migrant families, the development of findings with regard to immigrants and second-generation youths that young people's level of political engagement heavily depends on the support they have from community or educational institutions, that these activities seem to be difficult for young people who are not full time students, that young people's engagement is often motivated by personal experiences of marginalization, and that immigrant and second-generation youth find challenges in directly involving their immigrant families in civic and political life, findings which indicate that location of entry of news stories into the news affected sourcing, planning, and morality constructions for a specific issue, and a project which has laid the groundwork for a better understanding of the factors that influence immigrant women and men in sending remittances and use of discretionary income.

Conference presentations included the Association of American Studies, American Anthropological Association, Asian American Studies, Critical Ethnic Studies, International Congress of Qualitative Studies, International Symposium on Youth with Migrant Backgrounds in South Korea, U.S. Democratic Task Force on Southeast Education, and the National Council on Family Relations.

Extension activities included a wide variety of methods and focused on community participatory planning, organizational development, community economic development, and community leadership development and education. Key programming for the year included efforts by Extension Educators with community and economic development expertise to work with state and regional partners to educate residents about the value of broadband access and adoption and the availability of community challenge grants. One of these community discussions led to the creation of **Connecting Generations**, a program focused on recruiting students who want to earn volunteer service hours by teaching senior citizens who need assistance with computer usage. Other community participatory planning education included continuing work to help communities plan for and manage disasters, work on municipal and regional development plans, and on economic development plans.

Extension educators led and supported a myriad of community participatory planning processes. Educators coached student interns and facilitated six **Community Matters** engagement opportunities to involve the public through case studies, surveys, key-informant interviews and forums to identify needs and options for improving their communities. At least nine other major community participatory comprehensive or strategic planning processes received Extension assistance in determining how to carry out the updating or development of plans for a variety of entities including counties, municipalities, housing authorities, libraries, and non-profit organizations. Extension staff also facilitated county hazard mitigation plan development and progress assessment. **Community Swap** [reciprocal visits] and access to

economic profiles prepared by Extension educators were carried out to help four communities identify high priority development areas and define an action agenda.

Extension Educators offered a variety of programs related to economic development. Significant efforts were devoted to **Building Entrepreneurial Communities** in several counties [including forming and supporting 4-H youth groups and camps focused on designing entrepreneurial businesses]. In addition, Extension Educators are actively involved in community groups focused on supporting and recognizing entrepreneurial activities. Examples of such activities include the **Entrepreneurial Support Network of West Central Illinois' Small Business Day Celebration** complete with awards for four counties and the first **Clark County Business Expo** with a youth entrepreneurship component involving three local high schools. A dual county **Fast Pitch Competition** was created to award funding in four categories: retail, non-retail, 'got an idea', and student. Other activities included small business education workshops and delivery of the newly created **On The Front Line** curriculum targeted at developing employee skills in customer service.

The **Local Government Information and Education Networking Tele-Institute** series was redesigned this year and included eight distance education programs targeted at developing the knowledge and skills of local officials. Nearly two-thirds of the 235 participants were currently serving as county officials. The audio conference topics addressed legislative updates, redistricting, GIS in local government, the importance of broadband, and obstacles and opportunities related to special structure assessments. Community leadership development also included continued support of seven youth and adult **Leadership Academies** often conducted in partnership with other community organizations and presentations to non-profit organizations on topics such as team building, fundraising and marketing.

Extension Educators have been actively involved in interdisciplinary efforts focused on supporting local food systems, youth workforce development, and energy education which are addressed in other planned programs.

Online self-directed interactive training modules have been developed for statewide use and potential use by other states. Eight beginner modules and six advanced modules including **Introduction to Applied Research**, **Getting a Project Started**, **Logic Models**, **Data Management**, **Measuring Outcomes and Evaluation**, **Introduction to SPSS**, and **Using Excel** are online along with an evaluation process designed to collect data on knowledge change.

2. Brief description of the target audience

Members of the target audience included academics, youth practitioners, policy makers, immigrant communities, local practitioners, state and local policy makers, national and international scientific audiences, low-income rural mothers, and financial, economic, and consumer educators. Community leaders, business leaders, agencies and organizations, and local government officials involved in community and economic development are key target audiences that are large in scope. Other target audiences include youth and residents interested in starting small businesses.

3. How was eXtension used?

Thirteen Extension faculty and staff and Illinois residents are members of eXtension Communities of Practice Entrepreneurs and Their Communities, Enhancing Rural Capacities, and/or Extension Disaster Education.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	37489	108417	35856	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	4	4

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Research Projects

Year	Actual
2012	3

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number Of Individuals Who Worked On/Gave Leadership To Specific Community Issues
2	Number Of Plans Developed/Adopted/Adjusted By Communities Through Citizen Engagement
3	Dollar Value Of Grants And Resources Leveraged/Generated [Includes Gifts, Grants, Private Investments, Equipment, Workforce Training, Budget Allocations, Etc.]
4	Acceptance Of New Leadership Roles And Opportunities
5	Encouraging Young People To Build Political Capital In Their Families And Communities

Outcome #1

1. Outcome Measures

Number Of Individuals Who Worked On/Gave Leadership To Specific Community Issues

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number Of Plans Developed/Adopted/Adjusted By Communities Through Citizen Engagement

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Illinois communities face a host of challenging issues, such as declining populations and shrinking economies. To address these issues, community leaders and residents need assistance to identify strategies to engage residents in managing the rapidly changing social and economic landscape.

What has been done
Extension Educators with assigned responsibilities in community and economic development worked with community leaders on 15 community planning projects this past year. Extension Educators provided information on best practices for use in developing or updating: [1] two county and two community comprehensive plans, also known as a general, master, or land use plan; [2] two county hazard mitigation plans; [3] two SWOT [strengths, weaknesses, opportunities, and threats] analyses for a community and a library district; [4] a community garden development project; [5] a radio station plan to better meet the needs of local residents; [6] a county housing task force plan; [7] a strategic plan for a city development association; [8] a visioning session for a multi-community river project and subsequent design development; and [9] two city design planning processes. The latter four are participants in the 'Community Matters' program which draws on a collaboration with campus urban and regional planning and landscape architecture faculty, staff and students working with community members. The involvement of community

residents is critical to the planning process, and Extension facilitated and directed processes that included surveys, focus groups, key informant interviews, steering committees, and public meetings, working with community residents, local officials, volunteers, agency staff, and community organization boards and members.

Results

Six of these planning processes were completed this year. Especially notable was the completion of one county's comprehensive plan which was delayed when the staff member providing support for the project was not retained in the recent University of Illinois Extension reorganization. Public involvement [a key goal in creating understanding and support for plan implementation] in these 15 planning efforts, which varied in scope and method, totaled nearly 3,000 residents. This included more than 2,400 residents who completed community surveys, 349 who attended 19 public meetings, 187 steering committee members who attended 74 meetings, and 35 focus group participants [9 groups]. Involvement of first-time participants in community planning is another important objective focused on building future community leadership; a total of 75 residents were first-time community planning participants.

An obvious goal is not only to teach and use best practices to carry out planning processes, but to take actions in implementing decisions reflected in the plans. The annual meeting to monitor progress on a county hazard mitigation plan indicated that 19% of the elements in the plan had been completed and another 35% were in process. Other documented actions taken for three additional planning processes included broadband infrastructure investments, changes in sanitary sewer investments, formation of a park district, a buy local campaign, a business database, and establishing a community and economic development committee. Other actions are in process and are being monitored.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services

Outcome #3

1. Outcome Measures

Dollar Value Of Grants And Resources Leveraged/Generated [Includes Gifts, Grants, Private Investments, Equipment, Workforce Training, Budget Allocations, Etc.]

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Acceptance Of New Leadership Roles And Opportunities

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Encouraging Young People To Build Political Capital In Their Families And Communities

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The first objective of this project is to examine how young people are building political capital in their families and communities through their participation in inter-generational community-based organizations. It examines how youth develop expertise and connections to dominant knowledge and the kinds of skills concomitant with their acquisition of political knowledge, and the ways they enable or facilitate others in their sphere of influence. The second objective of this project is to conduct a longitudinal study to test the long-term individual and community impact of young people's participation in politically-oriented youth groups. It examines whether their participation resulted in more positive individual outcomes [leadership employment position, educational status, confidence, positive future outlook] and community outcomes [staying in the community as leaders, contributing to their immigrant communities, participating in careers or education that works towards positive changes for their communities].

What has been done
The major output of this project has been the dissemination of knowledge through events. This has been achieved namely through public presentations to a variety of audiences such as academic, policy, practitioner, and community audiences. Academic conferences have included

the Association of American Studies, American Anthropological Association, and the International Congress of Qualitative Studies. Presentations were made for a policy audience both internationally and domestically including the International Symposium on Youth with Migrant Backgrounds in South Korea and to the U.S. Democratic Task Force on Southeast Education. Public presentations were also made to disseminate knowledge at a community level that included practitioners, researchers, and young people such as to University of Illinois Extension, a local high school, and community organizations.

Results

The major outcome of this project was the change in knowledge. Some major changes in knowledge include: [1] young people's level of political engagement heavily depends on the support they have from community or educational institutions that promote such activities; [2] these activities seem to be difficult for young people who are not full time students, either in high school or college [young people who attend school part time and work part time find it difficult to translate their desire for civic and political engagement into action without structured programs to participate in]; [3] young people's engagement is often motivated by personal experiences of marginalization such as poverty or discrimination; and [4] immigrant and second generation youth find challenges in directly involving their immigrant families in civic and political life. Their bigger impact is in the indirect support they provide for their families and communities in the form of staying and living in their home communities and aiding family members in everyday life practices [acting as translators, accompanying family members with institutional officials, public assistance officials, school employees, and city officials, and mediating] which has the larger impact of providing essential social and political capital for these immigrant communities. This change in knowledge will impact a change in conditions to improve programs for young people in local community-based organizations but also in national and international forums.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Results regarding community participatory planning were identified through tracking use of best management practices, levels of resident participation, and contacts with community leaders to monitor program adoption and action to carry out plans. Six of these planning processes were completed this year. Especially notable was the completion of one county's comprehensive plan which was delayed when the staff member providing support for the project was not retained in the recent University of Illinois Extension reorganization. Public involvement [a key goal in creating understanding and support for plan implementation] in these 15 planning efforts, which varied in scope and method, totaled nearly 3,000 residents. The annual meeting to monitor progress on a county hazard mitigation plan indicated that 19% of the elements in the plan had been completed and another 35% were in process.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety And Food Security

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	5%		0%	
111	Conservation and Efficient Use of Water	10%		10%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		5%	
205	Plant Management Systems	10%		0%	
216	Integrated Pest Management Systems	5%		0%	
501	New and Improved Food Processing Technologies	0%		10%	
502	New and Improved Food Products	0%		10%	
503	Quality Maintenance in Storing and Marketing Food Products	10%		10%	
603	Market Economics	5%		0%	
701	Nutrient Composition of Food	0%		10%	
702	Requirements and Function of Nutrients and Other Food Components	0%		10%	
703	Nutrition Education and Behavior	0%		10%	
704	Nutrition and Hunger in the Population	10%		15%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	20%		0%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	20%		10%	
806	Youth Development	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890

Plan	20.0	0.0	7.0	0.0
Actual Paid Professional	0.0	0.0	6.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
801270	0	1277869	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
801270	0	1277869	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
7519640	0	2549065	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities included research into the use of continuous-flow ultrasonic washing of fresh produce [which has the potential to provide the produce industry with a means to significantly enhance microbial safety], the application of research findings to improve an industrial process of zein manufacture, research that resulted in the development of new flavor encapsulation processes by industry groups, development of Nutrigems as a feasible technology to deliver a known and stable amount of micronutrients [now ready for efficacy testing in Honduras], assessment of trade barriers for agricultural products, a project that allowed for growing markets around the world to build awareness about health benefits and food applications of soy protein products [by increasing private voluntary organization, policy maker, and consumer awareness about the importance of increasing protein content in weaning foods and diets of children, there exists an increase in opportunities for the export of U.S. soybeans and soy protein products to the developing world], and results that will allow for development of higher quality food products and associated materials by evaluation of important flavor-related quality indices for product development/improvement and shelf-life estimation.

Additional activities include efforts to measure the effect of the **Supplemental Nutrition Assistance Program [SNAP]** on poverty in the United States, studies that showed proof of the concept of using dry puffed pellets to deliver iron into a wet material such as nixtamalized corn [using dry puffed pellets is advantageous in developing countries as these are easy to make and well-known by local food processors and the target populations], improved understanding of the ingredient-product relationship of soy/whey-based high protein snack products [with a greater amount of soy protein, the high protein snacks have more acceptable physical and sensory properties], an evaluation of methods of sampling and measuring flavor and nutrition of fresh-cut products to facilitate comparison to traditional shelf life factors, the development of new strategies to improve and better maintain inherent fresh-cut product quality and nutrition, and the application of photonic crystal technology to build a low-cost, easy-to-use, rough diagnostic device to assess real-time micronutrient status [a major challenge to improving health in at-risk populations is the lack of current and reliable health and nutrition information].

Conference presentations included the Biennial Molecular and Cellular Biology of Soybean Meetings,

Illinois Specialty Crops, Agritourism, and Organics Conference, Institute of Food Technologists, Korean Society of Food Science and Technology, International Society for the Study of Fatty Acids and Lipids, Western Extension and Research Activities Committee on Agribusiness, Agricultural and Applied Economics Association, and the American Chemical Society.

Food safety training for employees of establishments and volunteers that prepare or serve food to the public was again delivered at a much reduced level this year while searches were launched to fill Extension educator positions with expertise in safe food preparation. Approximately 100 individuals were trained primarily through the first of the following three programs: [1] the Illinois Department of Public Health five-hour **Refresher Course for Food Handlers** designed for food service sanitation managers who must maintain their certification every three years; [2] a fifteen-hour **Food Services Sanitation Manager's Certification Course** for those seeking initial certification; and [3] **Serve it Safely**, a food class for volunteers who serve food for fundraisers, community organizations and family events. Findings are described in the outcome and evaluation sections of this planned program. The **Supplemental Nutrition Assistance Program-Education [SNAP-Ed]** curriculum for both youth and adults included an emphasis on proper hand-washing and cleanliness habits when preparing food.

During this past year, four **Enhancing Specialty Food Safety** programs were offered to specialty growers in northeastern Illinois addressing safe food production and handling in order to ensure that fresh produce is free from contamination by microorganisms that cause foodborne illness. Information on good agricultural practices to ensure food safety was also included as a topic for a statewide webinar and commercial fruit and vegetable production schools were held throughout the state. In addition, several Extension educators assigned to provide programs in small farms and local food systems shared updates of rules and regulations regarding farmers' markets, pesticide spraying, and open water systems.

State and regional Extension conferences/clinics and field days reach large numbers of corn and soybean producers with information on fertility and pest management. **Corn and Soybean Classics** [seven regional-based meetings] that featured eight faculty presentations on the latest research concerning weed management, fertility, stewardship, and pest management reached 981 producers and agricultural consultants. The multi-state **AGMasters Conference** was held on campus and two-day **Regional Crop Management Conferences** were held in four locations in 2012. The primary audience was certified crop advisers. Extension of research to the public also includes the **Varietal Information Program for Soybeans**, a website and publication that provided information on yield, protein and oil, and disease and pest susceptibility. Annual research farm field days [9] were held in the summer to showcase research plots to producers.

The electronic **Pest Management and Crop Development Bulletin** series was prepared biweekly during the growing season by entomologists, agronomists, and plant pathologists to report on the current agricultural conditions with advice on pest management. Of the 4,552 plant samples diagnosed by the **University of Illinois Plant Clinic,** the significant field crop disease issues evaluated were corn nematodes, soybean cyst nematode, and soybean vein necrosis virus. Samples diagnosed included client-submitted samples, phytosanitary inspection samples, and soybean cyst nematode egg extraction samples for private industry.

Statewide Extension conferences related to produce production included the Illiana Vegetable Growers School, Southern and Southwestern Tree Fruit School, Western Illinois Vegetable School, Illinois-Wisconsin Fruit and Vegetable School, Southern Illinois Commercial Vegetable School, and the Small Fruit and Strawberry School. Additional state and regional conferences focused specifically on growing horseradish, small fruits, and strawberries. Extension also provided leadership for the Specialty, Agritourism and Organic Conference and distributed 22 issues of **Fruit and Vegetable News**.

Pesticide safety education was conducted using presentations at numerous locations with teaching

contacts numbering 9,724 through commercial training and another 3,914 through private training. Information is also disseminated electronically via a quarterly multi-state newsletter focused on integrated pest management successes and activities.

Extension activities that addressed hunger within Illinois are delivered by **Expanded Food and Nutrition Education Program [EFNEP]** staff and **Supplemental Nutrition Assistance Program Education [SNAP-Ed]** staff members who conduct hands-on activities with children and their parents with limited incomes. These activities include using food stamps, meal planning, wise shopping, and use of food pantries. More than 550,000 teaching contacts including 345,728 youth were made through the **SNAP-Ed** program and 16,353 family members were reached through **EFNEP** this past year.

2. Brief description of the target audience

Members of the target audience include food scientists, pharmaceutical scientists, chemical engineers, biologists, plant scientists, food engineers, food product developers, physical chemists, microbiologists, personnel in academia, government, and the food industry, parents, physicians, infant formula manufacturers, fruit and vegetable producers [including seasonal workers], farmers' market managers, produce aggregators, food banks, policymakers charged with improving the well-being of low-income Americans, and administrators overseeing food assistance programs. Extension targeted youth, certified food handlers, volunteers who serve food to the public, producers of food distributed through local systems, producers of commercial fruit and vegetable crops, producers of feedstuffs for livestock, certified crop advisers, and limited-resource audiences that are food stamp eligible.

3. How was eXtension used?

Eight Extension and University of Illinois faculty are members of various eXtension Communities of Practice that address food safety and security.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	43511	211162	29727	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	1

Patents listed

TF11068-US - Microfluidic Device Comprising A Biodegradable Material And Method Of Making Such A Microfluidic Device

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	1	27	28

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Research Projects

Year	Actual
2012	11

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number Increasing Knowledge Of New Corn And Soybean Crop Management Techniques
2	Number Changing Application Of Recommended Pest Control Practices For Corn And Soybean Production
3	Dollars Saved Through Safe And Effective Pesticide Application
4	Improvement Of Soybean Cultivars To Meet Market Needs And Provide New Tools For Studying The Effects Of Soy Isoflavones On Human Health
5	Knowledge Gained Toward Improving The Availability Of Fresh Fruits And Vegetables To Low-Income Americans
6	Development Of Fortification Technologies For Developing Countries
7	Development Of High-Protein Snack Products And Packaging
8	Enhancement Of Microbial Safety In Fresh Produce
9	Development Of A Non-Field Screening Method For Charcoal Rot Resistance
10	Increase Knowledge Of Personal Cleanliness Habits That Prevent The Spread Of Disease Through Food
11	Using Appropriate Hygiene Procedures When Handling Food [Fresh Or Processed]
12	Practices Adopted That Prevent Foodborne Illness Contamination During The Production And Distribution Of Fresh Produce
13	Number Of Food Preparers Reporting Using Proper Time And Temperature Controls
14	Increased Knowledge Of Fresh Fruit And Vegetable Production Practices

Outcome #1

1. **Outcome Measures**

Number Increasing Knowledge Of New Corn And Soybean Crop Management Techniques

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Number Changing Application Of Recommended Pest Control Practices For Corn And Soybean Production

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Dollars Saved Through Safe And Effective Pesticide Application

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Improvement Of Soybean Cultivars To Meet Market Needs And Provide New Tools For Studying The Effects Of Soy Isoflavones On Human Health

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The goal of this project is to develop soybean cultivars with either high or low levels of seed isoflavones or with altered isoflavone composition to meet market needs and provide new research tools for studying the effects of soy isoflavones on human health. Soybean breeders will get information about the changes needed and germplasm available to accomplish the desired changes that would increase soybean disease resistance and also health-promoting and nutritional value. Soybean processors and manufactures will get these unique lines with health-promoting properties that should help to expand the soy product market. It would also help to have uniformity in the food products.

What has been done
For the first time the genetic biodiversity of several important phytochemicals was determined by simultaneous analyses of isoflavones, phytosterols, sphingolipids and saponins in different soybean genotypes that have high or low levels of protein and oil. Since soy-based protein products contain isoflavones and saponins co-extracted during seed processing and the oil fraction contains sphingolipids and sterols, the information generated during this study could be valuable for application in breeding programs aimed at soy health added values. The information will be also useful for future testing of the target individual bioactive compounds and their combinations for their health effects. Genetic engineering targeted to enhance the capacity of native [glyceollin] and non-native [resveratrol and pterostilbene] phytoalexin production in response to pathogen invasion and/or the capacity to prevent phytoalexin degradation by pathogens could increase soybean innate resistance to multiple pathogens.

Results
It is conceivable that new soybean cultivars with stronger innate resistance would have a superior ability to accumulate antibiotics in response to general pathogen invasion, and not just to specific pathogens only. Cultivars with such enhanced innate resistance could help stabilize soybean production in the presence of diseases. Increased synthesis in the seeds of the soybean native fungicidal chemical glyceollin, or the non-native chemicals resveratrol and pterostilbene, will lead to better germination of healthy seeds and production of more vigorous seedlings due to reduced infection.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
603	Market Economics
701	Nutrient Composition of Food
704	Nutrition and Hunger in the Population
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #5

1. Outcome Measures

Knowledge Gained Toward Improving The Availability Of Fresh Fruits And Vegetables To Low-Income Americans

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The diets of many Americans, especially low-income Americans, do not include sufficient quantities of fruits and vegetables, and fresh produce is not readily available in many low-income communities. Increased local production of fruits and vegetables would enhance state and local economies, contribute to better health, and increase food security, but the development of local food systems lags behind need in many regions. We will form multidisciplinary teams to develop specific research and outreach programs to support and increase the production and availability of fresh, local fruits and vegetables and an expansion in the number of farmers who supply fresh produce to enhance local economies, consumer health, and food security.

What has been done
Accomplishments include: [1] coordinated the Illinois Specialty Crops, Agritourism and Organics Conference [this conference included relevant programming for farmers' market directors, connecting buyers and producers to scale-up local food systems, food safety, and food sales to institutional buyers, including Farm-to-School programs, and using social media to connect producers and consumers]; [2] expanded the capabilities and geographic coverage of MarketMaker; [3] developed and offered a new course on Local Food Systems at the University of Illinois; [4] contributed food systems-related presentations and discussions at the Sustainable Living Expo in southern Illinois; [5] consulted with school districts and communities on building local food systems; and [6] participated in meetings of the Illinois Local Foods Working Group. We also established or continued a range of research and Extension projects to improve food production, marketing, and distribution, including projects on pest management, post-harvest handling, organic certification, and urban farming. Products included articles in the Illinois Fruit and Vegetable News newsletter and updates to MarketMaker.

Results
Over 400 attendees at the Illinois Specialty Crops, Agritourism, and Organics Conference acquired knowledge to better understand production, marketing, and purchase of fruits and vegetables for local food systems. Over 500 subscribers to the Illinois Fruit and Vegetable News gained knowledge of necessary steps to link production and marketing in local food systems. Over 2,000 attendees at the Sustainable Living Expo gained information about local food systems. The number of farmers' markets in Illinois increased to over 300 in 2012.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
603	Market Economics
701	Nutrient Composition of Food
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #6

1. Outcome Measures

Development Of Fortification Technologies For Developing Countries

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The overall goal of this project is to develop and field test new effective fortification technologies that are low-cost, easy to use and that do not change feeding habits of populations in developing countries. In the Central American region iron deficiency anemia is major health concern. Most populations in this region consume tortillas. Thus, fortification of nixtamalized corn for tortillas at the point of wet grinding could be an effective strategy against IDA in rural Central America.

What has been done
We are working on a process to fortify nixtamalized corn tortillas at the point of wet grinding using a stealth approach. In this process, we used extrusion to create puffed pellets fortified with iron. These pellets are added to nixtamalized corn prior to grinding at wet milling facilities. The iron source changed color in pellets, but it did not affect final masa color. Iron distributed well in masa fortified with both pellets types.

Results
These studies showed proof of the concept of using dry puffed pellets to deliver iron into a wet material [i.e. nixtamalized corn]. Using dry puffed pellets is advantageous in developing countries as these are easy to make and well-known by local food processors and the target populations. Also, the pellets have low water activity and do not require specialized packaging, making it a stable product under the conditions of use. Nixtamalized corn tortillas are consumed in more than 90% of households in most Central American countries, but in lesser amounts in Costa Rica and Panama. Nonetheless, traditional corn masa tortillas are almost exclusively consumed by low-income populations living in rural areas of Honduras, Guatemala, Nicaragua, and El Salvador.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
603	Market Economics
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

Outcome #7

1. Outcome Measures

Development Of High-Protein Snack Products And Packaging

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The long-term goal was to understand the characteristics of high protein ingredients and the resulting product qualities and to provide a guide for high protein soy foods development, which will provide more choices for better nutrition to consumers. The long-term goal of the study will be

achieved by identification and characterization of soy ingredients in various ratios of macronutrients and processing conditions. The specific objectives were to: [1] identify the possible processing parameters of high protein products; [2] characterize the model products and reiterate the process; and [3] correlate sample characteristics to raw material and processing parameters and model the relationship between material and product characteristics.

What has been done

To accomplish these objectives, the high protein snack samples were processed using formulations which include protein amounts that will meet FDA requirements for a claim of being high in protein [10 g per serving]. The protein source was initially soy flour. The protein source was expanded to soy protein concentrate [SPC], soy protein isolate [SPI], whey protein concentrate [WPC], and whey protein isolate [WPI]. The final formulations were prepared with carbohydrate source [corn meal] and protein sources [our total protein amounts [28, 33, 38, 42%] and five whey protein to soy protein ratios [100:0, 75:25, 50:50, 25:75, 0:100]]. The screw configuration and extrusion parameters were identified for the high protein expanded snacks. Based on the high protein snack product characteristics, a model has been set up based on protein content and the source of protein [soy vs. whey] to optimize formulation. The processed snacks were also stored in air tight containers for six months at room temperature. As for the freshly prepared samples, both protein amount and protein type had significant effects on selected properties by instrumental measurements as expected. The significant changes that occurred over a six-month storage period in ambient conditions include texture, water activity and color. The texture of the samples, especially the hardness of the samples, decreased significantly. In general samples can be described as less hard and less crunchy. Water activity increased over time although the absolute water activity values are still low enough so no microorganisms can grow on the samples. Color, in terms of redness and blueness, decreased and resulted in 'faded color' compared to the fresh samples.

Results

The gained knowledge from this project will aid in better understanding of ingredient-product relationship of soy/whey-based high protein snack products. The model suggests that with greater amounts of soy protein, the high protein snacks have more acceptable physical and sensory properties. Soy protein contributed to greater expansion and acceptable texture of the high protein snacks which leads to higher consumer preferences. Blends of soy and whey protein can be a great protein source for this type of expanded snack as long as the ratio of soy to whey protein is controlled carefully. Also, based on the findings from the long-term storage study, target quality factors could be identified to extend shelf life of the high protein snack samples. This is important information to design proper packaging material and storage conditions to decrease product return and waste. The results may be used to develop high protein snack products as well as to design packages, which is extremely important for the soy and snack food industries.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
603	Market Economics
701	Nutrient Composition of Food
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #8

1. Outcome Measures

Enhancement Of Microbial Safety In Fresh Produce

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The recent outbreaks of Escherichia coli O157:H7 and Listeria infections due to consumption of produce reaffirmed the importance and challenge of produce microbial safety. These outbreaks and recalls have brought significant economic losses to the produce industry, and more importantly, recurring produce-related outbreaks erode consumer confidence in fresh produce and could jeopardize the long term development of the produce industry.

What has been done
A pilot-scale continuous-flow washing system with three pairs of ultrasonic transducers operating at 25, 40, and 75 kHz was designed and fabricated and used to investigate the efficacy of ultrasound treatment for produce sanitization. A uniform ultrasound distribution in the channel was achieved, as shown by pitting on aluminum foil and log reduction of Escherichia coli O157:H7 population on spinach held at different locations in the channel. The inactivation normalized by acoustic power density for one-minute treatments at 25, 40, and 75 kHz was 0.056, 0.061, and 0.057 Log CFU/[W/L], respectively. 'Blockage' reduces the exposure of 'screened' leaves to ultrasound, and results in significantly lower microbial count reduction. Compared to treatment with chlorine alone, combined treatment with chlorine and ultrasound in the continuous-flow system achieved additional log reductions of 1.0 and 0.5 CFU/g for E. coli cells inoculated on spinach, for washing in single-leaf and batch-leaf modes, respectively.

Results
Continuous-flow ultrasonic washing of fresh produce has the potential to provide the produce industry with a means to significantly enhance microbial safety. However, care must be taken to

minimize the screening/blockage of ultrasound by produce leaves, minimize the variance in the residence-time distribution, and assure a near-uniform acoustic field distribution in the washing facility.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
704	Nutrition and Hunger in the Population
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #9

1. Outcome Measures

Development Of A Non-Field Screening Method For Charcoal Rot Resistance

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Field screening of soybean for charcoal rot resistance has had variable and inconsistent results. Development of a reliable non-field screening method, such as the new cut stem technique, significantly facilitates soybean resistance evaluation due to increased throughput and efficiency and control of factors such as plant maturity and environment that contribute to the inconsistency of field results. It can be used in breeding programs to reliably identify plants or lines in segregating populations with increased partial resistance.

What has been done
The soybean rust QPCR method developed in this project was shown to more accurately distinguish colonization in genotypes with incomplete and partial resistance than visual assessment of signs and symptoms. Soybean breeders seeking to identify and incorporate more durable partial rust resistance will apply the quantitative PCR screening method in their rust

resistance breeding programs, which will lead to the release of soybean cultivars with a broader spectrum of resistance to soybean rust. Identification of the soybean rust resistance gene Rpp1b provides soybean breeders with another resistance gene to combat the disease worldwide. Information that Rpp1 provides resistance to all soybean rust isolates in the U.S. will encourage soybean breeders to prioritize their rust-resistance breeding efforts toward incorporation of this gene into their elite lines. The soybean aphid resistance gene Rag2, identified and mapped in this project, is currently being stacked with Rag1 and other resistance genes through backcrossing and marker-assisted selection techniques.

Results
Soybean cultivars with stacked resistance genes will broaden the spectrum of resistance against aphid biotypes. Identification and characterization of soybean aphid biotypes found in this project indicated that high virulence variability towards soybean resistance genes is already present in soybean aphid populations. This finding will encourage research into improving integrated management of the pest with other control methods such as application of insecticides and biological controls, and to developing methods to monitor soybean aphid virulence to enable intelligent deployment of resistance genes. Currently, management of SDS has primarily been accomplished by breeders culling highly susceptible soybean cultivars from their portfolios. With knowledge of the new QTL for resistance to SDS identified in this project, soybean breeders have an additional gene providing partial resistance to SDS that can be stacked with the other known SDS resistance genes to improve SDS resistance.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
704	Nutrition and Hunger in the Population

Outcome #10

1. Outcome Measures

Increase Knowledge Of Personal Cleanliness Habits That Prevent The Spread Of Disease Through Food

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

Using Appropriate Hygiene Procedures When Handling Food [Fresh Or Processed]

Not Reporting on this Outcome Measure

Outcome #12

1. Outcome Measures

Practices Adopted That Prevent Foodborne Illness Contamination During The Production And Distribution Of Fresh Produce

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	23

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In recent times, the safety of fresh produce has become a growing concern to consumers and the horticulture industry. Contamination of produce by microorganisms that cause foodborne illness outbreaks result in significant associated health costs. In addition, these outbreaks have financial consequences for a given producer as well as other producers in the same industry who incur losses when the public refuses to buy any product associated with a given foodborne illness outbreak. As the Food and Drug Administration introduces new regulations regarding production and handling practices for fresh produce, it is imperative that the stakeholders in the food industry become proactive regarding both Good Agricultural Practices [GAPs] and Good Handling Practices [GHPs].

What has been done
In response, four one-day Extension educational programs were conducted in Northern Illinois in the winter and early spring of 2012 on safe food production and handling in order to ensure that fresh produce is free from contamination by microorganisms that cause foodborne illness. Specific topics addressed in these programs included water usage and water testing, worker health and hygiene, facilities and equipment sanitation, manure handling and field application, and record-keepng. More than fifty individuals participated in the conferences representing specialty crop producers and retailers, including farmers' market managers and vendors, as well as Master Gardeners and local health officials.

Results
An end-of-meeting evaluation form consisting of seven questions was distributed and collected from 47 of the participants. A key question asked respondents to assess the knowledge level gained on specific topics that were covered in the conference using a scale from one to five [1=None/Already knew; 5=Learned a great deal]. The average score for the 47 respondents was above a three rating for all topics. The areas of greatest learning were: [1] preparing for a GAPs

audit [4.66 average group scores; 34 of 47 [72%] checked 'a great deal']; [2] manure handling and application [4.36 average score; 26 of 47 [55%] checked 'a great deal']; [3] keeping records [4.32 average group score; 25 of 47 [53%] checked 'a great deal']; and [4] minimizing risks during food production [4.06 average group score; 24 of 47 [51%] checked 'a great deal']. Forty-four of the participants shared comments on actions they plan to take as a result of the training. Although a few of the indicated actions were quite general in nature, multiple respondents planned to create and implement a GAP plan [16], improve record-keeping [6], or share what they learned with workers, fellow gardeners, and students [4]. A follow-up evaluation was not conducted to identify practice implementation. However, the follow-up conducted on identical programs conducted in 2011 revealed that approximately half of the program attendees implemented at least one of 37 specific practices [most often citing worker health and hygiene practices].

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #13

1. Outcome Measures

Number Of Food Preparers Reporting Using Proper Time And Temperature Controls

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	37

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Periodic outbreaks of foodborne illnesses have generated public concern about the safety of the food they consume and have serious health consequences for those who eat contaminated foods and economic consequences for individuals who serve fresh or prepared food. As of 1999, the Food Service Sanitation Code required Illinois-certified food service sanitation managers to attend food safety training with a minimum of five hours or to complete a recertification exam to be eligible for re-certification to serve food every five years.

What has been done

Workshops on food safety have been conducted statewide by Extension educators with nutrition and wellness assigned responsibility. Adjustments in the content were initiated to incorporate the 2008 updates in the Illinois Food Sanitation Service code. Due to staff vacancies in the nutrition and wellness educator positions, only 8 workshops involving 102 participants were conducted. University of Illinois Extension Educators conducted the 5-Hour Refresher Course for Food Handlers in four locations in the state. Fifty-one [51] individuals involved in serving food to the public participated in the programs as a requirement to maintain their food service certification by the Illinois Department of Public Health. In addition, 51 volunteers from nine counties attended Serve It Safely programs designed for those not requiring certification statuses. A pre- and post-test consisting of eight multiple choice items focused on 2008 changes in the updates in the Illinois Food Sanitation Service code was distributed and collected from those in the certification course to measure knowledge change and a three month follow-up evaluation was distributed and completed by 30 of the 51 Serve it Safely volunteer participants to identify practice changes.

Results

Impact on knowledge of food safety measured by pre- and post-test scores from participants in the 5-Hour Refresher course revealed increases in one of more of the eight food safety practices by 49 of the 51 participants [96%]. Specific to maintaining proper temperatures of food, 31 [61%] learned the temperature range [danger zone] when food is most susceptible to the growth of bacteria that can cause foodborne illnesses, and 41 [80%] indicated learning that ready-to-eat potentially hazardous foods can be stored in the refrigerator for no more than seven days. A follow-up evaluation to determine practice changes collected from seven attendees at one certification training indicated that five [71%] changed at least one practice as a result of participating in the training. Based on results from a random follow-up study conducted in 2011, an additional twenty are likely to have changed food temperature monitoring practices [study results revealed that one-half of the respondents changed practices related to food temperature monitoring].

Of the 51 participants in Serve It Safety, 30 completed and returned the follow-up evaluation. Nearly one-half of the respondents [13] indicated changing at least one food handling practice. Six now use a thermometer to check temperatures of foods and two now use slow cookers only to hold hot foods hot and not to reheat foods. Additional information is provided in the final [evaluation] section of this planned program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
704	Nutrition and Hunger in the Population
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #14

1. Outcome Measures

Increased Knowledge Of Fresh Fruit And Vegetable Production Practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	102

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fruit and vegetable producers are seeking ways to improve their efficiency of production leading to enhanced profitability of their enterprise. Ultimately, consumers benefit in accessing quality produce that enhances their health and is safe for consumption.

What has been done
A number of annual one-day Extension schools for commercial fruit and vegetable producers are held during the winter months throughout the state, as well as in conjunction with neighboring states. These include vegetable, fruit, strawberry, and small fruit schools. Extension educators and specialists assist in organizing, promoting and teaching the latest research findings related to production, pest management, marketing, and safe food handling. Attendees are also able to visit with vendors and exhibitors. This past year a formal evaluation was designed, distributed and collected from participants at the end of the Southern Illinois Vegetable School and the two Southern Illinois Tree Fruit Schools.

Results
The 159 attendees at the tree fruit schools and 135 attendees at the vegetable school were offered an option to rate the knowledge they gained for each of the individual topic sessions using a 1-5 scale [1=None/Already knew and 5= Learned a great deal]. All but one of the 26 vegetable producers [19% of the attendees] who responded checked at least one topic as a 4 or 5, while 16 checked a 5 rating for at least one session topic. All but four of the 57 fruit producers [36% of the attendees] who responded checked at least one topic as a 4 or 5, while 38 checked a 5 rating for at least one session topic. Topics rated highest by vegetable school respondents were Basics of High Tunnel Production [rated 4 or 5 by 91%] and Scouting/Insect Management [rated 4 or 5 by 89%]. Topics rated highest by fruit school respondents were New Cultivars and Rootstocks [rated 4 or 5 by 84%] and Insect Management [rated 4 or 5 by 79%]. When asked to share comments about their plans for using the information they gained, 47 fruit growers and 14 vegetable growers

listed planned actions. These actions will be used in an evaluation distributed in 2013 to identify actual practices implemented by those who attended the previous year. Additional findings are located in the evaluation section of this planned program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
603	Market Economics
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Government Regulations
- Competing Public priorities

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Food Service Safety Education

University of Illinois Extension Nutrition and Wellness Educators conducted four **Food Service Sanitation Management Certification courses** in 2011-2012. Fifty-one individuals involved in serving food to the public participated in the programs as a requirement to maintain their food service certification by the Illinois Department of Public Health. In order to identify changes in their knowledge of food safety, a revised evaluation was developed that asked participants to answer eight multiple-choice questions at the beginning and at the end of the five-hour course. The questions were designed to address critical practices and recent regulation updates to reduce the risk of bacterial contamination that can cause foodborne illnesses.

All but two of the participants demonstrated an increase in knowledge to prevent food contamination by answering at least one question correctly at the end of the course that they had incorrectly answered before the course began. Forty-one [80%] were able to correctly answer 3-7 additional questions correctly at the end of the training. In addition, more than half of the participants who had answered each question incorrectly before the program answered it correctly at the end for the following items: 41 [80%] learned that ready-to-eat potentially hazardous foods can be stored in the refrigerator for no more than

seven days; 35 [68%] gained knowledge about how to correctly label prepared foods that are stored in the refrigerator or coolers; 31 [61%] learned the temperature range [danger zone] when food is most susceptible to the growth of bacteria that cause foodborne illnesses [however, over one-fourth of the participants were still unable to answer the question correctly at the end of the program]; and 30 [59%] learned to only drink from covered containers when they were involved in serving food. All 51 participants were able to correctly answer this question at the end of the program.

With respect to four additional food handling requirements, participants were already knowledgeable as evidenced by their ability to answer the questions correctly at the beginning of the course. More than half of the participants correctly answered the following questions at the beginning of the course: 38 [74%] could distinguish between potentially hazardous and non-hazardous food [however, five of these individuals incorrectly answered this question at the end of the program]; 34 [67%] already knew the temperature and time needed to reheat potentially hazardous foods; 32 [63%] already recognized the relationship of refrigerator shelf location with respect to variability of foodborne illness risk for various foods; and 27 [53%] already knew what jewelry is acceptable to wear when serving food to the public [an additional 22 were able to correctly answer the question after the program].

Fruit And Vegetable Production

The 159 attendees at the two Southern Illinois Commercial Tree Fruit schools and 135 attendees at the Southern Illinois Commercial Vegetable school were offered an option to rate the knowledge they gained for each of the individual topic sessions using a 1-5 scale [1=None/Already knew and 5= Learned a great deal]. Results are discussed below:

Tree Fruit School Knowledge Gained

All but four of the commercial tree fruits growers who responded [57 of 159] checked at least one topic as a 4 or 5, while 38 checked a 5 rating for at least one session topic. All topics were rated 4 or 5 by over 70% of those fruit growers who responded. The list of topics that follows is arranged from highest to lowest percentage of those responding: [1] New Cultivars & Rootstocks -- rated 4 or 5 by 47 of 56 individuals who responded [84%]; [2] Insect Management -- rated 4 or 5 by 45 of 57 individuals who responded [79%]; [3] Micronutrient Impact on Fruit Quality - rated 4 or 5 by 41 of 55 individuals who responded [75%]; [4] Grafting Fruit Trees -- rated 4 or 5 by 33 of 44 individuals who responded [75%]; and [5] Diseases Updates -- rated 4 or 5 by 40 of 56 individuals who responded [71%].

Twenty individuals provided comments related to knowledge they gained regarding Good Agricultural Practices [GAP]. The following were mentioned by several individuals: [1] status of legislation/policy development and exemptions; [2] importance of safe food production; [3] required recordkeeping; [4] details regarding Listeria contamination of cantaloupe; and [5] need for a GAP plan.

Plan For Using Tree Fruit School Information

Forty-seven responded to a request to share what they plan to do with the information gained. Twelve referenced insect and disease management practices [use the correct herbicide and fungicides for a problem, try and do better organizing my spray

schedule, better control of brown rot, organize orchard records so I can identify problem areas from the previous year, improve disease control, incorporate recommendations in insect and disease control management, do a better job on Wooly Aphid control, use information to help in adjustment of insurance claims, re-evaluate spray schedule, register as having a sensitive crop for spray drift]. Six referenced GAP actions. Five mentioned planting new peach and apple varieties. Four mentioned applying rootstock information [investigate new rootstocks, cultivars and pruning, plant new cultivars and rootstock, find a substitute for cultivars]. Four referenced micro-nutrient actions [use foliage analysis to check micro-nutrient levels on my orchard, take a serious look at my micro-nutrient levels, evaluate my soil micro-nutrients].

Vegetable School Knowledge Gained

All but one of the 26 commercial vegetable growers who completed the evaluation checked at least one topic as a 4 or 5, while 16 checked a 5 rating for at least one session topic. All topics were rated 4 or 5 by more than half of those who responded. The list of topics that follows is arranged from highest to lowest percentage: [1] Basics of High Tunnel Production -- rated 4 or 5 by 10 of 11 individuals who responded [91%]; [2] Scouting/Insect Management -- rated 4 or 5 by 20 of 25 individuals who responded [80%]; [3] Understanding the Tomato and Pumpkin Ripening Process - rated 4 or 5 by 18 of 26 individuals who responded [69%]; [4] Disease Management Updates -- rated 4 or 5 by 16 of 24 individuals who responded [66%]; [5] Sweet Potato Cultivar Trials -- rated 4 or 5 by 17 of 26 individuals who responded [65%]; [6] Adding Herbs to Your Product Line -- rated 4 or 5 by 12 of 23 individuals who responded [52%]; and [7] Foliar Nutrient Applications in Pumpkins -- rated 4 or 5 by 13 of 25 individuals who responded [52%].

Six individuals provided comments regarding knowledge they gained related to Good Agricultural Practices [GAP]. The following were mentioned: 'vocabulary that is used', 'very important to learn and follow', 'better to have slick floors and walls', 'best to harvest when dry', 'wash and dry equipment', and 'to watch out for future regulations'.

Plan For Using Vegetable School Information

Fourteen individuals shared comments about their plans for using the information they gained. Six related to pest and disease management [better field monitoring, more proactive with my insect scouting, better pest and mildew practices on pumpkins, spray a lot more, change spray schedules for tomatoes]. Four comments related to planting something new [try sweet potato cultivars, start sweet potato vines to sell/plant some sweet potatoes, try some new varieties, try pumpkins]. Two related to GAP [consider the cost of GAP, use Entrust/bleach spray on wires/cages/posts]. One planned to look at tunnel systems.

Nitrogen Calculator

Crop decision support applications for smartphones and tablets were developed in 2011-12 and included Nitrogen Rate Calculator and Crop Nutrient Removal Calculator [P and K] applications. An option to the Nitrogen app was then added to help facilitate farmers' decisions to reduce fall-applied nitrogen and split their nitrogen into multiple applications. This app was updated to Android, and an Apple version was also created.

As of January 2013 the Android version has been downloaded 405 times and the

Apple version has surpassed 1,000 downloads. Access to the list of Android users provided an opportunity to conduct a short survey. Thirty-five users responded: 79% rated the app as somewhat to very useful, 17% will switch all acres to split application, 21% will switch some acres to split application, 8% will eliminate fall nitrogen application, and 10% will reduce total nitrogen application amounts.

Key Items of Evaluation

Food Service Safety Education

The responses to questions before and after the food safety programs for individuals involved in retaining certification to serve food to the public indicated that 96% of the 51 participants gained knowledge in handling food safely. Most notably, 41 [80%] of the participants learned that ready-to-eat potentially hazardous foods can be stored in the refrigerator for no more than seven days. In addition, more than half of them [31] learned the temperature range [danger zone] during which food is most susceptible to the growth of bacteria that cause foodborne illnesses.

Using the information collected in 2011 through a University of Illinois Extension random survey that indicated that the conservative number of meals participants reported serving daily was 100 and the annual number of food handlers trained this year, an estimated 10,000 additional meals per day are free of contaminants that can cause foodborne illnesses. Based on the March, 2010 study funded by the Pew Charitable Trust indicating that the average cost of each foodborne illness is $1,850, this could represent a very significant contribution toward reducing healthcare costs.

Fruit And Vegetable Production

Responses collected through the evaluation forms evidenced a high level of knowledge gained regarding all the topics for the 2012 Southern Illinois Commercial Tree Fruit School and Southern Illinois Commercial Vegetable School. Nearly one-fourth of the commercial tree fruit producers who responded mentioned planning to implement suggested practices related to insect and disease management and several mentioned plans to implement GAP practices, plant new varieties, evaluate soil micro-nutrient levels, and apply rootstock recommendations. For commercial vegetable producers, the highest knowledge gains were for insect and disease management and high tunnel production. In addition, several respondents mentioned planning to implement suggested practices related to insect and disease management as well as planting new vegetables. Those planned actions will be included on the 2013 evaluation to determine actual practice changes by returning participants.

AgMasters Conference

An evaluation was distributed at the end of the **AgMasters Conference,** a two-day event that began with a single general session followed by 1½ days of advanced classes designed to educate participants using the latest information on specialized and relevant topics. Participants included producers and crop advisers who were asked to answer questions related to the impact of the conference. Fifty participants completed the

evaluation; 21 indicated the profit per acre that they believed will result from a practice they will put in place in 2013 that they learned by attending the 2012 conference. Specifically, one indicated projecting more than a $50 per acre profit; three projected a profit of between $31 and $50; two projected a profit of between $16 and $30; six projected a profit of between $10 and $15 per acre, and nine projected a profit of less than $10 per acre. Based on responses asking participants to indicate the number of acres farmed or advised, the average for those who did so was slightly less than 70,000 acres and suggests that the projected profit could be substantial. In response to the question asking if the conference worth the time and expense [$275 registration fee] required to attend, 49 of 50 indicated that it was.

Nitrogen Calculator

Research indicates that fall-applied nitrogen is a major contributor to nitrate impairments in water quality. If farmers and the agricultural industry do not voluntarily reduce nitrates in surface water, future restrictive regulations are likely. An evaluation survey of users of the new Nitrogen Calculator Android app indicated that more than half [56%] of the respondents plan to switch some or all of their acres to split application, reduce total nitrogen amounts, or eliminate fall nitrogen.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Human Health And Human Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	20%		15%	
704	Nutrition and Hunger in the Population	5%		15%	
724	Healthy Lifestyle	10%		10%	
802	Human Development and Family Well-Being	25%		40%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	10%		10%	
805	Community Institutions, Health, and Social Services	25%		0%	
806	Youth Development	5%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	17.0	0.0	7.0	0.0
Actual Paid Professional	0.2	0.0	5.5	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
982008	0	1170396	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
982008	0	1170396	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
9215800	0	4269829	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities include the ongoing implementation of the **Child Development Laboratory [CDL] Research Database Project**, research to better understand the protective factors that maintain relationship quality during the transitions to marriage and parenthood, the development of findings focusing on marital and co-parenting relationships and their associations with well-functioning parent-child relationships, the development of briefing sheets developed for major projects developed at the **Family Resiliency Center** [importance of shared mealtimes, childhood hunger, delivery of weekend feeding programs, healthy eating in early childhood, and healthy eating and physical activity programming for Spanish Speaking families], a project designed to examine how young preschool children develop cognitive belief structures and expectations about different relationships through their daily interactions with caregivers and peers, a study that adds to our knowledge regarding the role of different types of violence in different post-divorce co-parenting experiences, and research results illustrating that children whose mothers work nonstandard hours are more at risk of developing behavioral problems and have lower math ability and fewer early literacy skills compared to similar children whose mothers work standard hours [these findings highlight the potential source of conflict and stress working nonstandard jobs may cause, particularly for single mothers with young children, and demonstrate the importance of examining how nonstandard work may negatively affect mothers ability to care for their children].

Additional activities include the continuation of the **Even More Fun With Sisters and Brothers** program [offering children a carefully designed set of learning experiences aimed at increasing the frequency of positive sibling interaction], an analysis of caregiver strategies to promote child physical activities, the development of findings that schoolyard vegetation is not merely an aesthetic amenity but rather a functional component of the school environment that contributes materially to the academic mission, a project that is enhancing our understanding of the mechanisms of healthy foods in chronic disease prevention and providing new knowledge for understanding how nutrition early in life shapes physiology and susceptibility to childhood obesity, development of an afterschool physical activity curriculum and template to effectively support healthy weight among Latino school children, efforts to improve our understanding of how individual genetic material interacts with the environment to promote or delay metabolic effects that result in excessive weight gain or related diseases, research into the role of polyunsaturated fatty acids in nutritional programming that may provide additional insight into hepatic inflammation and obesity, and the development of computer software that can calculate and display results based on a newly-developed nutrient profiling system and development of a nutrition education curriculum that employs the nutrient profiling system as the central delivery tool of nutrition knowledge.

Conference presentations included the International Conference on Infant Studies, Congressional

Briefing on Raising Healthy Children, American Sociological Association, International Food Conference, Indiana Association of Environmental Educators, National Head Start Research Conference, National Council on Family Relations, National Agri-Marketing Association, Experimental Biology 2012, International Society of Functional Foods, and the International Society for the Study of Fatty Acids and Lipids.

A number of programs related to brain fitness [including **Wits Fitness** and **Headstrong**] were developed and delivered by Extension educators with family life expertise to make participants aware of what good cognitive health encompasses and steps to take in 'exercising' their brains to improve memory, critical thinking skills, and spatial reasoning. **Headstrong** workshops were developed and delivered to 640 Illinois Municipal Retirement Fund retirees. Resources related to aging and retirement were also made available through **Long-Term Care: Talking, Deciding, Taking Action** [an educational series and website that includes both family life and financial management topics for helping individuals and families plan effectively for their needs as aging adults] and through **Plan Well, Retire Well** [consisting of a comprehensive website, blog, e-news, and monthly news articles]. **Share Your Life Story,** a multi-week life series, provided a therapeutic approach to life renewal. The **Intentional Harmony: Managing Work and Life** curriculum and web-based self-study focusing on nurturing adult relationships continued to be offered.

Parenting 24/7 is a one-stop source for research-based information on the web that includes articles, breaking news and commentary, links to other resources and video clips of real parents of children from birth through the teen years and focuses on challenges and solutions. **Just in Time Parenting** is an age-paced electronic newsletter that is the product of the national **eXtension** network of parenting and child development experts who provide online support to parents and professionals and is distributed every month from birth to 12 months, and then every two months until the child is five years old. Access was also provided to **Your Young Child** [a research-based curriculum with customized brochures that help parents of infants and toddlers to manage seven difficult stages and behaviors that are linked to child abuse and neglect] and to **Parenting Again** topic-based discussion guides for grandparents raising grandchildren.

Most Extension activities that address healthy food choices to prevent childhood obesity were delivered by **Expanded Food and Nutrition Education Program [EFNEP]** staff and **Supplemental Nutrition Assistance Program Education [SNAP-Ed**] staff who conducted hands-on activities with children and their parents from limited income families. Nearly 346,000 youth were taught healthy eating choices by **SNAP-Ed** Extension staff members and more than 7,500 youth were reached through **EFNEP**. The **SNAP-Ed** and **EFNEP** staff used the **CATCH** and **SPARK** curricula to educate elementary and preschool students in after-school and summer programs about healthy snacks, good nutrition, and the importance of physical activity. **OrganWise Guys** materials were used by **SNAP-Ed** staff with youth in K-2nd grade classrooms and by **EFNEP** staff in 3rd through 5th grade classrooms. Under the leadership of 4-H Youth Development staff members, the **Health Jam** program was conducted for 5th grade students and offers support related to exercise, wellness, nutrition, and health careers using an experiential learning approach. Additional information about the programs and their impact is included in the outcome section of this planned program.

Healthy Hopping, a website with more than 53,000 page views, focused on increasing the physical activity of youth as well as providing recipes for healthy snacks to increase the consumption of fruits and vegetables. Lesson plans for teachers and jump rope stunts and rhymes and games for youth are also available on this website

Extension programs also focused on chronic diseases including heart disease and diabetes. **I on Diabetes** was taught as a four-part [2 ½ to 3 hours per part] Extension program that combined lectures, food demonstrations, activities, and samples of healthy foods. **Diabetes Lifelines,** a bi-monthly web-

accessible newsletter providing information in both English and Spanish to clientele on a variety of diabetes-related topics, can be found at **http://www.urbanext.uiuc.edu/diabetes** [more than 64,000 English page views and nearly 87,000 Spanish page views were recorded for this past year]. Two additional websites, **Your Guide to Diet and Diabetes** and **Diabetes Recipes**, logged more than 298,000 English page views and more than 306,000 Spanish page views. **Meals for a Healthy Heart** is a two-part series focused on increasing participant awareness of the risk factors of coronary heart disease, hypertension, high blood cholesterol, and other warning signs. Activity levels and weight management information as well as food demonstrations, taste testing, and recipes were provided at each session. **Live Well, Be Well**, a chronic disease self-management six-week series, was conducted in several locations throughout the state [particpants were encouraged to develop action plans as part of the program].

Additionally, all Extension educators [nutrition and wellness, family life, and consumer economics] reached out to all counties statewide by offering similar older adult-focused 'healthy living' programs. An interdisciplinary series of 52 programs titled **Learning is Timeless** was delivered at the Urban Leadership Center in Chicago to help participants develop skills in health, family life, consumer and money management, and horticulture skills to reduce stress and promote better mental and physical health.

2. Brief description of the target audience

Members of the target audience include low-income families with young children, child care providers, Spanish speaking families, university educators working across disciplines, federal funding agencies, policy makers, faculty from multiple disciplines including human nutrition, kinesiology, human development, economics, community health, public health, communication, advertising, and computer engineering, faculty graduate students, postdoctoral fellows, undergraduates interested in transdisciplinary approaches to obesity prevention and food insecurity in children, mothers who coparent after separation [including those who do and do not experience intimate partner violence], professionals working with mothers in the process of divorce, parent educators, health care providers, policy makers and service providers concerned with building strong communities and families, early care providers, food bank supervisors and agencies serving low income families, nutritionists, food scientists, companion animal feed specialists, segments of the U.S. population that would be at risk for mild-to-moderate deficiencies of specific micronutrients [in this case choline], and gestating women and those breastfeeding newborns. In addition, Extension targeted youth, teachers, parents, grandparents, caregivers of adults, retirees, and working couples.

3. How was eXtension used?

More than 30 University of Illinois faculty members and Extension staff are members of eXtension Communities of Practice that include Alliance for Better Child Care, Families, Food, and Fitness, Family Caregiving, Just in Time Parenting, and Military Families.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	179004	26970	373380	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	1

Patents listed
TF11051-PRO - System And Methods For Nutrient Profiling

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	1	38	39

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Projects

Year	Actual
2012	13

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number Of Research Projects Utilizing The Child Development Laboratory Research Database
2	Increased Knowledge Of Children's Behavior At A Given Stage Of Development And Parenting Practices To Foster That Behavior
3	Increased Parenting Practices That Promote Nurturing Relationships
4	Promoting Social And Emotional Health And Development Among Young Children
5	An Examination Of How Young Preschool Children Develop Cognitive Belief Structures
6	Addressing Gaps In Student Achievement
7	Identifying Chronic Stressors In The Lives Of Low-Income African American Families
8	Knowledge Of Food That Is Low In Fat And High In Fiber And/Or The Importance Of Increasing Physical Activity Levels
9	Increased Consumption Of Foods Low In Fat And High In Fiber And/Or Increased Physical Activity Levels
10	Utilizing A Family Resiliency Framework To Address Childhood Obesity
11	Increased Practices Related To Diabetes Management
12	Implementation Of Practices That Build Brain Fitness And Memory
13	Number Of Youth Planning To Adopt An Option For Responding To Bullying

Outcome #1

1. Outcome Measures

Number Of Research Projects Utilizing The Child Development Laboratory Research Database

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	19

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The purpose of this project is for the ongoing implementation of the Child Development Laboratory [CDL] Research Database Project. This project is designed to facilitate an interdisciplinary, longitudinal, and programmatic research agenda at the CDL.

What has been done
During the current reporting period the procedures developed during the previous year for conducting baseline assessments of children enrolled in the CDL program were continued. These procedures included using the BINS and DENVER II developmental screening tools for baseline data collection in combination with standardized data collection protocols, training procedures for classroom teachers and research teams gathering data at the CDL, mechanisms for the reciprocal exchange of data across projects being implemented at the CDL, and standardized data compilation procedures. Information from the research database was then made available to researchers collecting data with CDL children and staff for research projects.

Results
There are three beneficiaries of this project. First, the systematic procedures used to create this unique database of information on children's behavior across multiple developmental domains allows researchers to use this data for both historical and projective analyses that focus on child development and outcomes resulting from interactions in high-quality early childhood environments. Second, the continuation of the CDL Research Database Project facilitates long-term, interdepartmental and cross-departmental faculty and student collaborations that provide opportunities for creative investigations of children's development. Finally, children and families throughout Illinois and the U.S. have benefited from the knowledge being generated through research projects being conducted as part of this project. A total of 19 research projects were conducted at the CDL during the current reporting period. Fourteen of the 19 studies accessed information from the CDL Research Database project as part of their data collection. These 19

projects represent a diverse array of disciplines and all focused on various aspects of children's growth and development.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #2

1. Outcome Measures

Increased Knowledge Of Children's Behavior At A Given Stage Of Development And Parenting Practices To Foster That Behavior

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Increased Parenting Practices That Promote Nurturing Relationships

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Promoting Social And Emotional Health And Development Among Young Children

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A notable transformation takes place in children's understanding of people during the preschool period. That is, children come to understand that individuals have minds and that behavior is a predictable function of mental states, such as intentions, beliefs, desires, and emotions. Having a 'theory of mind' is central to the successful navigation of social interactions and relationships. Notably, previous research has highlighted the familial antecedents or peer outcomes associated with individual differences in children's theory-of-mind understanding, yet few studies have brought together these two lines of research. This research is unique in several respects and makes the following contributions to the literature: [1] a longitudinal examination of theory-of-mind understanding across the critical preschool years; [2] a more diverse measurement of theory-of-mind understanding, beyond typically examined false-belief understanding; and [3] an emphasis on the mechanisms through which early mother-child relationships are associated with theory-of-mind understanding, and in turn, the extent to which such understanding fosters children's ability to initiate and maintain positive interactions with peers.

What has been done
This Hatch project involves data analyses from three separate projects: the Toddler Transitions Project [TTP], the Children's Social Development Project, Phase I [CSDP-I], and the Children's Social Development Project, Phase II [CSDP-II]. Activities for the TTP include: [1] coding of maternal and child interview data; [2] conducting multivariate analyses to test associations between mother-child observational data, maternal physiological reactivity to infant vocalizations, and mother-reported empathy; and [3] submission of a poster presentation to the Society for Research in Child Development in which TTP findings will be presented. Activities for the CSDP-I include preparation and submission of two manuscripts that examine from a dyadic perspective child attachment security and temperament as predictors of children's interaction with an unfamiliar same-sex peer over the course of three separate play sessions. Activities for CSDP-II include conducting analyses to test hypothesized associations among mother-child attachment security, theory of mind understanding, and child-friend relationship quality.

Results
Key findings include several findings that are relevant to promoting social and emotional health and development among young children. Two sets of findings focus on the marital and coparenting relationships and their association with well-functioning parent-child relationships. Research indicates that marital intimacy may act as a protective factor for fathers who are depressed, but may be problematic for depressed mothers [because perhaps intimacy fosters ruminative tendencies that are more common among depressed women versus men]. It has been shown that the quality of the marital relationship is related to mother-child and father-child relationship quality via parental feelings of trust in and support by the co-parent. Child gender also moderated associations, such that mother-son but not mother-daughter relationship quality showed a link with coparenting support and trust. For both studies, the findings have clear implications for clinicians working with parents who suffer from depression or are in distressed marital relationships. A set of findings from the TTP provide basic insights into sensitive parenting. Mothers' dispositional empathy predicted more sensitive behavior with toddler-aged children, but only for mothers who were less reactive to infant emotional cues as assessed via electrodermal response during an experimental cry-laugh paradigm. This finding underscores the importance of both mothers' general tendencies to empathize with others and mothers' tendencies to be unperturbed by child emotional signals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #5

1. Outcome Measures

An Examination Of How Young Preschool Children Develop Cognitive Belief Structures

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This project was designed to examine how young preschool children develop cognitive belief structures and expectations about different relationships through their daily interactions with caregivers and peers. In order to examine these relationships, we have used different methodological approaches to obtain the data. For example, we conducted classroom observations of children interacting with their peers, we interviewed parents and children, and we collected self-report data from parents and teachers. Additionally, we conducted laboratory observations of parent-child interactions during structured tasks and home observations to assess parent-child interaction quality. Data to date have been collected on 110 families and 500 preschool-age children.

What has been done
The participants in this research included three to four year old children who attend the University-affiliated Child Development Laboratory [CDL] and their primary caregivers. The children participated in a laboratory procedure in which they were interviewed regarding their attachment representations [using a standard doll-play procedure] as well as their understanding of different emotions. During this time, the children were also asked to complete a measure that assesses perceptual asymmetries in the processing of emotion which has been shown to be important in the development of emotional dispositions and emotional responding in stressful situations. Naturalistic observational data were also obtained in the preschool setting. These data

included how often children expressed positive and negative affect as well as the positive and negative initiations of social interactions among peers and documented the frequency of positive and negative emotions experienced by children while interacting with peers as well as the nature of those interactions. Teachers and parents provided information on the children's social behavior, cognitive abilities, and on children's temperament.

Results

Our data analysis has revealed important relationships between hemispheric processing of emotion and observations of children's affect in the classroom setting. In particular, we have shown that children who have a right posterior bias in perceptually processing emotions are significantly more likely to express negative affect while interacting with peers than children who don't have this processing bias. These specific findings have been used to leverage additional funds to examine neurobiological correlates of attachment relationships. They have also been used to leverage funds for an interdisciplinary research program that examines children's emotion regulation and food consumption. With respect to parent-child relationships, results from this project revealed that a secure parent-child attachment relationship predicted how elaborative mothers were in discussing past events with their children, a narrative style typically associated with higher event memory and autobiographical memory development. Analyses also indicated that there are considerable differences in the relations between parent involvement and parent-child interaction for mothers and fathers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #6

1. Outcome Measures

Addressing Gaps In Student Achievement

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Despite decades of policies and programs aimed at reducing educational inequality, gaps in student achievement, school-related behaviors and attainment persist between students from different racial/ethnic and socioeconomic backgrounds. Research suggests that these gaps are present before kindergarten begins and endure throughout the elementary and secondary school years. The goal of this study is to analyze the complex relationships between family factors, early daycare and school settings and the cognitive and socioemotional development among children and adolescents.

What has been done
The study utilizes survey data from a national longitudinal sample of children collected by the U.S. Department of Education. During the past year, two studies were conducted for this project. The first study examined how maternal work schedules, and specifically nonstandard work hours, affected preschool children's socioemotional development and early literacy and math skills among a national sample of single mothers. The second study examined how the quality of the neighborhood environment coupled with family socioeconomic conditions impacted adolescent success in the transition to early adulthood among a national sample of second generation immigrant youth and their families.

Results
The results from the first study showed that children whose mothers work nonstandard hours are more at risk of developing behavioral problems and have lower math ability and lower early literacy skills compared to similar children whose mothers work standard hours. These effects persist even after controlling for a host of maternal characteristics, prior behavior and family and work conditions. These findings highlight the potential source of conflict and stress working nonstandard jobs may cause, particularly for single mothers with young children, and demonstrate the importance of examining how nonstandard work may negatively affect mothers ability to care for their children. The results from the second study show that the home environment experienced during early adolescence as well as the quality and safeness of the neighborhood impact the ability of second-generation immigrant youth to make a successful transition to adulthood defined by educational attainment and earnings as well as general health and life satisfaction. This study adds to the growing body of literature on immigrant youth by examining how multiple contextual factors including neighborhood poverty and family environments have persistent effects on adolescents as they move into early adulthood.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #7

1. Outcome Measures

Identifying Chronic Stressors In The Lives Of Low-Income African American Families

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The goal of the research was to identify chronic stressors in the lives of low-income, African American families living in inner-city neighborhoods and the coping strategies used to address these stressors. This research was a response to theoretical discussions that argued that organizational characteristics of impoverished inner-city communities undermine family functioning. According to theorists, families are unable to develop stable domestic routines or properly socialize their children in environments with large numbers of disadvantaged neighbors, few social or institutional supports, and unconventional value systems. In contrast, our research examined how families overcame the adversity of living in low-resource, high-risk neighborhoods. The research was informed by a family resilience framework. This approach focuses on family strengths and assets.

What has been done
Methodologically, an interpretive framework characterized the qualitative data collection: We sought to describe the daily lived experiences of participants and to understand the meanings that they gave to those experiences. Multiple data collection strategies were used: These included neighborhood observations, participant observation, open-ended, in-depth interviews, and photo elicitation interviews. The interview and observational data examined topics that illuminated coping strategies, such as family routines, social networks and social support, use of neighborhood resources, nutrition, health, and well-being, and parenting and childrearing. Additional insights on the larger neighborhood context focused on local organizations, including community gardening groups. To analyze the data we used an inductive approach that facilitated the discovery of meanings and social processes as they emerged from the data in addition to sensitizing concepts from extant literatures. We transcribed and coded the interview and observational data to identify key themes. To further facilitate the conceptualization processes and identify patterns among the families, we used data displays and analytic memos.

Results

Key insights emerged from our analysis of caregiver strategies to promote child physical activities. Low-income, African-American caregivers of preschool age children believed that it was important to promote child physical activity through their own efforts. Caregivers identified protective parenting strategies such as monitoring, boundary enforcement, chaperonage, and support from trusted family and non-family adults. We were also interested in generating insights from caregivers themselves to inform local policies and programs. In this regard, we used a collaborative framework with a key goal of empowerment. That is, we highlighted the importance of local residents providing first-hand insights based on their daily lived experience. Further, we sought to validate the importance of caregivers being key stakeholders in change processes. Caregivers had clear recommendations for policy makers to enhance physical activity options in the local neighborhood. They identified the need for safe spaces free from physical and moral dangers, including better formal and informal social control efforts. Caregivers also identified quality parks and programs that already existed in the neighborhood that could be used as the infrastructure for additional programming and activities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #8

1. Outcome Measures

Knowledge Of Food That Is Low In Fat And High In Fiber And/Or The Importance Of Increasing Physical Activity Levels

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	415

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Obesity among children in the United States has become a national public health concern. According to the 2003-2004 Healthy Smiles, Healthy Growth data from the Illinois Department of Public Health 39% of Illinois' third grade students are at risk of being overweight [18%] or are already overweight or obese [21%]. Lack of proper nutrition and inadequate physical exercise are two of many interacting factors that lead to childhood obesity.

What has been done
University of Illinois Extension 4-H conducted the Health Jam program with more than 400 youth from five counties participating in two-day camps and an eight-week Walk Across Illinois experience that followed the camps. During the camps, the youth learned how to keep their bodies healthy and fit and explored health professions. Educational activities focused on healthy eating behaviors, physical activity, disease prevention, dealing with health emergencies, and body functions and their measures. ZUMBA was a popular part of the activities this past year. The Walk Across Illinois follow-up used a team format to collect steps tracked by each student.

Results
A pre- and post-test evaluation format consisting of 21-25 questions tailored to the health activity topics taught at each delivery site was used to identify knowledge increases. All but three of the 415 youth participants who completed the pre- and post-tests were able to correctly answer at least one question on the post-test that was incorrectly answered on the pre-test. For example, more than half of the youth [137 of 241] at two Health Jam sites recognized that one must walk half a mile to burn off the calories contained in one small coated chocolate candy piece. At another site 37 of 71 youth [52%] correctly identified that obesity was the factor that causes type 2 diabetes after participating in Health Jam. A paired-sample t-test analysis indicated a statistically significant increase in the correct answers to questions on the post-test as compared to the pre-test for the above examples. For the walk, youth supported each other to complete 30 minutes of daily physical activity and to track the number of miles they walked. By working together, 100 percent of the youth achieved their goal and walked the equivalent of the length of Illinois.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #9

1. Outcome Measures

Increased Consumption Of Foods Low In Fat And High In Fiber And/Or Increased Physical Activity Levels

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

Utilizing A Family Resiliency Framework To Address Childhood Obesity

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One of the grand challenges of today's society is to raise healthy children. Childhood obesity affects over 20 million American children between the ages of 2 and 19, with a disproportionate number residing in persistently poor rural counties. Further, children who have existing chronic health conditions such as asthma are at increased risk for becoming obese. Although the simple explanation for rising rates of childhood obesity is more calories taken in than expended, the root causes are more complex. The overall aim of this Hatch project is to create a multidisciplinary research team and infrastructure that will support efforts to address complex family health issues that result in real solutions. The framework that guides this work is that of family resiliency.

What has been done
We completed an observational study of 60 families during mealtimes and collected biobehavioral data on all members of each family, conducted in-depth interviews with 76 parents who experienced food insecurity sometime within the past year, conducted a longitudinal survey study of 200 families experiencing food insecurity over a period of one year, and completed mealtime home observations of ethnically-diverse families who participate in WIC [women, infants and children assistance]. For the weekend feeding program, food banks partner with local schools who help identify children at-risk for hunger who are provided with child-friendly, easy-to-prepare foods which are discreetly distributed to children on Friday afternoons.

Results
Evaluation of the weekend feeding program indicates: [1] school personnel adequately select children most likely to go hungry over the weekend; [2] weekend feeding programs may have a small but significant effect on school attendance on Fridays [day of food distribution]; [3] weekend feeding programs may have a small but significant food security impact at program initiation but most families remain food insecure throughout the year; [4] most families who participate in

weekend feeding programs also experience problems with transportation which would make a school-based pantry program inaccessible for many families; and [5] many families who are food insecure experience poor health and poor quality of life. Family mealtime social interactions did not vary significantly by ethnicity for communcation patterns. However, African-American families tended to spend more time in 'activities' that took them away from the table such as talking on a cell phone and watching television.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
802	Human Development and Family Well-Being
806	Youth Development

Outcome #11

1. Outcome Measures

Increased Practices Related To Diabetes Management

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	107

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Diabetes ranks as the seventh leading cause of death in Illinois according the Illinois Department of Public Health. In fact, more than 800,000 adults [8.4%] in the state have been diagnosed with diabetes according to the National Center for Disease Control.

What has been done
University of Illinois Extension's 'I on Diabetes' is a series of 2½-3 hour face-to face sessions designed for anyone interested in preventing or managing diabetes. During the series held in Illinois this year, 124 participants received information on diabetes treatment goals and self-monitoring, managing carbohydrates, sodium, cholesterol and fat portions, planning meals, and reading food labels. Food demonstrations, taste testing, and recipes assisted participants in using

artificial sweeteners, low-fat products, and herbs and spices. Participants also completed a program evaluation to determine the impact of the program. Participants were asked to provide answers to four series of questions prior to and at the end of the I on Diabetes sessions.

Results
All but seven of the participants who completed all or sections of the pre- and post-evaluations indicated increasing their confidence, skills, or practices in managing their diabetes. Specifically: [1] using a four-part scale ranging from 'strongly disagree' to 'strongly agree', 92 of 124 participants [74%] who completed the series of questions indicated that they improved their ability to manage diabetes in one or more areas; [2] using another four-part scale ranging from 'not confident' to 'very confident', 105 of 124 participants [84%] indicated that they improved their confidence in managing their diabetes in one or more areas; and [3] using a four-part scale ranging from 'never' to 'almost always', 107 of 124 participants [86%] reported increasing their frequency in taking at least one recommended action to manage their diabetes. Additional information regarding specific areas of changes in skills, confidence, and practices related to participants' management of diabetes are included in the evaluation section of this planned program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #12

1. Outcome Measures

Implementation Of Practices That Build Brain Fitness And Memory

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	43

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According the Illinois Department of Public Health, more than 222,300 people 65 and older in Illinois have Alzheimer's disease. Memory loss and the fear of developing dementia is a concern for all, especially as people age.

What has been done

The Extension family life educator team agreed that an educational program that focused on identifying normal memory changes and strategies for improving memory might help many older adults who experience normal forgetfulness like forgetting where they've parked the car or fretting over not remembering someone's name. Over the years, thousands of older adults have participated in Building a Better Memory and FIT WITS workshops, the latter incorporating aerobic exercise and improving cognitive function. In response to a request from many of these participants who indicated that ongoing memory classes would be beneficial, Wits Fitness [an ongoing bi-weekly series] was developed to allow participants to get together to work on intellectually-stimulating and challenging activities. Each session offered the 78 participants hands-on, intellectually-challenging activities that focused on memory enhancement strategies related to association, visualization, attention, recall, and critical thinking. Headstrong workshops were also developed this year and delivered to Illinois Municipal Retirement Fund retirees.

Results

A mid-year evaluation for the Wits Fitness series was conducted after the first twelve sessions were completed. An evaluation tool was distributed to 38 participants at the 12th session. Each participant was asked 'As a result of attending Wits Fitness sessions, have you transferred any learned skills into everyday life?' Thirty [30] participants returned evaluations and 96.6% indicated that they did transfer learned skills. Sixty-three percent [63%] of the participants had self-identified as attending at least 10 of the 12 sessions offered. Through an additional evaluation mailed to participants at one location, 50 responded. When asked if they changed anything they did because of attending brain fitness related programs, 23 indicated specific practices focused on: [1] remembering names using various strategies [referenced by 14 of the 23 respondents]; [2] engaging in games, including those on the internet, to keep their brain active [3 respondents]; and [3] remembering item locations [3 respondents]. With respect to changes in knowledge, attitudes, and skills, respondents mentioned having a better understanding of long- and short-term memory, recognizing that it is normal not to remember names, realizing the importance of keeping your mind active, and that working to improve memory is continuous. All of these findings support the program goals to encourage participants to remain socially active, challenge themselves intellectually, and focus on healthy habits for mind and body.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
802	Human Development and Family Well-Being

Outcome #13

1. Outcome Measures

Number Of Youth Planning To Adopt An Option For Responding To Bullying

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	174

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Violence and bullying in schools is increasing among teens in the U.S. There is a scarcity of materials focused on bystanders and targeted for junior high and high school students.

What has been done
A team of current and now-retired educators developed a research-based prevention simulation and guided discussions for junior high and high school youth, supported by statistical research on bullying among teens in the U.S. The Breaking the Code [BTC] program focuses on helping youth to: [1] see the effects of bullying and understand the power of their decisions as bystanders in a bullying situation; [2] identify options for responding to bullying; and [3] be motivated to take a stand against bullying. BTC is a simulation that tells the story of youth observing everyday situations where bullying occurs. Eight 30-minute scenarios are played out in either narrator or skit form. Bystanders begin to realize that the choices they make have a big impact on the victim, the normalcy and acceptance of bullying, and the social climate of their school. Guided discussion assists students in processing the experience. At the end of 2012, Extension educators had completed presentations in seven counties and collected evaluations from 755 junior high youth.

Results
Data from 629 students who completed both pre- and post-program evaluations in 2012 have continued to show increases in the number of students who definitely would: [1] ask an adult for help -- 174 [28%] additional students checked this on the post-test [162 pre-test versus 336 post-test]; [2] understand that their decisions can strengthen or weaken the bully and/or the victim -- 159 [25%] additional students checked this on the post-test [339 pre-test vs. 498 on the post-test]; [3] help a victim -- 164 [26%] additional students checked this on the post-test [278 pre-test vs. 442 post-test]; and [4] confront a bully -- 140 [22%] additional students check this on the post-test [253 pre-test vs. 393 post-test]. Sample responses when asked how they will modify their behavior included 'include people', 'work on how I say things to certain people', 'treat others better', 'think before I speak', 'not tease people or treat them badly' and 'help people when they need it'.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

806 Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A total of 37 subjects [19 boys and 18 girls] participated in an evaluation of the **Healthy Outcomes for Teens [HOT]** project website. All subjects liked to use the website to learn about healthy eating and physical activity. The main reasons for liking the website were that it was better than learning in a classroom, more fun because of interactive features, the voiceover feature, and the ability to learn at their own pace. The preference of the interactive features for being helpful was in the following order: videos [68%], games [62%], pictures [41%] and voiceovers [20%]. The majority [70%] of the subjects thought nothing was distracting, but 16% found seeing ratings of friends as distracting and 22% found Google maps as distracting. Some subjects thought that seeing the ratings of friends [19%], Google maps [35%], and crosswords and review games [19%] added least to the overall objective of learning about healthy eating and physical activity. About 60% of the subjects said they would not spend more time reading the material if there were fewer interactive features. On the other hand, 68% of subjects would log in at home if given access to the intervention website. To design an ultimate website for learning, the participants suggested adding games [43%], videos [32%], pictures [19%], being the same as the HOT project [14%], not having too many difficult words [14%], and providing for social interaction like Facebook [11%].

Evaluation of a project focused on strengthening low-income rural Latino families to prevent childhood obesity determined that the intervention was effective in increasing healthy food consumption, decreasing sugar-sweetened beverage consumption, improving shared family meal quality, and increasing physical activity. Although not targeted, 65% of the Latino children and 82% of the parents were overweight or obese [illustrating a crucial need for intervention]. The support is allowing us to adapt and make the curriculum available broadly with an eventual goal of decreasing obesity among Latino families, especially in rural areas. The focus groups are helping shed more light on effective intervention strategies that will be rolled into the on-going adaptations of the materials.

In 2012, pre- and post-evaluations consisting of four sections of questions were collected from 124 participants at the beginning and again at the end of **I on Diabetes** programs conducted in seven counties in Illinois. **I on Diabetes** is a series of 2 ½-3 hour face-to face sessions designed for anyone interested in preventing or managing diabetes. Content of the program series addresses diabetes treatment goals and self-monitoring, managing carbohydrates, sodium, cholesterol and fat portions, planning meals, and reading food labels. Food demonstrations, taste testing, and recipes assisted participants in using artificial sweeteners, low-fat products, and herbs and spices. All but seven of the 124 participants who completed all or some of the sections of the evaluation indicated increasing their confidence, skills, or practices in managing their diabetes.

Improved Ability To Manage Diabetes

Ninety-two [92] of 124 participants [74%] who completed the series of questions indicated that they improved their ability to manage diabetes in one or more areas. Using a four-part scale ranging from 'strongly agree' to 'strongly disagree' we found that 54 of 124 participants [44%] who completed the evaluations indicated they improved their ability to select healthier choices when dining out; 52 [42%] indicated they could easily select foods that fit their meal plan; 52 [42%] reported they could now more easily prepare healthy foods; and 40 of 124 [32%] increased agreement that healthy foods taste good. Only 24 of 124 [19%] of the participants indicated feeling they had improved their ability to easily talk to the doctor about their diabetes.

Improved Confidence In Diabetes Self-Management

A second series of questions on the evaluation was designed to identify increases in the confidence of the participants to manage their diabetes using another four-part scale ranging from 'not confident' to 'very confident'. One hundred and five [105] of 124 participants [84%] indicated that they improved their confidence in managing their diabetes. More than half of the 124 who answered these questions indicated an increased confidence in: following a healthy diabetes meal plan [84 or 68%]; knowing which foods have carbohydrates [71 or 57%]; estimating the amount of food you should eat [70 or 56%]; preparing foods that fit into their meal plan [64 or 52%]; and selecting foods that will reduce the risk for heart disease [64 or 52%]. Only 36 [29%] felt they had increased confidence in talking with their doctor about their health.

Increased Frequency Of Recommended Actions To Manage Diabetes

A final series of questions explored increased frequency in using recommended practices by the participants. Using a four-part scale ranging from 'never' to 'almost always', 107 of 124 participants [86%] reported increasing their frequency in taking at least one recommended action. More than half of the participants revealed increasing the following practices: following a meal plan to help manage diabetes [71 or 57%]; setting goals to help manage their diabetes [69 or 56%]; and using food labels to plan their meals [64 or 52%]. From one-third to one-half indicated increasing their frequency in taking the following actions: keeping track of the amount of foods with carbohydrates they eat each day [59 or 48%]; trying to limit fat intake [45 or 36%]; reading food labels [44 or 35%]; and trying to be physically active [42 or 34%]. Thirty-two [26%] indicated trying to limit salt intake and 28 [23%] increased eating at least three regularly-spaced meals a day.

A pre- and post-test evaluation format consisting of 25 questions tailored to the health activity topics taught at each of six **Health Jam** delivery sites was used to identify knowledge increases. All but three of the 415 youth participants who completed the pre- and post-tests were able to correctly answer at least one question on the post-test that was incorrectly answered on the pre-test. For example, more than half of the youth [137 of 241] at two **Health Jam** sites recognized that one must walk half a mile to burn off the calories contained in one small coated chocolate candy piece. At another site 37 of 71 youth [52%] correctly identified that obesity was the factor that causes type 2 diabetes after participating in **Health Jam**. A paired-samples t-test analysis indicated a statistically significant increase in the correct answers to questions on the post-test as compared to the pre-test for the above examples, as well many of the other questions for each of the delivery sites.

For the walk, youth supported each other to complete 30 minutes of daily physical activity and to track the number of miles they walked. By working together, 100 percent of the youth achieved their goal and walked the equivalent of the length of Illinois.

Key Items of Evaluation

All but seven [94%] of the 124 **I on Diabetes** participants who completed all or some of the sections of the evaluation indicated increasing their confidence, skills, or practices in managing their diabetes [especially with respect to selecting healthy food choices and following a healthier meal plan to manage their diabetes]. Using a four-part scale ranging from 'strongly disagree' to 'strongly agree' 92 of 124 participants [74%] who completed the series of questions indicated that they improved their ability to manage diabetes in one or more areas. Using another four-part scale ranging from 'not confident' to 'very confident' 105 of 124 participants [84%] indicated that they improved their confidence in managing their diabetes in one or more areas. Using a four-part scale ranging from 'never' to 'almost always' 107 of 124 participants [86%] reported increasing their frequency in taking at least one recommended action to manage their diabetes.

The results of evaluations comparing responses to the same questions at the beginning and at the end of participation in **I on Diabetes** strongly suggest that the program was impacting participants' management of diabetes.

Health Jam is a mature program that through paired t-test significance tests continually evidences knowledge gained regarding healthy eating and exercise.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Natural Resources And The Environment

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	25%		10%	
112	Watershed Protection and Management	15%		15%	
123	Management and Sustainability of Forest Resources	10%		15%	
132	Weather and Climate	15%		10%	
133	Pollution Prevention and Mitigation	10%		15%	
134	Outdoor Recreation	0%		10%	
135	Aquatic and Terrestrial Wildlife	5%		15%	
405	Drainage and Irrigation Systems and Facilities	0%		5%	
605	Natural Resource and Environmental Economics	5%		5%	
806	Youth Development	15%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	9.0	0.0	10.0	0.0
Actual Paid Professional	0.0	0.0	3.7	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
259057	0	806759	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
259057	0	806759	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2431162	0	2360536	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities included research showing what best explained nitrate yields in watersheds across the Mississippi River basin [this work has been critical in showing that to reduce nitrate losses in the MRB, the tile-drained corn belt is where conservation activities must be focused], results to assess long-term changes in forest soils [by reporting on this project to other scientists these results can be combined with other studies to show the importance of reducing air pollutants such as sulfur], tile drainage modifications designed to reduce nitrate losses and accompanying outreach activities used to show farmers in the Salt Fork Watershed the response of the tile line to our nitrate reduction method, ongoing development of the **Illinois Soil Nitrogen Test** [ISNT was designed to quantify soil nitrogen supplying power as a means of improving the accuracy of nitrogen fertilizer recommendations and implementing site-specific nitrogen management], a study that will provide new knowledge on the effects of novel water treatment processes which are expected to have certain advantages [in particular, we are focused on treatment systems using activated carbon adsorption, ion exchange, membrane bioreactors, algal treatment systems, hydrothermal liquefaction, and various hybrids of these components], and the analysis of behavior for previously unstudied types of forest landowners [the most important of these unstudied types include landowners who neglect their forest holdings much of the time and those who consider the decisions of owners of adjacent forest properties].

Additional research activities included results that will help land managers identify priority areas for mitigation efforts, anticipate challenges to restoring ecosystem function across the region, and help to educate the public about changes ensuing from the loss of foundation species, an investigation into the mortality, predation risk, and movements of woodchucks across an urban-rural gradient within an agricultural landscape, and work that will generate land management strategies growers can implement on their property to enhance pollination, infiltration, and other ecosystem services.

Research activities focusing on climate change included a comparison of the ecology of ratsnakes across the complete range of this species to assess how the snakes' ecology is likely to be affected by climate change, ongoing monitoring work under the **National Atmospheric Deposition Program** with the goal of developing a better understanding of the chemical inputs resulting from atmospheric deposition and of nutrient cycling in both crop and forest systems, a project that will provide statisticians, modelers, managers and policy makers with the knowledge, methods, and guidelines to reduce uncertainties and improve decision-making with regard to forest carbon [the developed methods can be applied to other regional and global programs of carbon modeling and management and the results will serve as general suggestions applicable to the programs], development of an improved method that will provide environmental chemists with a stable, alternative method for analyzing methylmercury in environmental samples, development of a more thorough inventory and a better appreciation of forested algific talus

slopes [which will lead to better protection of the unique flora, fauna, and soils of fragile ecosystems], improved insights into how habitat structure might interact with climate change to influence the spatial distribution and dynamics of disease potential for amphibians, and a project that will provide us with a physiological, mechanistic understanding of how fish populations respond to stressors associated with land use changes and climate change scenarios.

Conference presentations included the Illinois Mosquito and Vector Control Association, American Society of Agronomy, Illinois Association of Wastewater Agencies, Soil Science Society of America, Rural Sociological Society, Land Grant and Sea Grant National Water Conference, Central States Water Environment Association, Prairie Rivers Network, National Water Quality Conference, American Society of Agricultural and Biological Engineers, Water Environment Federation Technical Exhibition and Concert, Algae Biomass Summit, Pathways to Success Conference: Integrating Human Dimensions Into Fish and Wildlife Management, International Symposium for Society and Resource Management, Ecological Society of America, New Phytologist Symposium, International Society of Chemical Ecologists, Entomological Society of America, Asia-Pacific Association of Chemical Ecologists, Latin American Association of Chemical Ecologists, International Congress of Entomology, Research Institute of Forest Ecology, Chinese Academy of Forestry, Symposium on Nitrogen Fixation with Non-Legumes, New Phytologist Symposium :Functions and Ecology of the Plant Microbiome, Annual Argonne Soil Metagenomics Meeting, and the American Geophysical Union.

Extension activities encompassed a variety of delivery methods to provide education regarding soil and water management, forestry, and environmental stewardship. A description of some of these major areas of focus follows. Activities related to natural resources can also be found in the Sustainable Energy planned program.

Drought conditions and how to deal with them was a topic included in many crop production, livestock, and home and commercial horticulture programs and the subject of many media releases. A drought resources website was created and promoted through Extension as was participation in a statewide webinar focused on drought. Extension educators made presentations on climate change considerations for seed companies, research field day participants, and area livestock producers. Information about crops and climate change was a topic for the four regional **Crop Management Conferences** and continued to be taught in **Master Naturalist** volunteer training as one of the twenty curriculum chapters. Integrated research and Extension supported activities included the campus-based **Third Annual Environmental Change Institute Symposium** which included a presentation on the publication **Change and the Heartland** that addresses climate change challenges in a understandable and meaningful manner and a seminar series that included a presentation on climate change as a health crisis.

This past year's **Soil and Water Management** webinar was hosted at 15 local Extension offices across the state in February of 2012. Topics covered included atmospheric deposition and its effect on soils, water, and crops, biofilters effects on field tile runoff, corn residue management with respect to foliar diseases, and irrigation scheduling. We are in the process of developing two online modules addressing bioreactors and drainage water management.

The statewide **Illinois Tillage Conferences** held in three locations addressed soil drainage, cover crops and no-till, water quality, nutrient placement in strip-till, and nutrient placement on Karst and Sodic soils. Sections of the statewide pesticide safety education program also covered practices related to preventing chemical contamination of our natural resources. **Regional Crop Management Conferences** also included a segment on the impacts of conservation tillage, erosion, and slope on soil organic carbon.

Extension campus and field staff continued to conduct emerald ash borer pest control activities to prevent the loss of shade trees that remove and sequester carbon from the atmosphere. Most of the

forestry-related education focused on forest landowner education and outreach that extends beyond management to include urban forestry, forest product marketing and utilization, and carbon sequestration through presentations, seminars, workshops and field days. **Ask A Forester** is a key feature of the Extension forestry website. We continue to partner with Iowa State University Extension forestry to offer the **Tri-State Extension Forest Stewardship Conference.**

The **Illinois Master Naturalist [ILMN]** program completed a fifth year of statewide implementation. Participation this year expanded to two new locations. A total of 15 Extension multi-county units have provided training for individuals who want to experience nature and to develop knowledge of and respect for the environment. In addition, 463 individuals are actively engaged in a wide variety of projects as environmental stewards. An internal website served as a forum to allow volunteers and Extension staff to communicate and exchange news. A web-based reporting site has been completed and is being used to collect information on all **Master Naturalist** and **Master Gardeners'** training, volunteer hours, and projects.

Youth conservation days with hands-on activities were held in many locations throughout the state and the **I Think Green** curriculum was developed to engage youth in investigating how living things interact with each other and with their environment [the curriculum reached 254 third through fifth graders].

2. Brief description of the target audience

Members of the target audience included other scientists, as well as those involved in the agricultural industry in Illinois [including the fertilizer industry, NRCS, soil and water conservation district personnel, and technical service providers], environmental groups, farmers and landowners in the upper Salt Fork watershed, professional insect taxonomists, Extension specialists, professional insect diagnosticians, students, amateur naturalists, insect ecologists, public officials, commercial interests, citizens interested in remediation and restoration of old industrial sites, hydrological scientists, low income minority and urban residents, livestock producers and municipal water and wastewater utilities, agency representatives from multiple land management agencies, private forest landowners, soil scientists, forest scientists, geologists, forest managers, private sector enterprises engaged in carbon credits, state and federal agencies formulating policies on carbon sequestration, USDA Forest Service personnel, aquatic ecologists, conservation biologists, state natural heritage programs, federal government agencies charged with protecting biotic integrity in the nation's waterways and parks, recreation managers, dredge sediment contractors, wildlife biologists and managers, and nuisance wildlife operators. Extension also targeted pesticide applicators and youth.

3. How was eXtension used?

Six Extension faculty, staff, and volunteers are members of the Natural Resources eXtenison Community of Practice

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	12995	56203	58320	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	1

Patents listed
TF09095-US - Hydrothermal Processing [HTP] Of Algae Grown In HTP Waste Systems

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	40	40

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Projects

Year	Actual
2012	8

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased Knowledge Of Human Actions That Negatively Affect The Environment
2	Nontarget Effects Of Pesticides And Fertilizers On Aquatic Communities
3	Evaluating The Impacts Of Nitrate And Phosphorus On Water Quality
4	Improvement Of Fertilizer Usage Recommendations To Increase Profitability And Reduce Environmental Impacts
5	Evaluating Watershed Scale Models For TMDL Planning
6	Evaluating Habitat Quality Of Translocated Species
7	Dissemination Of Air Quality And Atmospheric Data Through Web Hits On The National Atmospheric Deposition Program Website
8	Assessment Of The Impact Of Climate Change On Ratsnake Ecology
9	Reducing Uncertainties On Estimates And Spatial Distribution Of Forest Carbon
10	Toward Improving Our Understanding Of How Fish Populations Respond To Stressors Associated With Land Use Changes And Climate Change Scenarios
11	Development Or Revision Of Climate-Relevant Databases
12	Number Of Pesticide Applicators Making Decisions To Avoid Harming The Environment

Outcome #1

1. Outcome Measures

Increased Knowledge Of Human Actions That Negatively Affect The Environment

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	195

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increasing concern over degradation of the environment addresses a critical issue related to sustaining life for future generations.

What has been done
The new I Think Green curriculum was developed by 4-H and horticulture Extension specialists to engage third through fifth grade youth in investigating how living things interact with each other and with their environment. This program includes three tracks: [1] worms; [2] butterflies; and [3] insects. All three tracks are aligned with Illinois State Educational Goals and follow a sequence of four 40-60 minute investigations in which youth practice observation skills, conduct hands-on investigations with living things, explore different life cycles, identify how living things function/adapt/change, and compare how living things interact with each other and with their environment. The objectives of the program include: [1] to develop youth skills in scientific observation; [2] to increase youth knowledge of concepts that explain how living things function, adapt, change and interact within the environment; and [3] to increase youth knowledge of things they can personally do to help protect the environment. The program was delivered by 4-H and Master Gardener trained volunteers to 13 groups and involved 254 youth this past year.

Results
In responding to a ten-question evaluation given to the youth participants at the end of each of the three tracks, 77% [195] reported that the activities helped them learn how butterflies, worms, or insects contributed to the environment; 60% [154] reported having more ideas about ways they could help care for the environment; 68% [172] reported being more excited about helping to care for the environment; and 66% [167] reported that they would like to get involved in food composting, recycling, or other activities to help take care of the environment in their community after participating in I Think Green.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
135	Aquatic and Terrestrial Wildlife
806	Youth Development

Outcome #2

1. Outcome Measures

Nontarget Effects Of Pesticides And Fertilizers On Aquatic Communities

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the United States and throughout the world fertilizers and pesticides are used to improve crop production through nutrient enhancement and control of pest organisms. In general, fertilizers and pesticides are applied in terrestrial environments but they also reach water sources, including ditches, livestock watering ponds, and troughs used in agricultural practices. Some of these water sources are potential breeding sites for the immature stages [larvae] of mosquitoes. Little is known about how these nontarget effects of pesticides and fertilizers affect aquatic communities. Therefore, there is a need to study these aquatic systems, especially when considering mosquitoes are transmitters of human diseases.

What has been done
We have generated new knowledge on the non-target effects of a commonly used insecticide, malathion, on mosquito life history traits relevant to pathogen transmission. We have shown that larval rearing temperature can modify the impact of environmentally-realistic concentrations of insecticide malathion on adult mosquito fitness [body size, fecundity and immunity].

Results
Pesticides are widely used around the world to control undesired plants and animals including mosquitoes. The United States accounts for one-third of the total amount of pesticides used to control agricultural and public health pests around the world. This research has generated data

on non-target effects of pesticide use on mosquito life history traits relevant to mosquito-borne pathogen transmission. This data will aid in development of public health policies that mitigate the negative impacts of pesticide use on the risk of mosquito-borne disease.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Evaluating The Impacts Of Nitrate And Phosphorus On Water Quality

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agricultural fields in Illinois contribute nitrate and phosphorus to streams from both surface runoff and tile flow, which has led to degraded water quality. This project will examine how various concentrations and forms of these nutrients affect stream algal production, dissolved oxygen, and in-turn biotic integrity.

What has been done
Our analysis supports a series of conceptual models. The first representing small streams with clear water, dominated by periphyton. These streams have a large diel range in dissolved O2, but often the minimum dissolved O2 is high as well; habitat modification [these are often channelized agricultural streams] has reduced biotic integrity, rather than low dissolved O2. Our second model

represents large rivers that support sestonic algae. This can lead to lower minimum dissolved O2 concentrations together with a large diel range. However, physical processes often impact dissolved O2 concentrations in these larger rivers and habitat is again a major limitation to biotic integrity. Finally, our third model describes a large number of intermediate-sized streams in the state, with limited productivity [no periphyton and small amounts of sestonic algae] and limited diel range in dissolved O2 concentrations. Again, habitat is a major limitation to biotic integrity, and algal production is limited by substrate, light, or water residence time. In each of these models, nutrients are rarely the limiting factor controlling algal biomass because both N and P typically occur at concentrations well above limiting levels.

Results

One of the most significant outputs was a paper that showed what best explained nitrate yields in watersheds across the Mississippi River Basin [MRB]. This work has been critical in showing that to reduce nitrate losses in the MRB, the tile-drained corn belt is where conservation activities must be focused. Results from this work have been used by the state of Iowa in their recent nutrient reduction strategy. The other significant output was the summary of water quality and biotic effects which strongly influenced the state of Illinois in moving forward with development of nutrient criteria.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

Improvement Of Fertilizer Usage Recommendations To Increase Profitability And Reduce Environmental Impacts

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is substantial evidence that corn is largely dependent on soil N uptake, that soils differ considerably in their capacity to supply plant-available N through mineralization, and that these differences directly affect yield response to N fertilization. The overall goal of this project is to evaluate the potential of the Illinois Soil Nitrogen Test [ISNT] as a basis for fertilizer N recommendations.

What has been done
The database for multi-factor calibration of the Illinois Soil Nitrogen Test [ISNT] has been expanded to include soil pH, Bray-1 P, and exchangeable K as well as total nitrogen, organic and mineralizable carbon, and potentially mineralizable nitrogen estimated by the ISNT. In each case, duplicate analyses were performed on plot-specific soil samples collected from two depths [0-12 and 12-24 inches] in conjunction with two nitrogen response studies under a corn-soybean rotation and another under continuous corn that generated plot-specific yield data with plant populations from 20,000 to 40,000 plants/acre. The goal is to develop and evaluate different models that utilize the measured variables to improve the predictive value of the ISNT for optimizing nitrogen fertilizer rates. Modeling efforts to date have identified plant population and organic carbon availability as key factors that increase nitrogen fertilizer requirement at a given ISNT level.

Results
The extensive use of nitrogen fertilizers for corn production has major implications not only for the profitability of producers and agribusinesses, but also for the sustainability of cropping and management practices and their impact on soil, air, and water resources. Since the 1970's, these fertilizers have been used without adequately accounting for soil nitrogen reserves that in fact serve as the main source for crop uptake. The ISNT was designed to quantify soil nitrogen supplying power as a means of improving the accuracy of nitrogen fertilizer recommendations and implementing site-specific nitrogen management. Our previous work has provided ample evidence that numerous soil and plant factors affect the interpretive value of the ISNT for predicting crop nitrogen response. By utilizing the ISNT in conjunction with a multi-factor calibration, a 30 to 40 percent reduction should be readily attainable in nitrogen inputs with no yield penalty. At current fertilizer prices, such a reduction would cut the annual cost of Illinois corn production by more than 300 million dollars.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation

605 Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Evaluating Watershed Scale Models For TMDL Planning

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This study will evaluate watershed-scale water quality models for total maximum daily load [TMDL] planning. Specifically, the components to be examined are tile flow, direct runoff, and base flow. The relative proportions of these components will then be related to environmental variables such as previous rainfall, climate, land-use, tile density, and soil properties. Once algorithms have been examined and incorporated with existing models and evaluated, effort will focus on estimating nitrogen and pesticide loads carried by these flow components.

What has been done
In the past, extensive field work on the effects of subsurface drainage on water quality was conducted in Illinois at the Little Vermilion River [LVR] watershed, Lake Decatur watershed, and Upper Embarras River [UER] watershed. We accomplished significant modeling results on microbial pathogen transport in 2011. In 2012, modeling works have been continued. The significant work accomplished during 2012 was on soil erosion and sediment transport experiments. The site construction for the erosion and sediment transport research and training was completed during 2012. Work is underway on sediment transport modeling.

Results
In 2012, significant efforts have been made on soil and water assessment tool modeling and model results verification with collected data from Illinois watersheds. This work will have significant impacts for subsurface drained watersheds in Illinois and elsewhere. These results have been presented to watershed groups. Microbial pathogen modeling results are being used in development of guidelines for best management practices. Results from the erosion and sediment control research have been presented to Illinois EPA, Illinois Department of Transportation and other agencies related to environmental sustainability.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
605	Natural Resource and Environmental Economics

Outcome #6

1. Outcome Measures

Evaluating Habitat Quality Of Translocated Species

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increased urbanization coupled with increased abundance of urban-adapted wildlife species has escalated the frequency of human-wildlife conflicts in urban environments. Translocation of nuisance individuals is a common approach for dealing with conflicts because the public views translocation as a humane alternative to euthanasia. However, we know little about the fate of most translocated individuals. Our goal is to develop a clearer understanding of behavior and fate of translocated nuisance woodchucks in the Chicago metropolitan area. Our project has three interrelated research objectives: [1] determine post-release movements and home ranges for translocated woodchucks; [2] examine habitat selection by translocated woodchucks; and [3] estimate survival rates for translocated woodchucks.

What has been done
We collaborated with a nuisance wildlife operator who provided us with captured nuisance

woodchucks. Woodchucks were then radiomarked with internal transmitters and released at one of three semi-rural release sites that differed in landscape composition. Each woodchuck was located frequently [daily when possible] for two weeks after release, and then 3-4 times per week during the active season and 3 times per month during hibernation. We have radiomarked and translocated 24 woodchucks and monitored their fates post-release. Results and recommendations from the project were shared with biologists with the Illinois Department of Natural Resources who are responsible for management of woodchucks in Illinois. We communicated our research through presentations and online communications to the public.

Results
We have learned that movement patterns of translocated nuisance woodchucks varied among individuals with maximum distances moved from the release location ranging from <0.3 km to >5 km. In general, however, our initial results suggest that translocated woodchucks are more likely to stay near release sites after translocation compared to other species that often move substantial distances immediately after translocation. The woodchucks that moved considerable distances from release sites could be exposed to heightened mortality risk not only from natural predators, but also from human-related factors. Overall, survival rates of translocated woodchucks in Chicago appear to be lower than resident woodchucks studied in Urbana-Champaign, Illinois. Future efforts will focus on determining how much of the observed mortality of woodchucks in Chicago is due to the translocation process per se versus background predation risk at the semi-rural release sites. The patterns of survival of translocated woodchucks among our three release sites indicate predation risk could vary substantially among release sites. Current management practices for translocated species rarely take into account the habitat quality of release sites. In particular, how landscape structure affects predation risk for translocated individuals at release sites is not normally considered.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife

Outcome #7

1. Outcome Measures

Dissemination Of Air Quality And Atmospheric Data Through Web Hits On The National Atmospheric Deposition Program Website

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1613982

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The National Atmospheric Deposition Program provides fundamental measurements that support informed decisions on environmental and agricultural issues related to precipitation and deposition chemistry, as well as atmospheric mercury and ammonia. NADP data are relevant to a wide audience and provided to all. Data from our monitoring effort is used by a wide range of scientists for a number of research topic areas. Our data is used by policymakers to make informed decisions on agriculturally important topics. Our data is also used in many different education areas including chemical, agricultural, and environment science, and at many different levels. All data are available free of charge via the NADP website located at http://nadp.isws.illinois.edu.

What has been done
The USGS and NADP collaborated on tracking radionuclides wet deposition from the Japanese nuclear incident resulting from the March 2011 earthquake and tsunami. Normal precipitation samples from the National Trends Network, Atmospheric Integrated Research Monitoring Network, and the Mercury Deposition Network were used during the project, and the resulting studies can be found on the NADP website. By using the existing infrastructure of the NADP's networks in a new and important way, measurements were made that greatly added to the information on the impact on U.S. lands and population. The Central Analytical Laboratory has begun to measure bromide ion concentration in all NADP samples as a routine analyte of the NTN and AIRMoN. Regular measurements will soon be released for 2012. Bromide is important to agricultural users, given its fumigant usage. U.S. EPA scientists, with NADP, continued special studies to determine whether organic nitrogen deposition can be measured reliably and accurately. The results indicated that the measurements are reliable, and that organic N can be differentiated from inorganic N in our samples. This will add much needed information to the understanding of N deposition patterns and sources.

Results
NADP's principal outcomes and impacts on the broader scientific and educational communities are reflected in the value and usefulness of our networks and data. This is suggested by the download statistics and by the publications using our network and data [166 journal articles in 2012]. NADP's Ammonia Monitoring Network [AMoN] is now well established and has grown significantly over the past year. AMoN currently operates 58 sites, and has approximately 10,500 observations of atmospheric ammonia. This network has been receiving much interest from the agricultural community [nadpweb.isws.illinois.edu/nh3net/]. Since 2006, the NADP has been converting its precipitation gauges to an all-digital network. In mid FY 2012, 85% of our sites were reporting digital precipitation data.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife

Outcome #8

1. Outcome Measures

Assessment Of The Impact Of Climate Change On Ratsnake Ecology

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The ecology of ratsnakes was compared across the complete range of this species to assess how the snakes' ecology is likely to be affected by climate change. Study sites were in eastern Ontario, southern Illinois, and central Texas.

What has been done
After harmonizing data across the three populations, data analysis was completed and a publication submitted. Additional data collection was undertaken, both to document changes in populations and to focus specifically on the extent of nocturnal activity in each population and the temperature thresholds that trigger the switch between diurnal and nocturnal activity using automated telemetry. Thermal ecology data indicate that the ability of these snakes to switch between diurnal and nocturnal activity is a critical adaptation for dealing with climate variation, and will therefore also be critical in allowing these snakes to respond to climate warming. This research led to a new project in South Carolina investigating how thermally-driven changes in snake behavior affect the nesting bird community on which the snakes prey.

Results
Despite the populations spanning a north-south distance of more than 1,500 km, some aspects of the ratsnake biology are surprisingly similar. Although the duration of annual activity increases from north to south, the profile of the main period of activity is highly conserved across

populations. In addition, snakes in all three populations expend similar effort overall to regulate body temperature through selective use of habitat. The principal mechanism the snakes use for dealing with climate differences across their range is to adjust when they thermoregulate and when they are active. In particular, the ability to shift to nocturnal activity in hot weather appears to be a critical adaptation for dealing with climate variation. Identification of these patterns has substantially altered the direction of this research program. To understand how these snakes will respond to climate warming, and thus to predict the ecological consequences of climate warming on these snakes and their ecological communities, it will be necessary to understand what triggers the snakes to alter when they are active and to determine whether the snakes are able to function equally effectively at night as during the day.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife

Outcome #9

1. Outcome Measures

Reducing Uncertainties On Estimates And Spatial Distribution Of Forest Carbon

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As significant carbon sinks, forests play a critical role in the regional and global carbon cycle dynamics and the mitigation of the greenhouse effect. However, there are considerable uncertainties on estimates and spatial distribution of forest carbon because of landscape complexities, inaccurate data, incorrect models and knowledge gaps. There is thus a strong need to develop a methodology to improve the quality of data and products of forest carbon needed for climate change research at global and regional scales. This project intends to overcome current significant gaps in the generation and assessment of the data and products of forest carbon dynamics. The objectives are to develop a theoretical and methodological framework including a

method to scale up spatial data and their uncertainties across scales, and a method to generate spatial and temporal uncertainty and error budgets. This project will then use the methodology to analyze the potential of integrating a process model and various sensor images and will provide general guidelines to improve the accuracy of the data and products by quantifying contributions of various input uncertainties to the outputs.

What has been done
This year we primarily focused on applying our theoretical and methodological framework for comprehensive uncertainty analyses to various case studies where airborne and spaceborne LIDAR [Light Detection and Ranging] were used to generate forest landscape maps of current above-ground forest carbon estimates and for future landscape maps that were projected forward in time with the Forest Service Forest Vegetation Simulator. The FVS system we used for projecting forward time has been modified to account for potential climate change using IPCC [Intergovernmental Panel on Climate Change] global circulation models and emission scenarios. Uncertainty sources considered in the case study assessments were due to the LIDAR generated maps, FVS model projections of future forests, and IPCC global circulation models and scenarios.

Results
This project will provide statisticians, modelers, managers and policy makers of forest carbon with knowledge, methods, and guidelines to reduce uncertainties and improve decision-making. The developed methods can be applied to other regional and global programs of carbon modeling and management and the results will serve as general suggestions applicable to the programs. The knowledge, methods, results, and guidelines will serve to improve prediction of climate changes through the procedure of carbon budgets at global and regional scales.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation

Outcome #10

1. Outcome Measures

Toward Improving Our Understanding Of How Fish Populations Respond To Stressors Associated With Land Use Changes And Climate Change Scenarios

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
General outcomes and impacts of this work include: [1] improved understanding of the physiological responses of fishes to temperature; [2] improved understanding of how land use and climate stressors can dictate the response of fishes to stressors; [3] training of two graduate students using novel laboratory and field techniques; and [4] improved ability to predict how broad stressors such as climate change and land use alterations can impact fishes.

What has been done
The focus in 2012 was to improve our understanding of how land use [forested land, agricultural land, and restored land] impacts the health, condition and stress of resident fishes. Studies were conducted on fish stress, health and condition for individuals residing in a range of habitat qualities, across a gradient of land uses, and in a number of seasons. Outputs will help identify how the response of fish to stressors can vary based on land use and restoration, which will have implications for how different management techniques are applied across regions, and on best management practices for restoring aquatic ecosystems.

Results
This project will provide us with a physiological, mechanistic understanding of how fish populations respond to stressors associated with land use changes and climate change scenarios. Knowledge of how ecosystems respond to these different stressors will improve our ability to predict how aquatic ecosystems will respond to future conditions resulting from climate change, and will also provide managers and restoration biologists with definitive guidelines for the habitat requirements of fish species. The target audiences for this research include managers [who will be able to integrate this information into conservation activities and land use decisions to improve management of fish populations and improve water quality], restoration ecologists [who can use this information when either designing or assessing a restoration project], land owners [who can use these results to make informed land-use decisions regarding restoration and activities on their land], and biologists [who will gain an improved understanding of the physiological and ecological impacts of land-use stressors on disturbance, fitness and performance in aquatic ecosystems].

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife

Outcome #11

1. Outcome Measures

Development Or Revision Of Climate-Relevant Databases

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The NADP provides fundamental measurements that support informed decisions on environmental and agricultural issues related to precipitation and deposition chemistry, as well as atmospheric mercury and ammonia. NADP data are relevant to a wide audience and provided to all. Data from our monitoring effort is used by a wide range of scientists for a number of research topic areas. Our data is used by policymakers to make informed decisions on agriculturally important topics. Our data is also used in many different education areas including chemical, agricultural, and environment science, and at many different levels. All data are available free of charge via the NADP website located at http://nadp.isws.illinois.edu.

What has been done
Climate-relevent databases developed or updated in 2012 include: [1] sulfate in precipitation database [atmospheric aerosol, important climate forcing, in-cloud aerosol]; [2] nitrate in precipitation database [atmospheric aerosol, in-cloud aerosol]; [3] ammonium in precipitation database [atmospheric aerosol, in-cloud aerosol]; [4] atmospheric ammonia concentrations in the atmosphere [reactive gas, aerosol formation]; [5] pH of rainfall [partially a function of atmospheric carbon dioxide]; [6] other reactive atmospheric gases [nitrogen, sulfur, precipitation removal]; [7] precipitation record [indicator of climate change]; and [8] work to develop a method for measuring elemental carbon in precipitation.

Results
NADP's principal outcomes and impacts on the broader scientific and educational communities are reflected in the value and usefulness of our networks and data. This is suggested by the download statistics and by the number of publications using our networks and data [166 journal articles in 2012].

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife

Outcome #12

1. Outcome Measures

Number Of Pesticide Applicators Making Decisions To Avoid Harming The Environment

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Application of pesticides has the potential to adversely impact the environment, crops grown, and the pesticide applicator.

What has been done
Pesticide training sessions focused on pesticide characteristics, correct application procedures, problems that may occur with the use of pesticides, where information can be obtained, and steps to take if a problem occurs with the use of a pesticide. Private applicator training was delivered by Extension staff in 20 settings across the state to 3,914 individuals in 2011-2012 that included agricultural producers, agriculture and horticulture sales associates, and Extension master volunteers. Following the training, Illinois Department of Agriculture staff administered a certification test. A survey of practice changes was distributed at all the pesticide trainings prior to the beginning of each training session.

Results
A survey of practice changes was conducted for the third consecutive year at the beginning of the private applicator training sessions in 2011-12. The 629 completed surveys represent

approximately 16% of those who completed the training and had participated in previous training sessions. In response to the question "Because of knowledge gained in previous PSEP training session, I have made the following practice changes" respondents could check up to 16 practice changes. Those most frequently checked by the 581 participants who answered this question included: [1] reading and following label directions for proper pesticide application methods and rates [516 participants or 88.8%]; [2] taking precautions to minimize spray drift when applying pesticides [500 participants or 86.1%]; [3] scouting to determine proper identification of pest before determining if control is needed [497 participants or 85.5%]; and [4] understanding how pesticides can cause contamination and taking steps to prevent it [496 participants or 85.4%]. At least 60% of the respondents attributed at least 14 of 16 possible changes to the PSEP training provided by Extension. Only 219 [37.7%] made changes to prominently label and secure their pesticide storage areas. In response to the question "By successfully passing my private applicators exam, I estimate that I save xx dollars annually by being able to protect my production and apply appropriate pesticides when necessary to my farming operation," 207 [32.9%] chose to respond. The total estimate for all 207 who responded was $2,056,755 [an average of $9,936 per operation].

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The new **I Think Green** curriculum was developed by 4-H and horticulture Extension specialists to engage third through fifth grade youth in investigating how living things interact with each other and with their environment. This program includes three tracks: [1] worms; [2] butterflies; and [3] insects. All three tracks are in line with Illinois State Educational Goals and follow a sequence of four 40 to 60 minute investigations in which youth practice observation skills, conduct hands-on investigations with living things, explore different life cycles, identify how living things function/adapt/change, and compare how living things interact with each other and with their environment. The objectives of the

program include: [1] to develop youth skills in scientific observation; [2] increase youth knowledge of concepts that explain how living things function, adapt, change and interact within the environment; and [3] increase youth knowledge of things they can personally do to help protect the environment.

A ten-question evaluation was completed by 254 youth comprised of 88 who participated in the butterfly track, 42 in the worm track, and 124 in the insect track. Response tallies for the six questions that were identical for all three groups follow:

Environment Related Questions [n=254]

60% [154] of youth reported having more ideas about ways they could help care for the environment; 68% [172] reported being more excited about helping to care for the environment; and 66% [167] reported that they would like to get involved in food composting, recycling or other activities to help take care of the environment in their community.

Participation Related Questions [n=254]

48% [122] of youth reported that the **I Think Green** activities were fun to do; 77% [195] reported that they would like to do more activities like the ones in **I Think Green**; and 65% [167] reported that they would like to help with a community garden project.

Butterfly Track Specific Questions [n=88]

80% [70] of youth in this track reported that they were encouraged to ask questions about butterflies and the environment; 77% [68] reported that the activities helped them learn about butterflies and how they grow; 72% [63] reported that the activities help them to learn how butterflies interact with other living things; and 73% [64] reported that the activities help them learn how butterflies contribute to the environment.

Worm Track Specific Questions [n=42]

57% [24] of youth in this track reported that they were encouraged to ask questions about worms and the environment; 90% [38] reported that the activities helped them learn about worms and how they grow; 67% [28] reported that the activities help them to learn how worms interact with other living things; and 71% [30] reported that the activities help them learn how worms contribute to the environment.

Insect Track Specific Questions [n=124]

56% [69] of youth in this track reported that they were encouraged to ask questions about insects and the environment; 84% [104] reported that the activities helped them learn about insects and how they grow; 77% [95] reported that the activities help them to learn how insects interact with other living things; and 79% [98] reported that the activities help them learn how insects contribute to the environment.

A survey of practice changes was distributed for completion for the third consecutive year at the beginning of **private applicator training sessions** in 2011-2012. The 629

completed surveys represent approximately 16% of those who completed the training and had participated in previous training sessions. In response to the question 'Because of knowledge gained in previous PSEP training session, I have made the following practice changes' respondents could check up to 16 practice changes. Results follow and include responses from 581 participants who chose to answer this question: 88.8% [516] read and follow label directions for proper pesticide application methods and rates; 86.1% [500] take precautions to minimize spray drift when making pesticide applications; 85.5% [497] scout to determine proper identification of pests before determining if control is needed; 85.4% [496] understand how pesticides can cause contamination and take steps to prevent it; 80.4% [467] mix and load pesticides in a well-lit open-air area to minimize exposure to pesticides; 79.2% [460] store pesticides in a secure location separate from any feed stuffs; 78.5% [456] know how to respond to pesticide exposures if they should occur; 74.9% [435] use recommended personal protective equipment when working with pesticides; 73.3% [426] refer to treatment thresholds to decide if a pest needs to be controlled; 69.4% [403] calibrate their sprayer regularly to ensure accurate application rates; 68.8% [400] inform family, friends, and employees of the safety precautions to follow around pesticides; 66.4% [386] have adopted IPM practices in managing pests in their farming operation; 65.2% [379] adjust cultural practices whenever practical to control/manage pest populations; 63.2% [367] select the safest pesticides possible to control/manage pest populations; 58.9% [342] thoroughly examine their fields to determine the distribution of a pest population; and 37.7% [219] have their pesticide storage areas prominently labeled and secured.

Two hundred seven [207] of the respondents indicated that they had saved money by successfully passing the private applicators exam and applying appropriate pesticides when necessary to their farming operation. Estimated dollars saved totaled $2,056,755 which averages to slightly over $9,936 per operation. The 446 respondents who provided information on acres treated with pesticides reported application to 443,623 acres. It should be noted that since PSEP testing is required every three years, this is the last of the three annual groups of applicators that will be asked to complete the evaluation.

Key Items of Evaluation

Approximately three-fourths of the youth participants in **I Think Green** learned about how butterflies, worms, and insects grow, interact with other living things, and contribute to the environment. Although fewer youth reported changes in how they felt, ideas gained, and interest in how they could care for the environment, more than 60% of those responding did report changes. The number of participants was limited this past year. Continuation of the evaluation effort will be a priority as will increasing the number of trained volunteers with a resulting growth in youth participants who develop an understanding and commitment to protecting the environment in the coming year.

Although private pesticide applicators would prefer not to take the required Illinois Department of Agriculture certification exam every three years, those who attended recertification training and completed a survey indicated that the information taught during the training had been applied as a part of their farming operation. Although some of the practices applied relate to regulations concerning pesticide use, others clearly reflect actions taken to protect themselves, their friends, family, neighbors, livestock, and the environment. Attention needs to be given to address how to increase the prominent labeling of pesticide storage areas in future trainings.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Plant Health, Systems And Production

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%		10%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%		10%	
205	Plant Management Systems	30%		10%	
206	Basic Plant Biology	30%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	15%		10%	
212	Pathogens and Nematodes Affecting Plants	15%		10%	
213	Weeds Affecting Plants	0%		10%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	0%		10%	
216	Integrated Pest Management Systems	0%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	0.0	19.0	0.0
Actual Paid Professional	0.0	0.0	7.7	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
512090	0	1598387	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
512090	0	1598387	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
4805785	0	11941650	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities include the development of new knowledge about how epigenetic processes influence the expression of genes known to modulate nitrogen utilization in maize, an evaluation of crucifers and buckwheat as short cycle cover crops before pumpkins and cucumbers, the development of **Global Food in 3D** software to help analysts and policy makers think about the dimensions of the soybean yield plateau in the face of rising demand [**www.globalfoodin3d.com**], the development of the first genome sequences of Pseudomonas Savastanoi pv. Glycinea [the sequences have been highlighted at **http://www.pseudomonas-syringae.org**], the development of knowledge of gene expression changes between resistant and susceptible lines [which helps to identify major resistant genes to soybean cyst nematode that could be used to understand the mechanism of resistance and ways to integrate those genes during breeding approaches], a comparison of the agronomic performance of corn, soybean, winter wheat, alfalfa, and forage grass cultivars available to farmers in Illinois [seed companies that sell seed in Illinois enter cultivars into these trials on a voluntary basis], the characterization of the types of herbicide resistance present in numerous waterhemp populations [this information was directly transmitted to weed management clientele who use this knowledge to fine-tune weed management recommendations], and work designed to extend ongoing nematode management research through the development of new tools for technology transfer and decision support for effective management that will appeal to and be useful to farmers [to date, no single coordinated source of parasitic nematode information is currently available].

Additional activities included efforts to improve economic and environmental sustainability in tree-fruit production through changes in rootstock use, research designed to develop a greater fundamental knowledge of the processes controlling soil nitrogen and carbon cycling, growth chamber, greenhouse, and laboratory experiments conducted to determine if target-site or non-target-site mechanisms confer mesotrione resistance in a population of waterhemp designated MCR, efforts to determine the etiology, biology, and epidemiology of bacterial spot which will help to develop effective management strategies for the disease [the pumpkin industry is the most valuable vegetable industry in Illinois], results that contribute to improving our understanding of the control of gene expression in soybean seed and seedling development [a better understanding of pathways involved in seed composition will enhance our understanding of plant disease resistance or the modification of flavonoid, protein, and oil in the seed for improved nutritional and health value], a breeding program focused on the development of high-yield adapted wheat varieties for Illinois and surrounding states, and the evaluation of plant materials that show potential for increasing the genetic diversity, disease and insect resistance, drought and cold tolerance and improving climate adaptability in addition to possessing superior ornamental features.

Activities also included results from foliar fungicide trials that were used to develop fungicide guidelines for growers, crop consultants, Extension personnel, and industry personnel, the development of

knowledge that will be used to develop allele-specific DNA markers located in regulatory regions of the maize genome [together with new insights into the molecular basis of dominance, epistasis, and heterosis, these DNA markers will enable the designing of more efficient and innovative marker-assisted breeding strategies], and a project associated with the continuation and further analysis of materials and information produced from the **Illinois Long Term Selection Experiment** for protein and oil concentration in corn grain [2012 marks the 113th growing season].

Conference presentations included the American Seed Trade Association Seed Expo, American Society of Horticultural Science, National Association of Plant Breeders, National Academy of Sciences, Nara Institute of Science and Technology, American Society of Plant Biologists, Illinois Horticulture Society, Illinois Specialty Growers, Marketing, and Organic Conference, Weed Science Society of America, Ag Masters 2012, Plant and Animal Genome Conference, American Phytopathological Society, Cucurbitaceae 2012, American Society of Agronomy, Entomological Society of America, Latin American Biological Chemists Society, Midwest Cover Crop Council, and the National Fusarium Head Blight Forum.

Extension activities focused on non-food horticulture crops and pests. The **Ask Extension -- Hort Corner** program is comprised of 77 website topics [of which 17 are in Spanish]. The site allows visitors to ask a question of a University of Illinois Extension Educator or review the questions asked and answers received by previous visitors via an online web form. A series of 12 horticulture distance education programs titled **Four Seasons Gardening** were offered at Extension offices throughout the state during the spring and fall and were attended by 522 participants. Topics included invasive weeds, sustainable landscapes, and community gardens.

Extension **Master Gardeners** gave countless hours in providing horticulture information to the public. There are currently over 3,400 active Master Gardeners in Illinois. This past year, 470 new Master Gardeners completed training at various locations throughout the state and through an online course. Master Gardeners are involved in teaching audiences how to grow, preserve, and share or sell excess produce to encourage the consumption of food rich in required nutrients for good health. Responsibilities assumed by the Master Gardeners this past year included growing food for the hungry, answering questions at farmers markets, conducting a low tunnel workshop, serving as citizen scientists to monitor hail, rain, and snowfall, helping a suburban community manage flood areas, and improving the quality of life for residents of a convalescent home who have long-term medical needs or significant disabilities.

The **University of Illinois Plant Clinic** had a total of 4,870 client contacts [submitted samples, telephone inquiries, email requests, and walk-in consultations] in 2012 and diagnosed 4,552 plant samples. Clinic staff members also prepared news releases, articles for newsletters, news columns, and podcasts, initiated the new information bulletin series **Plant Clinic Report** and maintained a website, Facebook page, and blog [all of which recorded increased pageviews]. In addition, the Extension **Digital Diagnostic System** provided extensive outreach to homeowners and commercial producers in diagnosing and providing solutions for 1,082 samples of invasive and exotic species pests. In addition, 21 issues of the Home Yard and Garden newsletter were distributed.

2. Brief description of the target audience

Members of the target audience include plant and animal biologists, soybean biologists, soybean breeders, farmers, Extension educators, scientists, agricultural input companies, legislators, agency regulators, agribusiness leaders, weed management professionals, corn producers, apple growers and apple grower organizations, the chemical and formulations industries, weed scientists, agricultural input suppliers, agronomic crop producers, fruit farmers, pomologists, tree fruit nurseries, wheat producers, processors and consumers, sorghum seed companies and growers, growers and vegetable industry personnel, green industries [including members of the nursery and landscape industries, botanical gardens and arboreta], scientists and agricultural professionals familiar with crop physiology, plant breeding and

fertilizer use, marketing personnel in the soybean industry, molecular biologists, genomicists, population biologists, evolutionary biologists, plant pathologists, bioinformaticists, abiotic stress physiologists, and nutritionists in the feed industry. Extension audiences included homeowners, Master Gardeners, and green industry owners and employees [landscapers, nursery stock growers, lawn and garden business owners and employees, insurance adjustors, and arborists].

3. How was eXtension used?

Ten Extension staff and two volunteers are members of the Consumer Horticulture, Invasive Species, or Plant Breeding and Genomics eXtension Communities of Practice.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	55315	126434	18225	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	4

Patents listed

TF10087-US - Transmission Raman Spectroscopy Analysis Of Seed Composition; TF11129-PRO - Elongation Of Stigma-Style Length Of Flowers To Facilitate Cross Hybridization; TF10105-PRO - RHG1 Mediated Resistance To Soybean Cyst Nematode; TF12121-PRO - Composition And Methods Of Gene Silencing In Soybean

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	60	60

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Research Projects

Year	Actual

2012 17

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Percentage Of Nitrogen Utilization By Wheat

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

More Informed User Of Pesticides

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	158

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A great deal of demand exists for research-based horticultural information for homeowners.

What has been done
Master Gardener multi-county training sessions and online training sessions were completed by 470 new volunteers in 2012. An online survey was completed this past year by 221 new [with 2-4 years of experience] Master Gardeners. The survey was designed by the state coordinator of Master Gardeners to assess 13 gardening practices, 11 personal improvement skills, and Master Gardener experience in teaching horticulture topics.

Results
Pre- and post-tests completed by 221 of the new Master Gardeners evidenced a 23.3% increase in scores from pre-test to post-test. All but 7 of the respondents indicated that they adopted at least one of the 13 gardening practices. Specifically, 158 [71%] of the respondents reported now identifying an insect, disease or weed problem before deciding on a control measure and choosing plant varieties that are known to be resistant to insects and diseases. In addition, more than 60% are now keeping records of pest occurrence and control methods for later reference. More than one third are now using pesticides according to the label. Complete results from the

survey are indicated in the evaluation section of this planned program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Providing Management Information To Farmers With Regard To Managing Soybean Cyst Nematode Heteroda, Glycines

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Choosing Plant Varieties That Are Known To Be Resistant to Insects And Diseases

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	157

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A great deal of demand exists for research-based horticultural information for homeowners.

What has been done

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4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

Number Of Hectacres Impacted By A Long-Term Comparison Of The Agronomic Performance Of Corn, Soybean, Winter Wheat And Alfalfa Cultivars

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	9490000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research continues under this long-term project designed to compare the agronomic performance of corn, soybean, winter wheat, alfalfa, and forage grass cultivars that are available

to farmers in Illinois.

What has been done
The agronomic performance of corn, soybean, winter wheat, alfalfa, and forage grass cultivars available to farmers in Illinois were compared. Seed companies that sell seed in Illinois enter cultivars into these trials on a voluntary basis, by providing seed and paying a fixed fee. Standard crop cultivar testing procedures are used to measure performance of each cultivar. Comparative results are made available for general usage. Commercial corn hybrids and publicly and privately developed forage, soybean, and winter wheat varieties were evaluated for yield and agronomic performance. A number of publicly-developed advanced experimental lines were also included in the soybean and wheat tests. The results were published as an insert in a widely-distributed farm newspaper and were distributed through Extension offices. Results are available at http://vt.cropsci.illinois.edu/.

Results
These trials were conducted in a timely manner, using accepted agronomic practices and statistical design. The results provided unbiased data useful to crop producers choosing cultivars of these crops to be grown in different agronomic zones of Illinois. Companies who enter cultivars also used this information widely. The results of these trials, either through direct use by farmers or through use by seed companies, affect crop production on 9,490,000 hectares of five crops in Illinois. Reports issued by this program are regarded as the premier source of unbiased performance information on current cultivars. These reports guide cultivar selection in Illinois and surrounding states to ensure producers are growing the best cultivar for their farming operation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
206	Basic Plant Biology

Outcome #6

1. Outcome Measures

Testing Of Samples For Characterization Of Herbicide Resistance In Waterhemp Populations For Improved Control

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Waterhemp [Amaranthus tuberculatus] is one of the most problematic weeds for Midwest crop producers. In particular, many waterhemp populations possess resistance to one or more herbicide groups; thus, in any given field, only a subset of available herbicides may be effective.

What has been done
Knowledge of herbicide resistance traits at the molecular level enabled the development of molecular assays to detect specific herbicide resistances. These were utilized to test populations for resistance at a scale that would not have been possible with traditional methods of herbicide resistance testing. Crop producers and other weed management clientele submitted to us for testing waterhemp samples suspected of having herbicide resistance. Over a thousand samples were tested. Results from rapid assays for herbicide resistance in waterhemp were used to inform weed management clientele on how to best manage waterhemp populations present in their fields. Pooling data from multiple submissions enabled us to determine and track where herbicide resistant waterhemp is present in Illinois. A primary impact of this research is that it enables farmers to select the most efficacious herbicides for their fields, which can reduce wasteful applications of less effective herbicides.

Results
A primary output of this project has been a characterization of the types of herbicide resistance present in numerous waterhemp populations. This information was directly transmitted to weed management clientele [crop producers, commercial applicators, and industry representatives] who used this knowledge to fine-tune weed management recommendations. Additionally, the information was collated and disseminated via state, regional, and national venues [scientific publications, newsletter articles, and grower meetings] to increase awareness of herbicide resistance in waterhemp. Other significant outputs include new fundamental knowledge of how different resistance traits may evolve and be disseminated among Amaranthus weed populations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
206	Basic Plant Biology
213	Weeds Affecting Plants

Outcome #7

1. Outcome Measures

Measuring Western Corn Rootworm Movement To Evaluate Refuge Effectiveness

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Measurement of actual Western Corn Rootworm movement and mating in refuges under field conditions is a practical way to understand if refuges perform as expected. Collection of data that resulted in outcomes that corrected erroneous assumptions about pest biology are valuable because they improve insect resistance management models of refuge design.

What has been done
We observed: [1] that refuge male movement into transgenic corn from block refuges is most likely during the vegetative period of corn phenology; [2] that mating activity is concentrated in and around block refuges; and [3] that mating females just outside of refuge corn are older than mating females in refuge corn [this may indicate that while males are abundant in refuge, the proportion of males that are still reproductively competent may be quite low; many refuge females may wander out of refuges while they wait to be discovered by a mate-seeking male]. These observations represent some departures from assumptions that were accepted in current models. Limitations on male reproductive lifespan were not measured as part of this study; however, patterns of mating activity suggest that WCR male mating capabilities are less than what has been assumed in many models.

Results
During presentations in various venues, project findings have consistently been used to promote seed blends as superior refuge designs for assuring well-mixed WCR populations. These data have been embraced by industry; they have been used for or influenced new Insect Resistance Management models. During many presentations to growers, suggesting WCR beetle behavior was out of compliance with our expectations was found to be an effective shift of perspective, and one that is more favorably received than assertions that growers have failed to comply with refuge. These changes in knowledge about WCR movement and mating behavior/patterns were

incorporated into a published model and a Entomologia Experimentalis et Applicata publication about expectations for WCR mating in Bt corn.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #8

1. Outcome Measures

Improved Control Of Waterhemp

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Waterhemp [Amaranthus tuberculatus] is a difficult-to-control weed in Illinois soybean and corn production systems. This is in part due to the evolution of multiple herbicide resistances in waterhemp, which is facilitated by its dioecious nature, outcrossing, prolific seed production, and high degree of genetic diversity. A population of waterhemp [designated MCR] from a seed corn field in McLean County, Illinois displays resistance to mesotrione and other 4-hydroxyphenylpyruvate dioxygenase [HPPD] inhibitors, as well as to atrazine and certain ALS-inhibiting herbicides.

What has been done
Our results indicate this waterhemp biotype is resistant to mesotrione [plus all commercial HPPD-inhibiting herbicides used for weed control in corn] and atrazine, from both preemergence and postemergence applications, mainly due to rapid metabolism of mesotrione and atrazine [albeit by different detoxification mechanisms and enzymes]. The fact that this population is resistant to both HPPD inhibitors and atrazine suggests the ability to achieve herbicide synergism for enhanced weed control may be attenuated under field conditions.

Results
These research findings are particularly significant and relevant to crop production and weed management with postemergence herbicides in Zea mays because several other waterhemp populations have recently been identified in seedcorn fields throughout the Midwest that possess this unique form of multiple herbicide resistance.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
206	Basic Plant Biology
213	Weeds Affecting Plants

Outcome #9

1. Outcome Measures

Studying The Interaction Of Photosynthesis, Genotype, And Environment To Improve Maize Production

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Multiple experiments were conducted to elucidate the interaction of photosynthesis, genotype, and the environment to produce greater yield in maize. Since it is the plant that intercepts light and produces grain, a steady increase in seeding rate over the last 25 years [increase of approximately 700 seeds per ha per year] has played a large role in increasing average U.S. corn yields, and we believe that even greater plant populations will be needed to double yield over the next 25 years. The obvious caveat is that these greater plant populations must be managed to minimize plant competition, and we have examined row configuration, fertility level, fertilizer placement, hybrid selection, and the use of fungicides and/or growth regulators to minimize stress as potential ways to manage higher plant populations.

What has been done
We have also conducted studies with temperate x tropical maize [TTM] hybrids, which typically

produce increased biomass and sugar compared to commercial maize grown for grain. We are investigating the interaction of environment on the production of sugars and biomass in these TTM genotypes. Additionally, we are investigating these TTM maize hybrids for potential use as biofuel, either ethanol- or biomass-based, and as a forage and feed crop for animal feeding. A third area of investigation is the impact of stover carbon residue on subsequent maize production.

Results
Through this project, we have determined the amount and timing of nutrients required for modern maize hybrids, and have presented it at conferences and in a publication. We have also published a better understanding of the photoperiod sensitive tropical x temperate maize hybrids and their potential usefulness for feed and fuel. We have developed an analysis technique to more efficiently determine nitrogen use efficiency. Additionally, the yield penalty from continuous corn was further determined and presented.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
206	Basic Plant Biology
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #10

1. Outcome Measures

Improved Understanding Of The Control Of Gene Expression In Soybean Seed

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Soybean has a wealth of naturally-occurring mutations that affect other pigmentation properties and morphological types. Several are also mutable alleles that may harbor transposable elements. To date, the molecular identification of the genes that encode these traits are largely unknown.

What has been done
Over the course of the project, we reported on the changes in gene expression during immature seed development, the stage when the protein and oils are being synthesized. We also determined the genes expressed in the cotyledon during early seed germination when the seed reserves are utilized to fuel the growth of the young seedling. We employed high throughput sequencing of mRNAs to define genes potentially involved in seed and flower color, flavonoid and protein composition, trichome development, and leaf development. During 2012, we reported on over 135,000 unique small RNAs from 41 million total sequence reads.

Results
These outputs contribute to the project goals of understanding the control of gene expression in soybean seed and seedling development. They will benefit the biotechnology industry and soybean producers and consumers by providing basic information on gene regulation in soybean. A better understanding of the pathways involved in seed composition will enhance our understanding of plant disease resistance and the modification of flavonoid, protein, and oil in the seed for improved nutritional and health value. Soybean products are of immense value to U.S. agriculture, annually contributing nearly $17 billion in unprocessed crop value. Soybean has high protein [40%] and moderate oil [20%] content and is the main source of vegetable protein and oil in world markets.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology

Outcome #11

1. Outcome Measures

Development Of Rust-Resistant Lines For Illinois Soybean Growers

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2012 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The University of Illinois soybean breeding program developed new experimental lines and tested lines for yield, agronomic traits and disease and pest resistance during 2012. The program grew over 3,100 4-row yield test plots, 11,000 2-row yield test plots, and 14,000 plant row plots. The most advanced lines from the program were evaluated in regional tests in locations throughout soybean growing regions in the north central and eastern U.S. Data from these tests have been analyzed and selections are being made to decide what lines to test in experiments planned for 2013.

What has been done
Lines with the greatest yield and resistance over the past few years were selected and three new varieties and ten germplasm lines were released from the program. The released varieties are LD07-3419, LD07-4530, and LD06-7620. The three varieties are conventional [non-GMO] and were released because they combine high yield potential with resistance to soybean cyst nematode [SCN], which is the most important soybean disease in Illinois and across the U.S. LD07-3419 and LD07-4530 are both maturity group [MG] III varieties which are suitable for production in central Illinois and other regions with similar latitude. LD06-7620 is a MG IV variety suitable for production in southern Illinois and other regions with similar latitude. These varieties have been licensed for commercial production. Two germplasm lines were released because of their novel combinations of SCN resistance genes which make them useful as SCN resistance sources in breeding programs. The other eight released germplasm lines carry the soybean rust resistance genes Rpp1, Rpp1-b, Rpp?[Hyuuga], and Rpp5 in both an MG II and an MG IV genetic background.

Results
These rust-resistant lines will be a good resource for the Midwestern U.S. soybean breeding community because these genes all originate from backgrounds that are not adapted to this region. Results from the breeding program were disseminated in a number of ways. The varieties developed from the research program were included in the University of Illinois Variety Tests and results from the tests are made available to the public through the test website and publications.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

Outcome #12

1. Outcome Measures

Identification Of Nematode Pathogens Using DNA Sequencing

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Previous work on identifying nematode pathogens relied on the culture of disease-causing microorganisms. With the rise of new DNA sequencing technologies [next-generation DNA sequencing], the ability to acquire vast amounts of DNA sequence has become cost effective. The exponential increase of DNA sequence data output has made it possible to sequence the DNA of all organisms associated with soil-borne plant parasitic nematodes. Such analysis is referred to as metagenomics since it aims to sequence the DNA of all organisms in a given sample or environment.

What has been done
This type of analysis when applied to sequencing a single soybean cyst nematode strain identified a bacterial pathogen/endosymbiont and at least four viruses. Since metagenomics has the potential to discover organisms in a culture-independent manner, it has the ability to identify multi-trophic interactions that may be lowering nematode reproduction and thus may be useful for nematode control. In this project we proposed to conduct a metagenomic survey of important plant parasitic nematode communities common in Illinois with the intent of identifying microorganisms tightly associated with the nematodes. The use of techniques to identify viruses will at the same time identify bacterial and fungal organisms. These microorganisms may be of use in controlling plant parasitic nematodes.

Results
The initial goal was to develop a rapid approach to discover new viruses in plant parasitic nematodes. A method was developed to physically disrupt nematodes and then recover viral particles on a small scale. The ability to work with small volumes was critical since it is often hard to obtain large numbers of plant parasitic nematodes. We were able to obtain 21 different isolates of root-knot nematode and then applied the viral isolation method to the samples. Using a multiplex strategy, we were able to obtain over 150 million DNA sequences from the pooled

nematode samples. The sequences were analyzed by comparing them to a database containing known viral proteins. The initial results showed very significant matches to seven viruses, indicating the root-knot nematodes may contain similar viruses. While these viruses are not yet proven to infect nematodes, some of them probably cause disease in the root-knot nematodes. This project has been very successful and shows that viruses can be detected in pooled nematode samples using a fairly simple technique. This approach to virus discovery could be applied to any nematode population either in the laboratory or in the field. Nematode viruses have only been recently discovered, thus this approach has the potential to rapidly identify new viral species.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

Outcome #13

1. Outcome Measures

Development Of Improved Soft Red Winter Wheat Varieties

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
An objective of the wheat breeding program is to evaluate experimental genotypes for agronomic performance and disease resistance. The breeding project is focused on the development of high yield adapted wheat varieties for Illinois and surrounding states. High priority breeding objectives also include Fusarium head blight resistance and earliness. Each growing season about 100 to 110 advanced experimental breeding lines were evaluated in replicated tests at four locations.

What has been done

About 300-400 preliminary breeding lines were also evaluated each season. Selections were made based on yield, test weight, milling and baking quality, maturity, height, and resistance to Fusarium head blight [scab] and barley yellow dwarf virus. In addition, about 1,500 - 2,300 breeding lines were evaluated in single plots at two locations each year, and about 300 - 400 of these lines were selected for continued evaluation in the following season. About 25,000 - 30,000 F4 headrows were evaluated each season, and about 1,500 - 2,300 headrows were selected for further evaluation in the following year based on height, maturity, disease resistance, and kernel morphology. During the five years of this project sixteen wheat breeding lines were approved and released for further evaluation, seed increase and possible commercialization.

Results
Development of improved soft red winter wheat varieties has a significant economic impact and benefits wheat producers, processors, and consumers. The varieties are disease resistant, adapted varieties that reduce losses, improve stability of production, and improve the quality of the grain produced. The number of units of seed of breeding lines developed in this breeding program that were sold for commercial production increased compared to previous years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
206	Basic Plant Biology

Outcome #14

1. Outcome Measures

Evaluating The Effectiveness Of Cover Crops In Reducing Disease Severity

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The goal of this project is to determine if the use of cover crops in a corn:soybean rotation is an effective tool for reducing disease severity levels in soybean. This will provide soybean producers with another tool to manage important diseases. Managing diseases, weed problems, and increasing soil health through the use of cover crops will increase the sustainability of the corn:soybean rotation system and increase the profitability of soybean production by reducing yield losses resulting from disease.

What has been done
Disease severity levels of Rhizoctonia root rot on field grown soybean seedlings were found to be lower in rye cover crop plots when compared to those in fallow plots at some locations. No differences in symptoms of sudden death syndrome resulting from cover crop treatments were seen in the field plots. Lower levels of Rhizoctonia root rot and sudden death syndrome were associated with soils collected from rye cover crop plots in greenhouse bioassays, but the results were not consistent among all locations. QPCR analysis showed no impact of cover crop treatments on population levels of selected soybean pathogens. ARISA analysis found differences in microbial community structures in soils collected from the different locations in the study, but did not detect any differences associated with the cover crop treatments.

Results
Several isolates of fungal soybean pathogens were found to be infected with mycoviruses. Sequence analysis revealed the presence of a few previously unreported mycoviruses. This work may lead to the development of biocontrol strategies for some fungal pathogens based on mycoviruses that reduce the pathogenicity of the infected strains. The information may also help explain variation in virulence among isolates of a pathogen species, thus improving research efforts to study these organisms.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A study with slight modifications in the evaluation instrument used in 2007 was conducted in 2012 with Master Gardeners who had between two and four years of experience. The online evaluation was designed by the state coordinator of Master Gardeners who asked county Extension coordinators to send a prepared email to Master Gardeners with this level of experience inviting them to participate in the survey. The survey addressed perceived changes in 13 practices, 11 personal improvement skills, and experience in teaching horticulture topics.

The first set of findings were based on two questions that asked respondents to indicate their use of 13 gardening practices before and after becoming a University of Illinois Master Gardener. It should be noted that all but 7 of the 221 respondents indicated an increase in at least one or more of the recommended gardening practices. The results indicated that : 74.7% [165 of 221] now prune landscape plants properly; 71.5% [158] now identify an insect, disease or weed problem before deciding on a control measure; 71.0% [157] now chose plant varieties that are known to be resistant to insects and diseases; 64.7% [143] now keep records of pest occurrence for later reference; 62.4% [138] now install landscape plants properly; 62.0% [137] now keep records of results of control methods for later reference; 58.4% [129] now use water saving strategies in the garden; 57.9% [128] now choose landscape plants based on the conditions in the planting site; 54.7% [121] now take soil tests; 51.1% [113] now recycle organic materials in the yard through mulching and composting; 50.0% [113] now mulch landscape plants properly; 43.9% [97] now follow recommendations on soil test reports; and 36.2% [80] now use pesticides only according to the directions on the label.

The second set of questions addressed frequency in teaching the above gardening practices to others. Response choices included 'almost never', 'occasionally', 'often', 'very often', and 'don't know'. Approximately one fourth of the respondents [64] indicated that they had occasionally, often, or very often taught all thirteen topic areas. The topics 'often' or 'very often' taught include the following: 154 [69.8%] taught mulching landscape plants properly; 148 [67.0%] taught installing landscape plants properly; 146 [66.1%] taught choosing landscape plants based on the conditions in the planting site; 142 [64.3%] taught recycling organic materials in the yard through mulching and composting; 140 [63.3%] taught choosing plant varieties that are known to be resistant to insects and diseases; and 135 [61.1%] taught pruning landscape plants properly.

A third set of questions was developed to assess the Master Gardener's perceptions in changes related to 11 skills for working with others. Response options to each skill included 'not at all', 'slightly', 'moderately', 'much', and 'a great deal'. Of the 187 who answered this question, 81.8% indicated that their skills for one or more of those listed had improved 'much' or 'a great deal'. Skills improvement rated 'much' or 'a great deal' follow in order of frequency: 143 [76.5%] increased their skill in solving gardening problems; 128 [67.4%] acquired information better; 98 [52.4%] indicated they were willing to accept more challenges; 92 [49.2%] increased skills in working more productively with a group; 86 [46.0%] gained skill in communicating more effectively with others; 80 [42.8%] indicated setting goals more effectively; 75 [40.1%] could reach goals more effectively; 54 [28.9%] could speak to a group more effectively; 51 [27.3%] could lead a group more effectively; 51 [27.3%] gained skill in delegating responsibilities within a group; and 22 [11.8%] improved

computer skills.

Key Items of Evaluation

Master Gardener training improved more than half of the participant's use of recommended practices with respect to controlling home yard and garden pests through practices designed to reduce the use of pesticides that may be harmful to the environment, conserving water in home lawn and gardening activities, and using practices that insure landscaping plant health [minimizing replacement costs to the homeowner]. Since these Master Gardeners teach others, their outreach likely has a similar effect on the practices of those they reach [nearly 90,000, face-to-face teaching contacts in 2012]. In addition, University of Illinois Extension has contributed to effectively building skills that will enhance the Master Gardener's teaching and leadership to serve both individuals and communities.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation	0%		15%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		25%	
206	Basic Plant Biology	35%		25%	
402	Engineering Systems and Equipment	15%		20%	
601	Economics of Agricultural Production and Farm Management	15%		10%	
801	Individual and Family Resource Management	10%		0%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	15%		5%	
806	Youth Development	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	6.0	0.0
Actual Paid Professional	0.0	0.0	1.9	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
126516	0	705221	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
126516	0	705221	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1187311	0	2512399	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities included an examination of the use of glycerol as a biodiesel fuel additive or fuel extender, the establishment and nitrogen management of switchgrass for sustainable bioenergy feedstock production, experimentation which showed that additional glucose in thin stillage did not greatly accelerate fouling rates [a widely held belief in the biofuels industry], research into selection of plant genetics, planting locations, harvest moisture and drying air temperatures to improve dry grind ethanol yields, chromosome engineering by inducing ploidy [this proved to be a valuable technique in improving biomass of plants], the compression of biomass to the highest pressure level ever reported on [we discovered that at this pressure level biomass can self-combust - this was the first time such a phenomenon was reported on], exploration of rapid methods [such as high resolution thermogravimetric analysis [HR-TGA], near-infrared [NIR], and Pyrolysis-GCMS] to improve and speed up the process for identifying and selecting Miscanthus genotypes with desirable composition, and the finding that modulation of shoot maturation via variation in activities of AP2 genes can achieve some of the beneficial aspects of faster dry-down and improved cell wall composition without the negative pleiotropic effects of more upstream regulators on biomass yields [a better understanding of the regulation of the shoot maturation pathway offers a novel opportunity to both better understand the control of desirable traits and may provide new strategies for Sorghum improvement via molecular breeding approaches].

Conference presentations included the American Society of Agronomy, Soil Science Society of America, Crop Science Society of America, AACC International, the American Institute of Chemical Engineers, and the 3rd Pan American Congress on Plants and Bioenergy.

The **Dudley Smith Initiative** continued to provide financial support to bring together area landowners, Extension field staff and University of Illinois specialists to conduct research and demonstrate practical solutions for growing miscanthus, switchgrass, and more recently tropical maize. The local Extension educator has continued to conduct presentations, tours, and field demonstrations at the Dudley Smith Farm. Presentations have also been made at other state educational institution events to describe the activities associated with biomass energy production including storage of baled biomass, land application of biochar residue from burned biomass, and marketing strategies for biomass. A display and demonstration focused on the gasification test unit that operates on corn crop field residue was prepared and operated by Extension staff at the Farm Progress Show and campus annual Agronomy Day. In addition, an energy crop display was created for the Illinois State Fair.

Extension campus specialists and Extension field educators continued to support quarterly meetings of the **Illinois Biomass Working Group** that includes representatives from industry, entrepreneurs, and

agency representatives interested in building better networks to support innovative bioenergy systems and cross-listing activities with the Indiana Bioenergy Working Group based at Purdue. Extension is giving leadership to coordinating energy crop production with bioenergy processors with regional and international networks to expand cellulosic conversion technologies.

Other Extension sustainable energy activities included working with the Smart Energy Design Assistance Center [sponsored by the Illinois Department of Commerce and Economic Opportunity] to conduct energy audits to evaluate energy usage and identify opportunities for energy savings for buildings in three communities and collaboration with the Illinois Wind Energy Working group to sponsor a **Wind 101 Landowner** series and webinar on wind energy siting issues for local county officials. The **Illinois Energy Education Council**, a cooperative effort of University of Illinois Extension and the investor-owned electric utilities, rural electric cooperatives, and municipal power supplies, actively promoted their website as a source of information to increase energy efficiency that includes presentations, videos, games, and links. A total of 958 youth participated in 4-H energy projects and wind science experiments during the 2011-2012 4-H year.

2. Brief description of the target audience

Members of the target audience included biofuels researchers and users of diesel or biodiesel, producers of energy crops and local conservation groups, crop consultants, farm input suppliers, regional and national agriculture industries, state and national governmental agencies, plant genetics companies, corn processors, corn ethanol and biofuel producers, commodity and producer groups, university and government researchers and industries involved in supporting the biofuels sector, dry grind ethanol plants, growers interested in producing biomass feedstocks and industries involved in producing biomass plants and seeds, manufacturing biomass planting and harvesting equipment, and developing pest control products for biomass production, scientists involved in the development of lignocellulosic feedstocks for the production of renewable biofuels, and farmers and industry interested in the use of agricultural waste for biofuel production. Extension also targeted individuals and families who wish to reduce energy consumption and expenses, as well as youth.

3. How was eXtension used?

Five Extension staff are members of the Wood Energy, Home Energy, or Sustainable Ag Energy eXtension Communities of Practice.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6546	2669	6093	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	5

Patents listed
TF11147-PRO - Xylitol Production From Cellulosic Biomass; TF10181-PRO - Xylose-Fermenting Microorganism; TF11160-PRO - Enhanced Cellodextrin Metabolism; TF11111-PRO - Improved Cellobiose Fermentation Using A Mutant HXT2.4 [A219D] From Scheffersomyces Stipitis; TF12043-PRO - New Prairie Cordgrass [Spartina Pectinata] Cultivar 'Savoy' For A Bioenergy Feedstock Production

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	48	48

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Projects

Year	Actual
2012	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. **Outcome Measures**

   Proportion Of The Use Of Biomass Relative To Total Energy [Currently At 4-5%]

   Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

   Percent Reduction In NOx Emissions From Biodiesel

   Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

   Increased Knowledge Of Current And Future Energy Source Options

   Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

   Number Implementing Recommended Practices To Reduce Energy Use

   Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

   Determination And Development Of Management Practices For Sustainable Biomass Feedstock Production

2. **Associated Institution Types**

   - 1862 Extension
   - 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The goal of this research is to determine and develop management practices for sustainable biomass feedstock production. During 2012, research activities were focused on determination of long-term effects of N fertilization and harvest timing on switchgrass biomass production and of corn-switchgrass companion cropping effects on switchgrass establishment. The field research was continued from previous research trials, which were established during 2009 and 2010, respectively. For the management study, switchgrass biomass was harvested either at peak standing crops, after a killing frost, or over winter for the growing season of 2010 and 2011. For the establishment study, switchgrass biomass was harvested after a killing frost in November 2010 through 2012.

What has been done
The switchgrass and corn companion cropping trial demonstrated the potential benefits of corn as a nursery crop during switchgrass establishment. This companion cropping research also provided optimum nitrogen fertilization and corn-seeding rates for both corn grain yield and switchgrass establishment. The replicated study during 2009 through 2012 indicated that the second year switchgrass biomass production under a corn-switchgrass companion system was very comparable to a switchgrass monoculture while corn grain yield was maintained. The results also indicated the importance of nitrogen fertility. The switchgrass nitrogen study showed the importance of nitrogen fertilization on switchgrass biomass production. The switchgrass biomass responses to nitrogen fertilization were highly correlated with soil fertility levels and previous cropping history. A continuous nitrogen fertilization study in multiple locations in conjunction with harvest timing will be necessary for future biomass feedstock production of switchgrass.

Results
2012 was the third growing season after establishment and we were able to evaluate biomass productivity of switchgrass depending on management practices including seeding rate, cultivars, nitrogen fertility, and harvest timing and frequency. These data will be very useful for local producers who are looking for switchgrass as an alternative energy crop for their cropping system. During 2012, research output of switchgrass feedstock production in Illinois has been presented to producers and commercial industries through field day and crop management conference events throughout the state. Currently, we are compiling three-year field data to publish on the effects of nitrogen fertility and harvest timing on switchgrass biomass yield and stand consistency.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
601	Economics of Agricultural Production and Farm Management

Outcome #6

1. Outcome Measures

Determination Of The Components Which Increase Evaporator Fouling Rates

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All commercial biofuel plants use multi-effect evaporators to remove water from processing streams. Proteins, carbohydrates, fats, ash and fiber in corn thin stillage are involved in evaporator fouling. It is not understood which components increase fouling rates. Costs associated with fouling include labor and equipment needed to clean fouled heat transfer surfaces, increased capital, antifoulant chemicals and production losses.

What has been done
Effects of starch [STA] and sucrose [SUC] composition in a synthetic thin stillage fluid on fouling resistance were studied. Effects of total solids [TS] content [1 to 10% db] on fouling resistance [Rf] were also studied. Fluid flow was turbulent [Re > 4000] for synthetic thin stillage with 1% TS and was constant, irrespective of starch:glucose [STA:SUC] ratio. Rf for synthetic thin stillage with 5 and 10% TS and having various STA:SUC ratios was laminar and ranged from 500 to 1,100. An annular probe was used to measure fouling tendencies of synthetic thin stillage and Rf was found at the end of 10 hours or until the probe temperature reached 170 C. Synthetic thin stillage with 5% TS and GLU only did not foul after 10 hours while 5% TS and STA only reached the maximum probe temperature, 170 C, in 4.2 hours. Synthetic thin stillage with 10% TS and STA:SUC of 1:9 did not reach the maximum probe temperature by the end of the test period. For 1, 5 and 10% TS, Rf increased mainly because of the starch present in synthetic thin stillage, while sucrose had a smaller effect on Rf. Higher concentrations of starch in synthetic thin stillage shortened the time to reach the maximum probe temperature.

Results

Understanding from the biofuels industry is that sucrose and other sugars alone cause fouling. Inferring from these results, starch or other sugars must interact with thin stillage components to increase fouling. Additional experimentation showed that additional glucose in thin stillage did not greatly accelerate fouling rates, another widely held belief in the biofuels industry. Additional work will investigate the influence of other compounds on thin stillage and model fluid systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment

Outcome #7

1. Outcome Measures

The Development Of A Protocol To Rapidly Estimate Variation In Miscanthus Cell Wall Composition

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The goal of this project is the development of a protocol to rapidly estimate variation in cell wall composition among genotypes of the dedicated bioenergy crop Miscanthus

What has been done
The goal of this study was to accelerate the process of screening biomass of approximately 40 accessions of Miscanthus germplasm for desirable end use in various biofuels processes with the following objectives: [1] sample selection and preparation; [2] generation of compositional information on Miscanthus genotypes; and [3] screening Miscanthus samples using generated data to determine composition. Variation in Miscanthus biomass composition can be used to identify and breed for superior germplasm with enhanced lignocellulosic properties conducive to bioenergy and renewable chemical generation. HR-TGA provides composition information in terms of cellulose, hemicellulose and lignin. Pyrolysis-GCMS gives more detailed compositional analysis for generation of high-value chemicals and biofuels, requires only a minute amount of samples, and has low labor requirements. NIR spectra were used for partial least squares [PLS] modeling using TGA-derived compositional data. Correlations between NIR and HR-TGA appear

to be sufficiently robust such that rapid NIR analysis can be used to predict cell wall composition.

Results

Classical wet chemistry methods are time consuming; to improve and speed up the process for identifying and selecting Miscanthus genotypes with desirable composition, rapid methods like high resolution thermogravimetric analysis [HR-TGA], near-infrared [NIR], and pyrolysis-GCMS methods were explored in this study. FT-NIR [Fourier transform near-infrared] models were developed to predict biomass composition [cellulose, hemicellulose and lignin] using 40 Miscanthus samples with known composition from wet chemistry methods. Although the correlation coefficient [R-sq] obtained for cellulose [0.952], hemicellulose [0.964], and lignin [0.955] were higher, addition of more samples will make these models more robust. For this purpose, the TGA method was used to generate compositional information in terms of cellulose, hemicelluloses, lignin, ash and moisture. NIR spectra were used for partial least squares [PLS] modeling using TGA-derived compositional data. R-sq values obtained for cellulose, hemicellulose, lignin and ash in the calibration set are 0.99, 0.985, 0.999, and 0.996 respectively, while for the validation set, values were 0.715, 0.834, 0.751, and 0.977 respectively. Pyrolysis-GCMS provided more detailed compositional analysis for generation of high-value chemicals and biofuels through thermo-chemical conversion of biomass samples. Our data suggest that we have geneated a dataset that will provide a robust predicition of cell wall composition from rapid NIR analysis of samples.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
601	Economics of Agricultural Production and Farm Management

Outcome #8

1. Outcome Measures

Improved Understanding Of The Regulation Of The Shoot Maturation Pathway Of Sorghum

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This project brings together scientists with expertise in maize shoot maturation genes, sorghum genetics and sorghum biotechnology to pursue the following three research objectives: [1] to characterize the DNA sequences and expression of genes regulating shoot maturation in sorghum; [2] to investigate the contribution of natural variation in shoot maturation pathway genes to traits that distinguish sweet, forage and grain sorghum cultivars; and [3] to build upon proof-of-concept studies in maize by modifying Glossy15 activity in grain sorghum cultivars and evaluation of biomass and fermentable carbon yields with low N fertilizer inputs.

What has been done
Prior work has established that overexpression of the maize Glossy15 gene delays shoot maturation in a dosage-dependent manner. These Glossy15 overexpressing [Gl15-OX] lines exhibit delayed flowering and senescence, but also increases in total biomass and stem sugar concentrations. Importantly, field trials demonstrated that maize Gl15-OX hybrids maintain high biomass yield potential in low nitrogen soils, indicating an unexpected advantage in nitrogen use efficiency. Our third objective is to extend these findings to sorghum by increasing activity of the sorghum Glossy15 gene [SbGl15].

Results
Modulation of shoot maturation via variation in activities of AP2 genes can achieve some of the beneficial aspects of faster dry-down and improved cell wall composition without the negative pleiotropic effects of more upstream regulators on biomass yields. A better understanding of the regulation of the shoot maturation pathway offers a novel opportunity to both better understand the control of desirable traits and to develop new strategies for Sorghum improvement via molecular breeding approaches.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No formal evaluation of Extension programs was conducted this year but will be conducted in the future.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

4-H Youth Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
724	Healthy Lifestyle	10%		0%	
806	Youth Development	90%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	35.0	0.0	0.0	0.0
Actual Paid Professional	0.0	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
2204999	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2204999	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
20693145	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

4-H Club enrollment in Illinois totaled 21,739. Nearly 135,300 youth were involved in some type of 4-

H program [such as after-school group programs, conferences, and camps]. Additional **Metro Educator** positions were established in areas of 100,000 or more; they explored how to work with existing youth groups and offered sustained science and/or gardening opportunities for younger youth and helped older youth to develop civic engagement and leadership skills. Educational priorities for all 4-H delivery systems focused on: [1] learning employment skills; [2] experiencing healthy relationships; [3] becoming physically fit; [4] thinking green; and [5] engaging in science.

Emphasis on engaging youth in science included clubs participating in the **4-H National Youth Science Day** completing an **Ecobot Challenge** experiment and sharing their experience with other youth and adults at retail outlets. The 4-H robotics project membership doubled in enrollment with 1,807 youth enrolled in one of three project levels. Twenty-five teams participated in the **State 4-H Robotics Team Competition. 4-H Tech Wizards**, designed to establish mentoring programs for at-risk, underserved youth in an after-school setting, continued to engage youth participants. State and national partners played an important role in providing grants to support these science experiences and opportunities for awarding college scholarships.

Cook County continued to offer youth science classes through its **Mobile Science Laboratory**. The **4-H Incubation and Embryology program** engaged youth in experiencing hands-on science concepts while caring for and observing the growth process of chicken embryos. **Science Siesta,** designed for girls in grades four through six, introduced them to fun hands-on science activities and career opportunities. The program aims to dispel myths that science is too difficult, not fun, and more suited to males. The new **I Think Green** curriculum was developed by 4-H and horticulture Extension specialists to engage third through fifth grade youth in investigating how living things interact with each other and with their environment [also discussed in the Natural Resources and the Environment planned program].

Several activities and programs focused on career exploration and workforce preparation. **Illinois Summer Academies** are three-day conferences held on the University of Illinois campus that provide high school teens with opportunities to explore a college campus as well as hands-on workshops on potential careers in 4-H science or leadership development training. **Welcome to the Real World,** a multi-disciplinary curriculum and simulation that allows youth from 12-18 to explore careers and money management [balancing income and expenses] in adult life, was ongoing [also discussed in the Agricultural and Consumer Economics planned program impact section]. A grant-funded national applied research project, **Health Jam**, involved over 400 youth in two-day camps that allowed them to explore health careers and to learn about pursuing a healthy lifestyle and keeping their bodies fit [discussed in the Human Health and Human Development planned program impact report as well as the impact report for this planned program].

Building youth leadership skills is both a national and statewide area of focus. At the state level opportunities and training were provided for Youth Leadership Team members to plan and conduct conferences and to articulate the impact of the 4-H program to legislators. Youth participants in **Speaking for Illinois 4-H** also demonstrated their skills in articulating the impact of the 4-H program to legislators. Illinois 4-H is also focusing on developing teens as teachers. This past year the Illinois and Missouri 4-H programs joined forces to successfully implement the grant-funded **Teens Teaching Youth AgriScience/Biotechnology** program in the St. Louis metro area. Youth served on a number of committees to plan events through hands-on experience and mentoring by Extension staff members and adult leader advisors.

Volunteer Training: Volunteers are vital to delivering 4-H Youth Development programs and are instrumental as caring adults who create an environment that is a critical element to positive youth development. This past year more than 16,000 volunteers gave time and talent to the 4-H Youth Development program in Illinois with nearly 3,600 serving as club leaders. Leaders had instant access to a series of online tips through **Leaders on the Go** written in a question and answer format. A six-session

webinar series for volunteers included the following topics: [1] positive youth development; [2] communication within the 4-H Club; [3] behavior management; [4] risk management; [5] parental involvement; and [6] community service. In addition, the State 4-H Office promoted staff participation in the national **Everyone Ready®** online professional development modules focused on working with volunteers.

2. Brief description of the target audience

Youth between the ages of 8 and 19 including children of military families, volunteers who work with youth, teachers, parents, and community members.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	141136	0	282122	457379

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	1	0	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- New Extension Program Curricula Developed

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Increased Knowledge About Science And Health Careers

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	4351

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Older youth need knowledge and skills to assist them in selecting careers and managing income and expenses in order to live as an independent adult. Reports of college degrees awarded, media reports, and business and industry leaders have expressed concerns about the declining interest of youth in science, engineering, and technology and have identified this decline as a problem that may undermine the country's standard of living and global position of leadership.

What has been done
University of Illinois Extension 4-H conducted Health Jam for more than 400 youth using a two-day camp format and an eight-week Walk Across Illinois activity. During the camps, youth learned how to keep their bodies healthy and fit and explored health professions. The Welcome to the Real World training and curriculum materials for teachers and a simulation for their middle and high school students allow them to explore careers and money management [balancing income and expenses] in adult life. This past year 4,004 youth from 29 counties participated in Welcome to the Real World and over 400 youth participated in Health Jam.

Results
Using an evaluation distributed to youth participants in Welcome to the Real World, 369 [33%] of the 1,029 who completed the evaluation indicated that they had increased their skill in exploring career possibilities. Using a pre- and post-test evaluation format, 224 [54%] of the 415 Health Jam youth respondents were able to list at least one additional health profession on the post-test. A paired-samples t-test analysis indicated a statistically significant increase in the number of health professions participants listed on the post-test as compared to the pre-test. In addition, at one location 34 of 65 participants [52%] learned to recognize equipment used by lab technicians and doctors. A recent survey of Illinois 4-H graduating seniors revealed that 136 of 144 [94%] respondents know of careers that are related to their 4-H project and 80 of 144 [56%] are looking into a career related to their project. A second recent survey of youth experiences in 4-H clubs

across Illinois revealed that 3,722 respondents [83%] do things in 4-H that help them think about a career. In addition, 82 of 144 [57%] indicated they are likely to choose a college major related to their 4-H project [evidencing an influence of 4-H on their college decision]. Additional information about these studies is included in the evaluation section of this planned program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Increased Knowledge Of Positive Youth Development

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Self-Reported 4-H Club Experiences That Provide Opportunities for Positive Youth Development

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	4200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Ensuring that young people who participate in 4-H youth development programs have experiences of the highest quality is important. When young people join 4-H, inherent in their membership is the promise of an opportunity to gain a sense of belonging within their group, independence through decision-making and responsibility, a spirit of generosity toward others, and mastery through project completion, presentations and exhibitions.

What has been done

4-H Club enrollment in Illinois totaled 21,739 in 2011-12. Access was provided to 4-H project resources and experiences, club meetings, and activities at the club, county, and state level for 4-H members. These resources and activities incorporated opportunities for youth to experience the elements of positive youth development. This past year nearly 3,600 adults served as club leaders. Leaders had instant access to a series of online tips through Leaders on the Go written in a question and answer format. A six-session webinar series for volunteers included the following topics: [1] positive youth development; [2] communications within the 4-H Club; [3] behavior management; [4] risk management; [5] parental involvement; and [6] community service. A survey of youth experiences in a subset of 4-H clubs across Illinois was created and conducted in the spring of 2012. The survey included 16 close-ended questions asking about the youth respondents attitudes toward 4-H. The responses were coded on a four-point scale, with a value of 1 indicating strong disagreement to the statement and a value of 4 indicating strong agreement. 4-H members in a sample subset of clubs in each county completed the survey at a club meeting. The survey was distributed by 4-H leaders and collected by a 4-H staff person who was present.

Results

The total number of respondents in the data file that was analyzed was 4,579. In the analysis, the questions were organized into four themes: [1] belonging; [2] independence; [3] generosity; and [4] mastery. These reflect the four components of positive youth development. The evaluation indicated that 4-H clubs are providing opportunities that allow more than three-fourths of the youth respondents to experience belonging, independence, generosity, and mastery. With a few exceptions, the higher the age [and the higher the grade in school], the greater the percentage of respondents that agree or strongly agree with the 16 questions. When comparing respondents who answered yes to having at least one leadership activity with those who had none, differences in their agreement or strong agreement with the statements in the four categories of positive youth development were small but all were statistically significant at the $p<.05$ level. Comparisons of those who answered 'yes' to having a least one item of participation beyond their club with those who had none revealed significant differences [higher] in agreement or strong agreement for statements in each category of positive youth development. Results are further discussed in the evaluation section of this planned program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
806	Youth Development

Outcome #4

1. Outcome Measures

Number Of Youth Who Indicate Increased Knowledge Of Science, Engineering, And Technology

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Business leaders in Illinois are struggling to find the science, technology, engineering and mathematics [STEM] talent they need to stay competitive. Youth need more exposure to challenging and engaging content. Exploring the capabilities and applications of robots offers a glimpse into the future of science, technology, engineering and math. Youth can learn to put inquiry science techniques into practice, grow more familiar with the engineering design process, and use process tools that scientists and engineers use to solve real-world problems.

What has been done
The 4-H Incubation and Embryology project has been carried out in elementary school classrooms for over two decades using hands-on science concepts in caring for and observing the growth process of chicken embryos from the inception of the eggs through hatching of chicks. The majority of youth participants were in K-3 classrooms, but middle school youth were also engaged in the activities this past year. Curriculum development and training was provided by the Extension poultry faculty member, state 4-H staff and local educators. Evaluations were collected from 314 teachers in nine counties in Northeastern Illinois to determine their perceptions of impact related to the nearly 14,000 students science ability gains. With the goal of increasing youth interest in science, University of Illinois Extension staff and volunteers conducted the EcoBot Challenge, this year's National Youth Science Day experiment, with 85 different groups reaching over 3,500 youth in elementary school through high school grades. In addition, 267 4-H youth science teen ambassadors were involved in helping to provide this learning opportunity for other youth. EcoBot Challenge provided an opportunity for youth to program a robot to clean up a simulated environmental spill. In addition, youth designed a set of control surfaces to program the Eco-Bot to perform the cleanup project, and then measured the effectiveness of their control surface by recording how much of the spill is 'swept up' by the Eco-Bot.

Results
Using a scale of 1-4 [1=Not at all; 2=Sometimes; 3=Usually; 4=Always] , grade K-2 teachers were asked to rate their student's level [as a group] with respect to nine science abilities, and grades 3-12 teachers were to rate their student's level on 19 science abilities after participating in the multi-week 4-H Incubation and Embryology project. Observed increases in at least one of these skills were reported by 84% of the 248 teachers who answered these questions. At the end of the EcoBot Challenge, youth participants were asked to respond to several questions. Findings from the 77 groups evaluated showed evidence that youth who participated in the EcoBot Challenge got excited about robotics, engineering, and science. Specifically: [1] 99% would like to do more activities like this in the future; [2] 96% have a better understanding of what robots can do, how

they are controlled, and the role they serve in solving environmental problems; [3] 94% had a hands-on opportunity to explore and design different ways to control a robot's motion; and [4] 88% could identify design factors that influence the behavior of the EcoBot.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Incubation And Embryology Science Program

Using materials developed by the University of Illinois poultry specialist in conjunction with state and local 4-H staff, 314 teachers in nine Northeastern Illinois counties responded to a survey asking them to share their perception of the impact of the multi-week **4-H Incubation and Embryology Program**. A reported 9,269 students were enrolled in grades K-2 and 4,698 students were enrolled from grades 3-12. Two surveys were tailored around grade level science skills learning standards for the two grade level groupings [9 science skills for K-2 and 19 for Grades 3-12].

With respect to students in grades K-2, 151 [80%] of the 208 teachers who answered this question indicated a perceived increase in at least one of these 19 science abilities. More than one-half of the teachers reported perceived increases in their students' observation ability [68% of the teachers], predicting ability [63%], hypothesizing ability [62%], organizing/ordering/classify [57%], comparing/contrasting [55%], and using tools [55%]. Slightly under half of the teachers perceived increases in their students' ability to communicate/demonstrate [49%], design solutions [48%], and model/graph/use numbers [48%].

With respect to students in grades 3-12, 57 [75%] of the 74 teachers who answered this question indicated a perceived increase in at least one of the nine science abilities. More than one-half of the teachers reported perceived increases in their students' demonstrating data collecting ability [70% of the teachers], observation ability [59%], and hypothesizing ability [52%]. Between 40% and 50% of the teachers reported perceived increases in students' ability to question [49%], interpret/analyze/reason [48%], communication/demonstration [47%], evaluate [46%], infer [46%], summarize [46%], predict

[45%], problem solve [45%], troubleshoot [45%], collaborate [44%], optimize [43%], use tools [41%], measure [41%] and compare/contrast [38%]. Less than one-third of the teachers perceived increases in students' abilities to test [30%] and model/graph/use numbers [22%].

Students were asked to hold up their hands in responding to science-related statements. More than 90% of the teachers sharing the information indicated that more than half of their students like science, disagreed that science is boring, and would like to do more activities like this incubation and embryology program in the future.

4-H Positive Youth Development Club Survey

A survey of youth experiences in a subset of 4-H clubs across Illinois was conducted in the spring of 2012. The bulk of the questionnaire that was developed consisted of 16 closed-ended questions asking about the youth respondents' attitudes toward 4-H. The responses were coded on a four-point scale, with a value of 1 indicating strong disagreement to the statement and a value of 4 indicating strong agreement. 4-H members completed the survey at a club meeting. The survey was distributed by 4-H leaders and collected by a 4-H staff person who was present. The total number of respondents in the data file that was analyzed was 4,579.

In the analysis, the questions were organized into four themes: [1] belongingness; [2] independence; [3] generosity; and [4] mastery. These reflect the four components of positive youth development. The percentage of youth who agreed or strongly agreed with each statement and the mean score [based on a rating scale of one through four] follows:

Belongingness Items: We found that 96% felt they receive help from 4-H leaders and others when needed [n=4,503 mean score=3.5]; 95% feel included, rather than excluded in 4-H [n=4,514 mean score=3.5]; 95% felt adult leaders in 4-H listen to what they say [n=4,486 mean score=3.5]; and 91% feel comfortable sharing ideas at 4-H [n=4,549 mean score=3.3].

Independence Items: We found that 94% felt experiences in their 4-H club helps to prepare them me for their future [n=4,490 mean score=3.4]; 83% felt they help to make decisions about what happens in 4-H [n=4,467 mean score=3.2]; 83% felt they do things in 4-H that help them think about a career [n=4,485 mean score=3.2]; and 76% felt they had a chance to lead 4-H activities or meetings [n=4,422 mean score=3.1].

Generosity Items: We found that 95% felt that as part of 4-H they were able to work on service projects that help the community [n=4,527 mean score=3.4]; 93% felt that activities in 4-H encouraged them to help others [n=4,532 mean score=3.3]; 91% felt that 4-H helps them to think of ways to make a difference in their community [n=4,476 mean score=3.3]; and 91% felt that as a part of 4-H, they are able to contribute to community issues [n=4,414 mean score=3.1].

Mastery Items: We found that 93% of 4-H youth share learning with others because of their 4-H club experience [n=4,482 mean score=3.4]; 90% felt that in a 4-H club, they were encouraged to set club and project goals [n=4,500 mean score=3.3]; 86% felt that they often take part in hands-on activities during 4-H meetings [n=4,497 mean score=3.2]; and 77% felt they worked with adult leaders and 4-H members to plan activities [n=4,547 mean score=3.0].

The data was also analyzed with respect to: [1] grade in school; [2] age; [3] 4-H leadership [club office, county/region/state leadership role, completion of a 4-H record or awards application]; [4] 4-H experiences [county fair or events, regional contests or events, state fair or state events, 4-H camp]; and [5] how often the respondent socializes with 4-H members outside of 4-H meetings. The latter three items related to 4-H experience were analyzed by comparing the counts of each individual respondent's agreement or strong agreement for the four questions in each of the four areas of positive youth development.

4-H Graduating Seniors Career Development Survey

A questionnaire seeking to evaluate the effectiveness of 4-H program efforts in the area of career development was developed for online administration to be completed by 4-H members who were graduating seniors. The survey consisted of 17 closed-ended questions asking respondents about ways in which 4-H helped them with their plans for the future. The responses were coded on a four-point scale, with a value of 1 indicating strong disagreement with the statement and a value of 4 indicating strong agreement. There were also two yes-no type questions.

Names were gathered from the 4-H enrollment database, and an email invitation to participate in the study was sent by 4-H staff in local offices to the graduating 4-H members in the spring of 2012. The staff also used U.S. postal mail, text messages, or social media to alert the graduating youth about the survey and to encourage their participation. A reminder email was sent to those youth who had been invited but not responded.

One hundred forty-six 12th graders completed the online survey, two of which were not planning on going on to higher education. These respondents represented 10-20% of the enrolled 4-H graduating seniors.

The following six questions were focused on measuring the influence of 4-H projects on plans for higher education. The percentage represents the number of students selecting three or four on the scale for that question.

We found that 96% felt they were learning skills through 4-H that they could use in a future job [3.58 average group score]; 94% felt they now knew of careers that were related to their 4-H project [3.53 average group score]; 91% believed they could think of [more] ways in which their 4-H project could be a business [3.24 average group score]; 75% felt that, as a result of participating in 4-H, they now know of a college major related to their 4-H project [3.03 average group score]; 57% stated they were likely to choose a college major related to their 4-H project [2.76 average group score]; and 55% stated they were currently looking into a career related to their 4-H project [2.75 average score]. Of interest is that more males than females are looking into a career and college major related to their 4-H project.

The additional six questions below were focused on measuring the influence of 4-H staff/leaders on plans for higher education. Results follow:

We found that 75% had already talked to people who work in a career related to their 4-H project [3.08 average group score]; 68% felt that 4-H staff/leaders took an active interest in their studies [2.86 average group score]; 66% felt that 4-H staff/leaders helped them identify their strengths and weaknesses [2.77 average group score]; 65% stated that

4-H staff/leaders have talked to them about what skills they need to achieve their future goals [2.73 average group score]; 63% felt that 4-H staff/leaders had spent time talking to them about what they wanted to do in the future [2.71 average group score]; and 47% stated that 4-H staff/leaders helped them to make career decisions [2.49 average group score]. We also found that 12.6% of respondents reported starting a business as part of their 4-H project and 27% reported that a specific 4-H program or event influenced their future plans.

Information on plans following high school graduation, college campus visits, years enrolled in 4-H, 4-H experiences, gender, race, and ethnicity was also collected from each individual. When comparing differences in responses by number of years in 4-H, the percentages of youth who agreed or strongly agreed were generally higher for youth who have been in 4-H for 10 years or more compared to youth with between four and nine years. A slightly higher percentage of 4-H members in this older group reported having started a business as part of a 4-H project. Approximately one third of respondents who have been in 4-H for the longest period of time say that a specific 4-H program or event has influenced their future plans, while about a fourth of respondents who have been in 4-H between 4-9 years agreed with this statement.

With respect to plans for higher education, one-third of respondents plan to attend an in-state institution offering a four-year college degree and about one-third plan to attend a community college. A majority of respondents did not visit a college campus through 4-H.

4-H Science Baseline Study

A questionnaire seeking to establish a baseline regarding 4-H members attitude/interest in science, their opinion regarding the relevance/value/utility of science, encouragement to engage in science, and aspirations regarding pursuing a career in science or using it to solve everyday problems was distributed to youth at 4-H science group meetings or science-related 4-H events and collected after completion by a 4-H staff member and volunteer during the summer of 2012. The questionnaire included 11 statements regarding science and 4-H. Youth were instructed to rate the statements as 'strongly disagree', 'disagree', 'agree', and 'strongly disagree'. Those coding data for analysis assigned values ranging from 1='strongly disagree' to 4='strongly agree'.

A total of 679 youth who were eligible completed the questionnaire. Two very large events accounted for a substantial number of these respondents [149 participating in the state livestock judging contest and 125 attending a County Science Discovery Day], so the sample was split into three groups for analysis. An analysis by question for the majority of the respondents [401] group follows:

Attitude/Interest in Science

We found that 87.2% percent agreed or strongly agreed with the statement 'I like science', 82.9 percent agreed or strongly agreed with the statement 'I am good at science', and 70.7 percent agreed or strongly agreed with the statement 'I do science-related activities that are not for schoolwork'.

Relevance/Value/Utility

We found that 87.3 percent diasagreed or strongly disagreed with the statement 'Science is boring', 80.6 percent agreed or strongly agreed with the statement 'I think science, engineering, or technology will be important in my future job', and 76.6 percent agreed or strongly agreed with the statement 'I can explain to others how I use science, engineering, or technology in my 4-H program/project'.

Encouragement

We found that 87.6 percent agreed or strongly agreed with the statement 'I often get to do hands-on activities in my 4-H program/project', 79.5 percent agreed or strongly agreed with the statement 'I am encouraged to ask questions about science, engineering, or technology, and 61.1 percent agreed or strongly agreed with the statement 'When I graduate from high school, I would like to have a job related to science'.

Aspiration

We found that 82.8 percent agreed or strongly agreed with the statement 'I think a career in science, engineering, or technology would be exciting' and 70.5 percent agreed or strongly agreed with the statement 'Science is useful for solving everyday problems'.

Of note, the two other large groups tended to have fewer "strongly agree" ratings, but average group scores still exceeded 2.0.

The three groups were also compared on the basis of: [1] age; [2] school level; [3] gender; [4] number of out-of-school time activities in which they participated; [5] how often they socialized with other members of their club outside of meetings; and [6] experience with certain 4-H activities or programs. There were statistically significant differences between these three groups for all or parts of each of these items.

Key Items of Evaluation

Incubation And Embryology Science Program

After conducting the **4-H Incubation and Embryology** program in their classrooms, more than half of the K-2 and 3-12 teachers perceived observed increases in their student's hypothesizing and observation skills. More than half of the K-2 teachers also reported observed increases in demonstration of data collection skills. In addition, more than half of the grades 3-12 teachers reported observed increases in their student's ability to predict, organize/order/classify, compare/contrast, and use scientific tools.

4-H Positive Youth Development Club Survey

The evaluation indicates that 4-H clubs are providing opportunities that allow more than three-fourths of the youth respondents to experience belongingness, independence, generosity, and mastery. With a few exceptions the higher the age [and the higher the grade in school], the greater the percentage of respondents that agree or strongly agree with the 16 questions.

When comparing respondents who answered yes to having at least one leadership activity with those who had none, differences in their agreement or strong agreement with

the statements in the four categories of positive youth development were small but all were statistically significant at the p<.05 level. Comparisons of those who answered 'yes' to having a least one item of participation beyond their club with those who had none revealed significant differences [higher] in agreement or strong agreement for statements in each category of positive youth development. Those respondents who socialized outside of 4-H meetings with other 4-H members also had statistically significant differences in their agreement or strong agreement with the questions related to belonging, independence, generosity, and mastery.

When asked what they like most about their 4-H club experience, most frequently mentioned were club activities and projects, variety of activities, making a difference, community service, helping others, learning opportunities/things to learn, and fairs, shows, and fair projects. Note that complete findings from this survey are available upon request.

4-H Graduating Seniors Career Development Survey

In general 4-H participants agreed that 4-H project experiences influenced their higher education plans more than did 4-H staff and leaders. However, more than 40% of the youth indicated that 4-H project experiences are not influencing their choice of a college major and career. The influence of a caring adult increases with years in 4-H and more females report having spent time talking with 4-H staff/leaders than males. 4-H members reported that their 4-H experience: [1] exposed them to areas of interest; [2] helped them develop leadership skills; [3] instilled in them a work ethic and sense of responsibility; [4] helped them to grow and develop and to become more confident; and [5] reported learning skills through 4-H that they can use in a future job. Program improvement opportunities for the Illinois 4-H program include increasing opportunities for 4-H members to visit college campuses, supporting 4-H members in their business start-ups, and enhancing the role of caring adults. Note that complete findings from this survey are available upon request.

4-H Science Baseline Study

Overall, there appears to be a pattern in which 4-H youth are reporting more positive attitudes toward science and stronger confidence in their science ability than their peers based on two national surveys. Youth agree more strongly than national study peers that they: [1] would like to have a job related to science when the graduate from high school [61.1%]; [2] think a career in science, engineering, or technology would be exciting [82.8%]; and [3] agree that science is useful for solving everyday problems [79.9]%.

Similar to findings in other national surveys, 4-H participants are less likely to report positive attitudes toward science as they got older. However, at the higher grades, youth in this Illinois sample were more likely to agree that they like science and are good at science than their peers in these national reports. For example, 83% of middle school youth report that they are good at science as compared to only 44% in National Assessment of Educational Progress sample and 52% in a national 4-H sample.

National science standards identify communication skills as a critical component to science literacy. One's ability to express ideas and identify new questions are valued skills, and all 4-H science programs are designed with these target outcomes in mind. While the majority of youth across our sample agree they have these opportunities [nearly 80%], this

survey identifies that youth who have been in a leadership role, have participated in 4-H regional contests or events, or have attended 4-H camp are significantly more likely to agree that they can explain how to use science, engineering, or technology in their 4-H project. This difference may be attributed to the advanced training and experience associated with these leadership and mastery activities. Youth who have participated in regional events are also significantly more likely to agree that they are encouraged to ask questions about their science, engineering, or technology project.

Illinois plans to continue distributing the questionnaire to various 4-H science participants over the next few years to identify progress and success in the priority 4-H is placing on science projects and new science activities to interest youth in pursuing careers in science, engineering, and technology.

Complete findings are available upon request.

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Childhood Obesity

☐ Reporting on this Program

Reason for not reporting

This Planned Program is now part of the Human Health and Human Development Planned Program.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	12.0	0.0	2.0	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

2. Brief description of the target audience

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Research Projects

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Knowledge Of Food That Is Low In Fat And High In Fiber And/Or The Importance Of Increasing Physical Activity Levels

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Increased Consumption Of Foods Low In Fat And High In Fiber And/Or Increased Physical Activity Levels

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Competing Programmatic Challenges

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 12

1. Name of the Planned Program

Climate Change

☐ Reporting on this Program

Reason for not reporting

Activities for this Planned Program can now be found under the Natural Resources and the Environment Planned Program.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.5	0.0	2.0	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

2. Brief description of the target audience

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	9	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Projects
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. **Outcome Measures**

   Dissemination Of Air Quality And Atmospheric Data Through Web Hits On The National Atmospheric Deposition Program Website

   Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

   Identifying Ways Greenhouse Gases Can Be Removed From the Atmosphere

   Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 13

1. Name of the Planned Program

Food Safety

☐ Reporting on this Program

Reason for not reporting

This Planned Program is now part of the Food Safety and Food Security Planned Program.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	4.0	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

2. Brief description of the target audience

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Projects

Year	Actual
2012	0

Output #2

Output Measure

- Number Of Individuals Completing Food Safety Certification Required Training

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase Knowledge Of Personal Cleanliness Habits That Prevent The Spread Of Disease Through Food
2	Using Appropriate Hygiene Procedures When Handling Food [Fresh Or Processed]
3	Practices Adopted That Prevent Foodborne Illness Contamination During The Production And Distribution Of Fresh Produce

Outcome #1

1. Outcome Measures

Increase Knowledge Of Personal Cleanliness Habits That Prevent The Spread Of Disease Through Food

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Using Appropriate Hygiene Procedures When Handling Food [Fresh Or Processed]

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

Practices Adopted That Prevent Foodborne Illness Contamination During The Production And Distribution Of Fresh Produce

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2012 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}